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THE IMPACT OF INNOVATION ON ECONOMIC GROWTH IN ALGERIA: AN ECONOMETRIC ANALYSIS USING THE ARDL MODEL (1996–2021)

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Abstract: *The present study has been conducted for the purpose of analysing the relationship between innovation and economic growth in Algeria during the period 1996-2021. The study adopted a standard quantitative analytical approach using the augmented distributed lag regression (ARDL) model to estimate the relationships. The model was applied to a sample of 24 observations using EViews version 12. The study addressed four independent variables: high and medium technology exports, patent applications by residents, patent applications by non-residents, and scientific and technological articles. The findings indicated a negative correlation between high- and medium-technology exports and gross domestic product (GDP), with no discernible impact on the latter. Conversely, scientific and technological articles exhibited a positive correlation with GDP, albeit without exerting an effect on the immediate economic landscape. Furthermore, patent applications by residents demonstrated a negative correlation with GDP, affecting it in both the short and long term. In contrast, patent applications by non-residents exhibited a negative effect on GDP in the long term. In light of the findings, it is evident that innovation in Algeria is characterised by inefficiency and economic unproductivity within the prevailing structural framework. This necessitates a thorough re-evaluation of the policies and strategies associated with the national innovation system and Algerian economic growth by the state.*

Keywords: *innovation, Patent registration applications, residents, Patent registration applications, non-residents, Scientific and technical journal articles, Medium and high-tech exports, Economic Growth, ARDL, Algeria*

1. Introduction

Innovation has been identified as a fundamental catalyst for economic progress, playing a pivotal role in driving transformative change within industries and societies (Challoumis, 2024). It has been posited by certain economists that policies which embrace openness, competition and productivity improvement will promote sustainable growth. However, this assertion has been countered by others, who have argued that the strategy should instead emphasise domestic innovation activity, with a particular focus on high-tech manufacturing. (Siong Hook Law, 2020). In the pursuit of augmenting the conventional neo-classical growth model, an endeavour was made to enhance it through the utilisation of innovation (INV) in order to achieve enhanced productivity through the explicit modelling of total factor productivity. In the growth model, the acronym INV may be referred to as follows: Innovation and technology improvement, Research and development (R&D) spending, Patenting (Sardar Fawad Saleem, 2024). It is evident that innovation plays a pivotal role in catalysing economic growth on both a national and global scale. By cultivating a competitive environment, innovation fosters the creation of employment opportunities and facilitates the adaptation of economies to the evolving global landscape. In essence, it may be argued that, in the absence of innovation, economic growth would stagnate, and societies would be subject to decline. It is evident that there is a considerable challenge in addressing emerging issues. The ability to either confront challenges or to capitalise on new opportunities is of paramount importance (Challoumis, 2024). The Spring 2025 World Bank Economic Update highlights Algeria's robust economic growth and decreasing inflation in 2024, while emphasizing the need to boost productivity in key sectors to achieve more sustainable

THE IMPACT OF INNOVATION ON ECONOMIC GROWTH IN ALGERIA: AN ECONOMETRIC ANALYSIS USING THE ARDL MODEL (1996–2021)

and diversified growth, thereby mitigating external risks (Bank, 2025). In light of the mounting interest in the role of innovation in achieving economic growth, a considerable number of previous studies have addressed this topic from a variety of theoretical and applied perspectives, the study conducted by Siong Hook Law, Tamat Sarmidi, Lim Thye Goh (2020) titled: *Impact of Innovation on Economic Growth: Evidence from Malaysia*. The present study has been designed to analyse the relationship between innovation and economic growth in Malaysia. To this end, a neoclassical growth model that includes labour, physical capital and human capital has been employed. The study focuses on innovation as a key driver of strong growth. Time series methods (Time Series Techniques) have been used to analyse long-term economic and innovation data. The measurement of innovation was achieved through the utilisation of several indicators, including the number of patent applications (both domestic and foreign) and the number of patents granted (Patent Grants). The study results demonstrated that the number of patent applications (both local and foreign) exerted no significant impact on economic growth. In contrast, the number of patents granted has been shown to have a positive and moral impact on economic growth. This suggests that the quality of innovation is more important than its quantity (Siong Hook Law, 2020).

as well as the research by Irsan Hardi, Samrat Ray, Muhammad Umer Quddoos Attari, Najabat Ali and Ghalieb Mutig Idroes (2024) titled: *Innovation and Economic Growth in the Top Five Southeast Asian Economies: A Decomposition Analysis*. The present study examines the dual impact of innovation on economic growth in five Southeast Asian countries (Indonesia, Thailand, Singapore, Malaysia, and Vietnam). The index was derived from 21 innovation indicators drawn from the Global Innovation Index (GII), which were then categorised into seven distinct groupings: institutions, human capital and research, infrastructure, market development, business development, knowledge and technology outputs, and creative outputs. The findings of Panel analysis and country-specific studies demonstrated that innovation exerts a substantial influence on economic growth. However, an examination of sub-indicators revealed that a considerable number of them impede growth rather than fostering it. The study indicates that innovation in these countries has not yet been optimally invested in, and recommends the need to adopt policies that stimulate innovation, such as removing barriers, directing investments towards vital sectors, and promoting education and skills development, in a way that creates an enabling environment to consolidate innovation as a major driver of economic growth (Irsan Hardi, 2024).

as well as the research by Vicente J. Coronel, Carmen Díaz-Roldán (2025) titled: *Economic growth in the European Union: Exploring the role of innovation and gender*. The present paper summarises the role of innovation and gender in the economic growth of EU countries. To this end, dynamic panel data analysis is employed to examine the relationships between human capital and employment in high-tech sectors. The findings indicated that employment in high-tech sectors is the primary contributing factor to growth, particularly in countries that are recognised as leaders in innovation. However, the study revealed a positive and moral impact of the gender gap in employment on growth in these innovative countries, highlighting the need for further analysis to understand how the current disparity in gender job roles affects the dynamics of economic growth in the European Union (Vicente J. Coronel, 2025).

- as well as the research by Ayousha Fayyaz, · Zoltan Bartha (2025) titled: *Research and development as a driver of innovation and economic growth; case of developing economies*. The present study has been designed to analyse the channels of impact of research and development (R&D) on economic growth in developing countries. The analysis will be based on data from 32 countries from the lower middle-income bracket for 2019, according to the World Economic Forum database. The study adopted a theoretical model based on a research and development system that includes institutions, human capital, the financial market, and innovation. Structural Equation Modeling (SEM) method was employed to construct a path model, thereby illustrating the relationships between these components. The findings indicated that research and development, as well as financial institutions, exert a positive influence on innovation. However, the study concluded that there is no direct moral

impact on economic growth. Findings suggest that research, development and innovation (RD&I) endeavours in middle-income countries do not invariably result in sustainable growth, thereby reinforcing the concept of a middle-income trap. This notion posits that while innovation activities may foster entrepreneurship, they are often inadequate to catalyse genuine economic growth (Ayousha Fayyaz, 2025).

It is important to acknowledge that the majority of studies examining the impact of innovation on economic growth in Algeria have concentrated on the micro level, i.e. industrial firms and companies. However, there is a notable absence of studies that address this subject from a macroeconomic perspective. This research gap signifies a fruitful area that merits further analysis to ascertain the relationship between innovation and economic growth at the level of the national economy as a whole. The central research question guiding this study is as follows: **What is the extent to which innovation affects economic growth in Algeria?**

The following main hypothesis is hereby formulated:

H: Innovation affects economic growth positively and statistically significantly

H1: The positive and significant impact of Patent registration applications, residents on Algeria's gross domestic product (GDP)

H2: The positive and significant impact of Patent registration applications, non-residents on Algeria's gross domestic product (GDP)

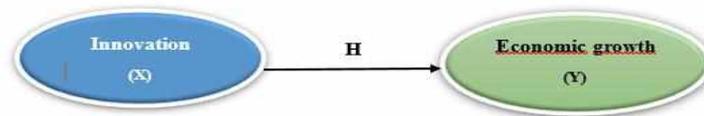
H3: The positive and significant impact of Scientific and technical journal articles on Algeria's gross domestic product (GDP)

H4: The positive and significant impact of Medium and high-tech exports (% manufactured exports) on Algeria's gross domestic product (GDP)

The primary objectives of this research are as follows:

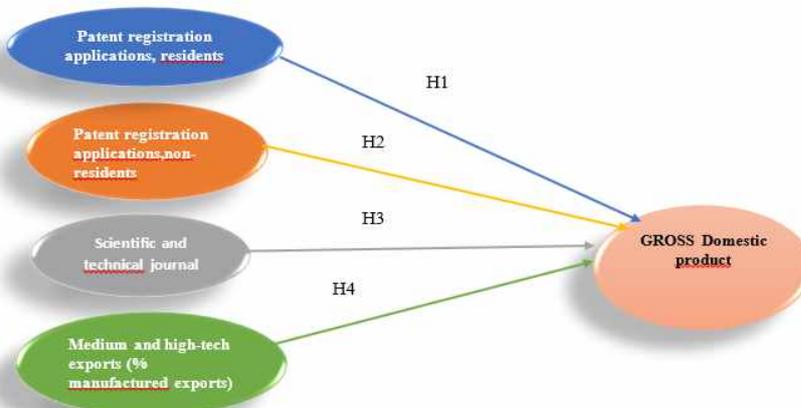
-Analysis of relationships: This study explores the impact of innovation on economic growth in Algeria during the period 1996-2020.

Figure 01. The study model



Source: Author's estimations

Figure 02. The model is expressed as:



Source: Author's estimations

2.Literature Review

Innovation is the process of transforming new ideas and knowledge into new products and services (Gerguri, 2010). **Joseph Schumpeter** defines innovation as "the activity which leads to new production functions and new products". He divides this activity into several steps, as follows:

- 1)- The introduction of a new product: the entrepreneur should produce a new product that is easy to sell and that does not yet exist on the market.
- 2)- Introducing a new production method: innovation should offer a new scheme of production that can be achieved using existing inputs. This should lead to an increased output, a decrease in costs per unit product, the introduction of new inputs and the replacement of existing ones.
- 3)- Establishing new market presence: Innovations have the potential to expand sales into new regions and increase customer base.
- 4)- The identification of suitable raw material sources is a key priority. It is important to note that raw material suppliers may, on occasion, compromise the quality of their products or increase their prices. This can have a direct impact on the quality and selling price of the final product. Therefore, it is the responsibility of the entrepreneur to identify a suitable source of inputs for production of new products.
- 5) -The establishment of a new organisation in the industry. Schumpeter characterises this phase as the entry of the entrepreneur into a monopoly market, where there has been an absence of competition; or the establishment of conditions that enable the entrepreneur (McDaniel, 2002).

Innovations are defined as a process involving the creation of new products or services, new technological processes, new organisations, or enhancements to existing products or services, existing technological processes and existing organisations (Gerguri, 2010).

According to Tom Cannon, the distinction between these terms is as follows:

-Creativity represents an opportunity to generate new appearances, content or The process involves combining existing inputs or factors of production.

-Inventiveness is defined as the process of creating something new. This is a contribution to the overall knowledge of humankind.

-Innovation is inextricably linked to the effective marketing of new products and services. This is a technological process, the result of inventiveness (Cannon, 1991).

Innovation is widely regarded as a primary catalyst for economic growth and development. The term refers to the generation and execution of novel concepts, methodologies, commodities, and technologies (Grii Nihal, 2023).

As illustrated in **Figure No. 3**, the indicators of inputs (resources) and outputs (performance) are represented. The Input Indicators (Resources) are divided into two main categories.

-The following section will address the subject of Human Resources.

The data is represented by the number of science and technology graduates (i.e. engineers), the number of researchers in research and development (R&D), and the number of scientists.

It is widely acknowledged that this resource is of paramount importance in terms of facilitating economic growth and social development.

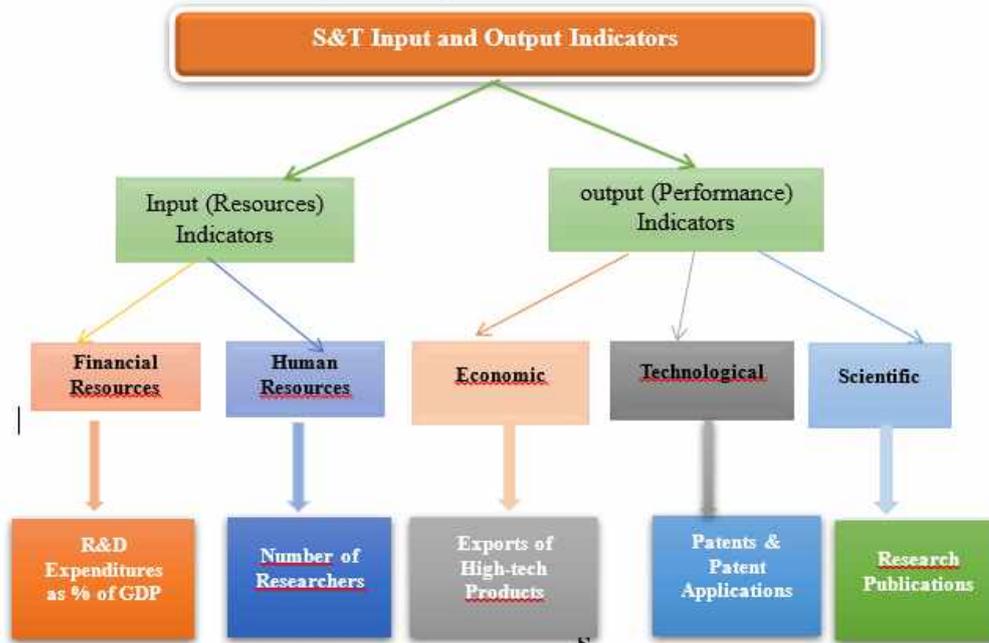
-The financial resources available are as follows:

The representation is by expenditure on research and development (R&D) as a percentage of Gross Domestic Product (GDP). This indicator is the most widely used for the evaluation and comparison of creativity and scientific and technological development across different countries. The Outputs (Performance) are divided into three sections: Economy, Science, and Technology, with the following specific indicators:

Economic Indicator: The export of high-technology products as a percentage of the country's total exports is indicative of economic benefit. The following technological indicator is hereby presented for consideration: The number of patent applications and their implementation serve as the primary indicators.

Scientific Indicator: The number of published scientific articles is used as a metric for this purpose. (Seyma Caliskan Cavdar, 2015)

Figure 03.S&T Input and Output Indicator



Source : Seyma Caliskan Cavdar, Alev Dilek Aydinb, An Empirical Analysis about Technological Development,2015,page 1488. (Seyma Caliskan Cavdar, 2015)

Economic growth is defined as a sustained, long-term increase in real national income, preferably measured in terms of per capita income because it reflects improvements in living standards. It is imperative to ascertain that this increase is not merely nominal, but rather an indication of an actual rise in the volume of goods and services produced. This necessitates a foundation in a permanent increase in the productive capacity of the economy, such as the introduction of modern technology or the strengthening of infrastructure. This ensures that the improvement is sustained and does not merely represent a short-term fluctuation (Avinash Mishra, 2024)

The seminal work in economics, entitled Endogenous Growth Theory, was authored by Aghion and Howitt. This offers a novel interpretation of the phenomenon of economic growth. The authors posit that economic growth. The phenomenon of accumulation is influenced by a number of factors, including the level of innovation and human capital. Within the context of an economy. The theory accentuates the significance of economic policies that are conducive to the promotion of the following factors have been identified as key drivers of economic growth: innovation, investment in human capital, and competition (Aghion P, 1998).

The measurement of economic growth is most commonly achieved through the analysis of fluctuations in the aggregate value of goods and services that are produced within a nation's economy. This measurement is commonly referred to as Gross Domestic Product (GDP).

Innovation and Economic Growth

Innovation is not a recent phenomenon; it is an innate human tendency to seek new and better ways of accomplishing tasks. Innovation is a key and decisive factor for economic growth and performance in a globalised economy. The introduction of new technologies and products, and the provision of improved methods for producing goods and delivering services, are key factors in innovation. These measures have been shown to boost productivity, create jobs and improve citizens' quality of life. As the driving force of the 21st-century economy, innovation constantly injects new vitality into the economic system. Conversely, commoditisation rapidly transforms distinctive and profitable entities into commonplace and marginal ones, resulting in the loss of vitality and profits (Gerguri, 2010).

As Schumpeter (1939) originally identified, innovation plays a vital role in driving economic growth, and achieving an optimum level of innovation and R&D is crucial for this purpose. A substantial body of research among development economists indicates that innovation is a catalyst for productivity growth, thereby leading to the translation of a high level of innovation engagement into sustainable real GDP growth (Gill, 2007) (Pece, 2015) (Pradhan, 2018). One well-established theory that provides a valuable foundation for understanding the relationship between innovation and economic growth is the 'Schumpeterian Growth Theory'. This theory asserts that innovation is pivotal to economic growth, as it fosters the creation of new products, processes and technologies. This, in turn, results in increased productivity, higher profits and overall economic advancement (Alcouffe, 2004). The impact of innovation on economic growth is frequently gauged by means of a variety of indicators, including but not limited to gross domestic product (GDP) growth rate, employment, and per capita income (Ramadani, 2013).

The impact of innovation on economic growth is defined as the effect that innovation has on the overall economic performance of a country. The impact may be either positive or negative, with positive impacts resulting in increased economic growth and negative impacts resulting in decreased economic growth (Grii Nihal, 2023).

3. Data And Methodology

3.1. Variables Used in the Analysis

GDP	Per capita economic growth: expansion of a country's economy, expressed in per capita gross domestic product.
PAR	Patent registration applications, residents
PARN	Patent registration applications, non- residents
MHTE	Medium and high-tech exports (% manufactured exports)
STJ	Scientific & technical journal article

Source: Author' estimations

The data set under consideration consists of 24 observations over the 1996–2021 periods, obtained from the database of world development indicators. (<http://data.worldbank.org/indicator>). The approach adopted in the present study is quantitative and analytical in nature, with the EViews 12 programme being utilised for the purpose of analysis.

The following equation has been defined and employed for the purpose of testing the hypothesis:

$$GDP_t = \beta_0 + \beta_1 PAR_t + \beta_2 PARN_t + \beta_3 MHTE_t + \beta_4 STJ_t + \epsilon_t$$

β_0 : Constant (intercept)

$\beta_1, \beta_2, \beta_3, \beta_4$: Coefficients

ϵ : Error term

3.2. The study employed the following model: ARDL (Autoregressive Distributed Lag Model)

The ARDL cointegration technique was first developed by (Pesaran, 1999). and subsequently refined by (pesaran, 2001). The ARDL (Autoregressive Distributed Lag) method is an econometric approach that is frequently employed to examine dynamic relationships between variables over time, particularly when these variables are of different integration orders (I(0) or I(1)) and potential cointegration between them is under consideration. This methodological approach permits the concurrent evaluation of short- and long-term impacts within a malleable framework, obviating the necessity for all series to be integrated into the same sequence (Blancheton, 2020). The augmented-autoregressive-distributed-lag (ARDL) model is a hybrid model that integrates an autoregressive (AR) model with distributed lags.

The following variables are to be considered in order to provide an explanation. The aforementioned principle is expressed in the following formal statement:

$$Y_t = \phi + \sum_{i=1}^p \alpha_i Y_{t-i} + \sum_{j=0}^q b_j X_{t-j} + \epsilon_t$$

In this model, the dependent variable is denoted by Y_t , the explanatory variables by X_t , and the parameters p and q . The respective lag orders are represented by ϕ , a constant, and ϵ_t , an error term assumed to be white noise (Seabold, 2010) (Kripfganz, 2023).

4. Results And Discussion

4.1. Descriptive statistics

The following presentation offers an exposition of the descriptive statistics of the variables over the 1996–2021 period. The summary statistics encompass the means, median, maximum and minimum of each series

Table 1.. Descriptive statistics of the variables for the period 1996–2021

	GPD	MHTE	PAR	PARN	STJ
Mean	2.960870	2.483646	93.56522	544.6087	2730.277
Median	3.100000	2.158900	84.00000	581.0000	2115.440
Maximum	6.500000	6.051154	268.0000	803.0000	6839.000
Minimum	-5.000000	0.458049	30.00000	94.00000	311.0000
Std. Dev.	2.234592	1.608828	53.74316	216.7496	2078.649
Skewness	-1.829528	0.312959	1.503742	-0.694812	0.511620
Kurtosis	8.200780	2.039852	5.852434	2.303661	1.966042
Jarque-Bera	38.75194	1.258921	16.46545	2.315280	2.027920

Source: Author’s calculation using Eviews 12 application

4.2. Time Series Stability Test (ADF Test)

The Dickey-Fuller test (DF test) was originally developed by Dickey and Fuller to demonstrate the presence of a unit root (Guo, 2023) . The formula for the DF test as formula 1 :

$$Y_t = pY_{t-1} + \epsilon_t$$

Y_t is the value of the time series at time t ,

p is the coefficient on the lagged value of the time series, and

ϵ_t is an error term.

The null hypothesis posits that Y_t is not stationary and that $p = 1$. In addition, it is assumed that the error term in the Dickey-Fuller test is identical and that it is distributed independently.. (de Carvalho, 2014). The null hypothesis for the DF test is that $p = 1$, which means the time series contains a unit root. Conversely, the alternative hypothesis does not contain a unit root, and p should be less than 1.

The formula for the ADF test as formula 2 :

$$\Delta y_t = \alpha + \beta t + \gamma y_{t-1} + \delta_1 \Delta y_{t-1} + \delta_2 \Delta y_{t-2} + \dots + \delta_p \Delta y_{t-p} + \epsilon_t$$

Δy_t is the first difference of the time series y , α is a constant term,

βt is a linear trend term,

y_{t-1} is the lagged value of y , Δy_{t-1} , Δy_{t-2} ,.....

Δy_{t-p} are the lagged differences of y up to p lags,

ϵ_t is the error term

The ADF test is a statistical technique that has been developed to account for potential trends and serial correlations in time series data. It is evident that the constant term and linear trend term are instrumental in the capture of deterministic trends in the time series. Furthermore, the lagged value of y , denoted as Δy_{t-1} , Δy_{t-2} , and so forth, up to and including Δy_{t-p} (Guo, 2023). The null hypothesis posits that the time series contains a unit root, signifying that the series is non-stationary. The alternative hypothesis is that the time series is stationary. The presence of a unit root in the series is indicated by the non-stationary nature of the series, whilst the stationarity of the first difference is indicative of a unit root (Guo, 2023). The ADF test is a widely utilised tool for the identification of unit roots (Gillynn, 2007).

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Table 2. Augmented Dickey-Fuller (ADF) Test Results for the Stationarity of the Dependent Variable (Y) Gross Domestic Product (GDP) at Level

Null Hypothesis: GPD has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on SIC, maxlag=5)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-3.911596	0.0065
Test critical values:		
1% level	-3.724070	
5% level	-2.986225	
10% level	-2.632604	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(GPD)

Method: Least Squares

Date: 07/11/25 Time: 19:42

Sample (adjusted): 1997 2021

Included observations: 25 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GPD(-1)	-0.796505	0.203627	-3.911596	0.0007
C	2.364771	0.752130	3.144100	0.0045
R-squared	0.399487	Mean dependent var		-0.012000
Adjusted R-squared	0.373378	S.D. dependent var		2.799899
S.E. of regression	2.216386	Akaike info criterion		4.506251
Sum squared resid	112.9844	Schwarz criterion		4.603761
Log likelihood	-54.32814	Hannan-Quinn criter.		4.533296
F-statistic	15.30058	Durbin-Watson stat		1.946176
Prob(F-statistic)	0.000700			

Source: Author's calculation using Eviews 12 application

The results of the ADF test, following the implementation of the first difference, indicate that the variable It is evident that the GDP (Y) has become stable, as evidenced by the probability value (p-value) being less than 0.05. This indicates that the null hypothesis of the existence of a unit root is to be rejected. Therefore, it can be concluded that the variable Y is of the level order of integration, I(0).

Table 3. Augmented Dickey-Fuller (ADF) Test Results for the Stationarity of the Dependent Variable (X_1) Patent registration applications, residents at First Difference

Null Hypothesis: D(PAR) has a unit root

Exogenous: Constant

Lag Length: 1 (Automatic - based on SIC, maxlag=5)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-5.083009	0.0005
Test critical values:		
1% level	-3.752946	
5% level	-2.998064	
10% level	-2.638752	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(PAR,2)

Method: Least Squares

Date: 07/11/25 Time: 19:45

Sample (adjusted): 1999 2021

Included observations: 23 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(PAR(-1))	-1.984700	0.390458	-5.083009	0.0001
D(PAR(-1),2)	1.062317	0.262556	4.046054	0.0006
C	12.30058	4.908460	2.505996	0.0210
R-squared	0.563735	Mean dependent var		4.217391
Adjusted R-squared	0.520108	S.D. dependent var		32.01642
S.E. of regression	22.17913	Akaike info criterion		9.157288
Sum squared resid	9838.279	Schwarz criterion		9.305396
Log likelihood	-102.3088	Hannan-Quinn criter.		9.194537
F-statistic	12.92183	Durbin-Watson stat		1.424512
Prob(F-statistic)	0.000250			

Source: Author's calculation using Eviews 12 application

The results of the ADF test, following the implementation of the first difference, indicate that the variable It is evident that the (X_1) Patent registration applications, residents has become stable, as evidenced by the probability value (p-value) being less than 0.05. This indicates that the null hypothesis of the existence of a unit root is to be rejected. Therefore, it can be concluded that the variable Y is of the first order of integration, I(1).

Table 4. Augmented Dickey-Fuller (ADF) Test Results for the Stationarity of the Dependent Variable (X_2) Patent registration applications, non- residents at First Difference

Null Hypothesis: D(PARN) has a unit root
 Exogenous: Constant
 Lag Length: 0 (Automatic - based on SIC, maxlag=5)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-3.752279	0.0097
Test critical values:	1% level	-3.737853
	5% level	-2.991878
	10% level	-2.635542

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
 Dependent Variable: D(PARN,2)
 Method: Least Squares
 Date: 07/11/25 Time: 19:46
 Sample (adjusted): 1998 2021
 Included observations: 24 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(PARN(-1))	-0.776167	0.206852	-3.752279	0.0011
C	11.88076	17.13173	0.693494	0.4953
R-squared	0.390237	Mean dependent var		-0.958333
Adjusted R-squared	0.362521	S.D. dependent var		102.9993
S.E. of regression	82.23699	Akaike info criterion		11.73674
Sum squared resid	148784.3	Schwarz criterion		11.83491
Log likelihood	-138.8409	Hannan-Quinn criter.		11.76279
F-statistic	14.07960	Durbin-Watson stat		1.986127
Prob(F-statistic)	0.001101			

Source: Author’s calculation using Eviews 12 application

The results of the ADF test, following the implementation of the first difference, indicate that the variable It is evident that the (X_2) Patent registration applications, non-residents has become stable, as evidenced by the probability value (p-value) being less than 0.05. This indicates that the null hypothesis of the existence of a unit root is to be rejected. Therefore, it can be concluded that the variable Y is of the first order of integration, I(1).

Table 5. Augmented Dickey-Fuller (ADF) Test Results for the Stationarity of the Dependent Variable (X_3) Medium and high-tech exports (% manufactured exports) at First Difference

Null Hypothesis: D(MHTE) has a unit root
 Exogenous: Constant
 Lag Length: 0 (Automatic - based on SIC, maxlag=5)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-5.683050	0.0001
Test critical values:	1% level	-3.737853
	5% level	-2.991878
	10% level	-2.635542

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
 Dependent Variable: D(MHTE,2)
 Method: Least Squares
 Date: 07/11/25 Time: 19:44
 Sample (adjusted): 1998 2021
 Included observations: 24 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(MHTE(-1))	-1.002849	0.176463	-5.683050	0.0000
C	0.069102	0.206442	0.334730	0.7410
R-squared	0.594821	Mean dependent var		0.133707
Adjusted R-squared	0.576404	S.D. dependent var		1.551558
S.E. of regression	1.009819	Akaike info criterion		2.937075
Sum squared resid	22.43418	Schwarz criterion		3.035247
Log likelihood	-33.24491	Hannan-Quinn criter.		2.963120
F-statistic	32.29705	Durbin-Watson stat		1.872460
Prob(F-statistic)	0.000010			

Source: Author’s calculation using Eviews 12 application

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The results of the ADF test, following the implementation of the first difference, indicate that the variable It is evident that the (X₃) Medium and high-tech exports (% manufactured exports) has become stable, as evidenced by the probability value (p-value) being less than 0.05. This indicates that the null hypothesis of the existence of a unit root is to be rejected. Therefore, it can be concluded that the variable Y is of the first order of integration, I(1).

Table 6. Augmented Dickey-Fuller (ADF) Test Results for the Stationarity of the Dependent Variable (X₄) Scientific & technical journal article at First Difference

Null Hypothesis: D(STJ) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=5)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-11.63002	0.0000
Test critical values:		
1% level	-4.394309	
5% level	-3.612199	
10% level	-3.243079	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(STJ,2)
Method: Least Squares
Date: 07/11/25 Time: 19:49
Sample (adjusted): 1998 2021
Included observations: 24 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(STJ(-1))	-1.852828	0.159314	-11.63002	0.0000
C	-3.298102	91.49836	-0.036045	0.9716
@TREND("1996")	34.99144	6.492318	5.389668	0.0000
R-squared	0.866721	Mean dependent var		45.64417
Adjusted R-squared	0.854028	S.D. dependent var		534.8514
S.E. of regression	204.3471	Akaike info criterion		13.59399
Sum squared resid	876912.8	Schwarz criterion		13.74124
Log likelihood	-160.1278	Hannan-Quinn criter.		13.63305
F-statistic	68.28201	Durbin-Watson stat		1.992790
Prob(F-statistic)	0.000000			

Source: Author's calculation using Eviews 12 application

The results of the ADF test, following the implementation of the first difference, indicate that the variable It is evident that the (X₄) Scientific & technical journal article has become stable, as evidenced by the probability value (p-value) being less than 0.05. This indicates that the null hypothesis of the existence of a unit root is to be rejected. Therefore, it can be concluded that the variable Y is of the first order of integration, I(1).

4.3. The ARDL-Bounds Test approach was employed to examine the cointegration

4.3.1. Optimal Lag Length Selection

The objective of this study is to ascertain the optimal number of deceleration periods (p) that should be incorporated into the initial ARDL model.

As demonstrated in Table No. 7, it is evident that the optimal model for the study is 145, as evidenced by the smaller values of AIC, BIC and HQ. This finding is further substantiated by Figure No. 1, which illustrates the model's performance. The adjusted R² value of 0.7365 signifies that the ARDL model (3, 1, 2, 3, 3) possesses the capacity to elucidate the phenomenon by 73.65 percent.

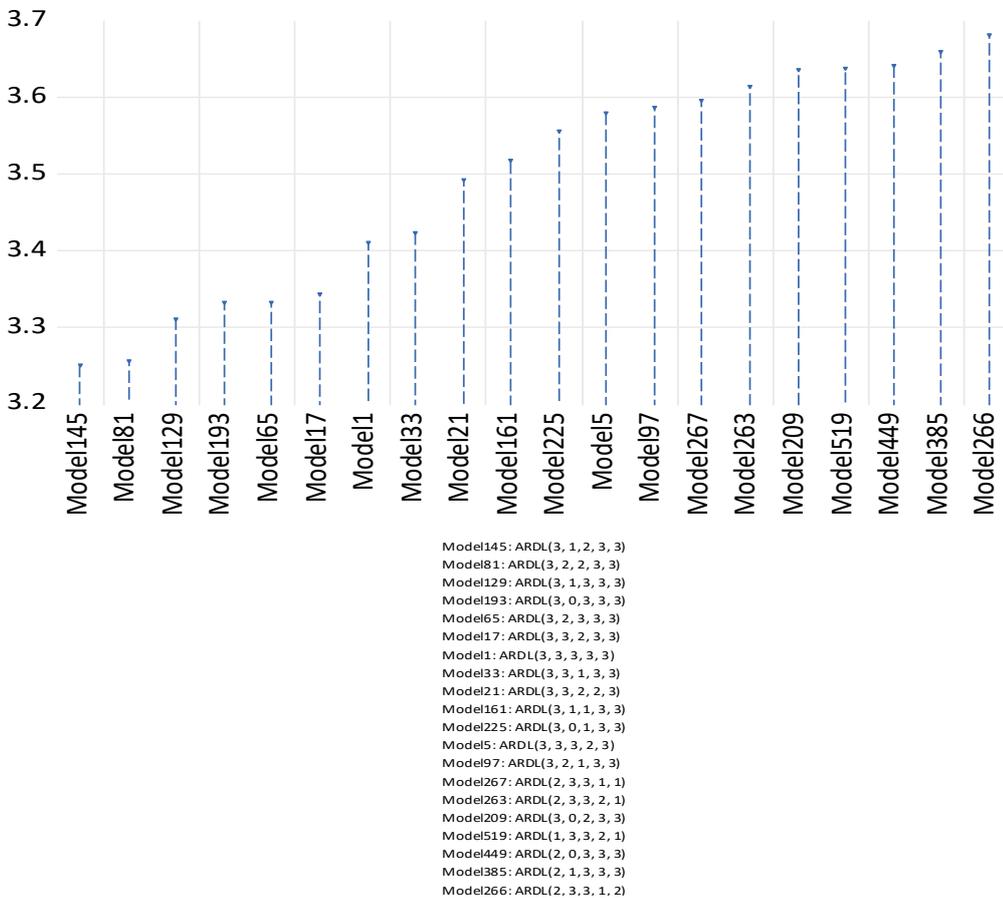
Table 7. Model Selection Criteria

Model Selection Criteria Table
 Dependent Variable: GPD
 Date: 07/11/25 Time: 20:17
 Sample: 1996 2021
 Included observations: 23

Model	LogL	AIC*	BIC	HQ	Adj. R-sq	Specification
145	-20.380880	3.250511	4.089790	3.461587	0.735525	ARDL(3, 1, 2, 3, 3)
81	-19.443149	3.255926	4.144574	3.479418	0.707482	ARDL(3, 2, 2, 3, 3)
129	-20.058793	3.309460	4.198108	3.532953	0.691396	ARDL(3, 1, 3, 3, 3)
193	-21.307529	3.331089	4.170368	3.542166	0.713332	ARDL(3, 0, 3, 3, 3)
65	-19.310126	3.331315	4.269332	3.567224	0.638558	ARDL(3, 2, 3, 3, 3)
17	-19.437823	3.342419	4.280436	3.578328	0.634522	ARDL(3, 3, 2, 3, 3)
1	-19.211061	3.409658	4.397044	3.657982	0.522210	ARDL(3, 3, 3, 3, 3)
33	-21.370279	3.423503	4.312150	3.646995	0.654116	ARDL(3, 3, 1, 3, 3)
21	-22.165657	3.492666	4.381313	3.716158	0.629347	ARDL(3, 3, 2, 2, 3)
161	-24.457770	3.518067	4.307976	3.716727	0.676853	ARDL(3, 1, 1, 3, 3)
225	-25.897858	3.556335	4.296875	3.742579	0.679526	ARDL(3, 0, 1, 3, 3)
5	-22.151727	3.578411	4.516428	3.814320	0.537245	ARDL(3, 3, 3, 2, 3)
97	-24.238012	3.585914	4.425192	3.796990	0.630131	ARDL(3, 2, 1, 3, 3)
267	-26.354229	3.596020	4.336560	3.782264	0.666552	ARDL(2, 3, 3, 1, 1)
263	-25.561909	3.614079	4.403988	3.812739	0.644288	ARDL(2, 3, 3, 2, 1)
209	-25.811963	3.635823	4.425732	3.834483	0.636469	ARDL(3, 0, 2, 3, 3)

Source: Author’s calculation using Eviews 12 application

Figure 4. Akaike information criteria (top20models)
 Akaike Information Criteria (top 20 models)



Source: Author’s calculation using Eviews 12 application

4.3.2. ARDL Bounds Test

1. Testing the Hypotheses of the ARDL Bounds Test

H₀ : There is no cointegration relationship between variables (no long-term relationship).

H₁ : There is a cointegration relationship between the variables (there is a long-term relationship between the variables)

From the data presented in **Table 08**, we accept the alternative hypothesis (H1) and reject the null hypothesis (H0), due to the existence of a long-term cointegration relationship between the variables. This decision is based on a comparison of the calculated statistician value (F-statistic) with the two scheduled critical values: the minimum critical value I(0) and the maximum critical value I(1). The F-statistic of 3.80 is greater than I(0) of 2.2 and I(1) of 3.09.

F-statistic > I(0) and F-statistic > I(1)

Table 8. ARDL Long Run Form and Bounda Test

ARDL Long Run Form and Bounds Test
 Dependent Variable: D(GPD)
 Selected Model: ARDL(3, 1, 2, 3, 3)
 Case 2: Restricted Constant and No Trend
 Date: 10/11/25 Time: 00:36
 Sample: 1996 2021
 Included observations: 23

Conditional Error Correction Regression				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	21.47619	8.771310	2.448459	0.0499
GPD(-1)*	-2.567430	0.759674	-3.379648	0.0149
MHTE(-1)	-0.908428	0.791346	-1.147952	0.2947
PAR(-1)	-0.244906	0.122693	-1.996085	0.0929
PARN(-1)	-0.008897	0.004846	-1.835958	0.1160
STJ(-1)	0.000482	0.002101	0.229210	0.8263
D(GPD(-1))	1.158546	0.607661	1.906568	0.1052
D(GPD(-2))	1.007220	0.357255	2.819328	0.0304
D(MHTE)	0.233862	0.390313	0.599166	0.5710
D(PAR)	-0.018500	0.030446	-0.607641	0.5657
D(PAR(-1))	0.092239	0.057729	1.597783	0.1612
D(PARN)	-0.003240	0.004134	-0.783586	0.4631
D(PARN(-1))	0.018326	0.006557	2.794830	0.0314
D(PARN(-2))	-0.013359	0.004768	-2.801851	0.0311
D(STJ)	0.011418	0.004042	2.824861	0.0302
D(STJ(-1))	0.016157	0.005779	2.795849	0.0313
D(STJ(-2))	0.021042	0.005114	4.114795	0.0063

* p-value incompatible with t-Bounds distribution.

Levels Equation Case 2: Restricted Constant and No Trend				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
MHTE	-0.353828	0.258387	-1.369369	0.2199
PAR	-0.095389	0.031292	-3.048379	0.0226
PARN	-0.003465	0.001408	-2.461281	0.0490
STJ	0.000188	0.000790	0.237334	0.8203
C	8.364858	1.779160	4.701578	0.0033

$$EC = GPD - (-0.3538 * MHTE - 0.0954 * PAR - 0.0035 * PARN + 0.0002 * STJ + 8.3649)$$

F-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic k	3.804531 4	10%	2.2	3.09
		5%	2.56	3.49
		2.5%	2.88	3.87
		1%	3.29	4.37
Actual Sample Size	23	Asymptotic: n=1000		
		Finite Sample: n=35		
		10%	2.46	3.46
		5%	2.947	4.088
		1%	4.093	5.532
		Finite Sample: n=30		
10%	2.525	3.56		
5%	3.058	4.223		
1%	4.28	5.84		

Source: Author's calculation using Eviews 12 application

-The (ARDL) model estimates that exports of high- and medium-tech products exhibit a negative and insignificant relationship, indicating that there is no discernible impact on GDP in the short and long term.

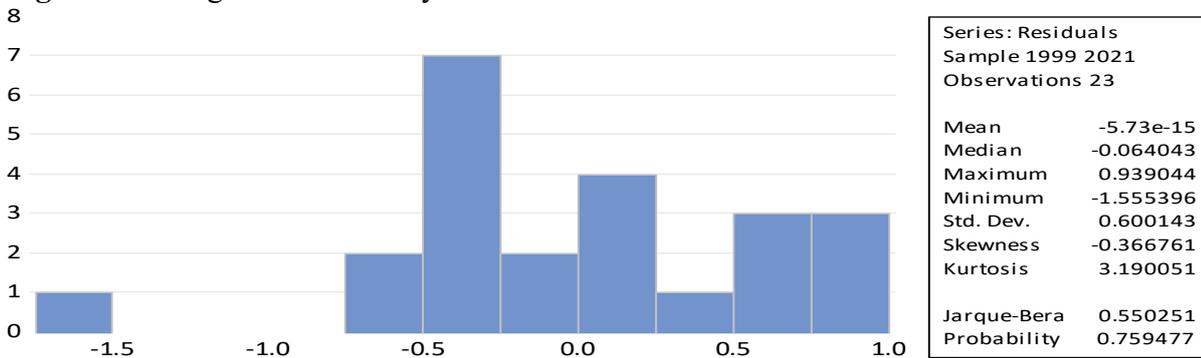
-Patent applications for residents have a detrimental effect on the gross domestic product in the short and long term.

-Patent applications for non-residents have a negative and insignificant relationship in the short term and a significant relationship in the long term, meaning there is a negative impact on the gross domestic product in the long term.

-- Scientific and technological journals have a positive and insignificant relationship, which means that there is no impact on GDP in the short and long term

4.3.3. Normality Test

Figure 5. Histogram – Normality Test



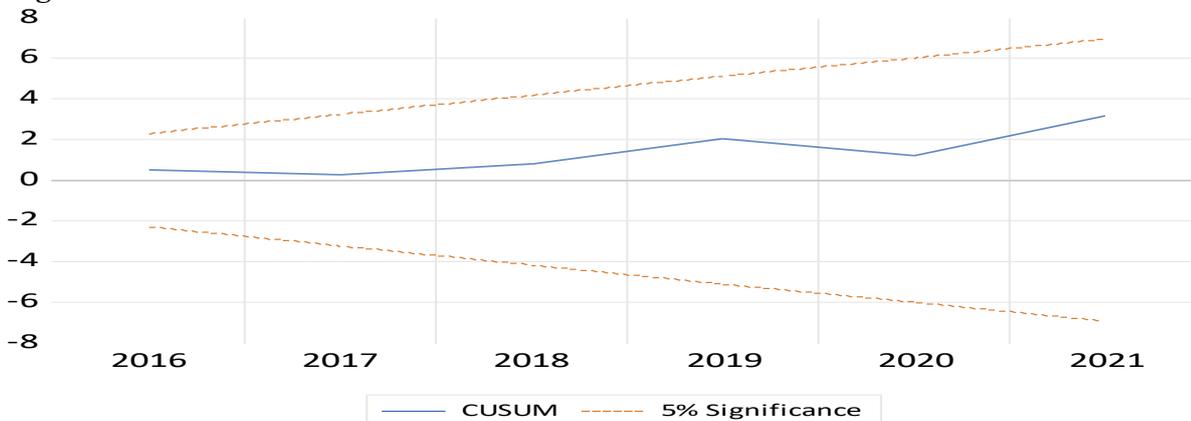
Source: Author’s calculation using Eviews 12 application

The Jarque–Bera test was applied in order to verify the nature of the distribution of the ARDL model residue. The test value was found to be (JB = 0.55) with a probability value of (Prob = 0.76 > 0.05). This finding suggests that the residuals follow a normal distribution, thereby demonstrating that the model fulfils the normal distribution of error hypothesis.

4.3.4. Structural Stability Test (CUSUM)

The findings demonstrated that the blue line persisted within the confidence limits at a significance level of 5%, thereby signifying that the model coefficients exhibited structural stability over the course of the study period.

Figure 6. CUSUM



Source: Author’s calculation using Eviews 12 application

6. Conclusions

Innovation is widely regarded as one of the fundamental pillars of sustainable economic growth, given its capacity to enhance productivity and develop and strengthen the competitiveness of the national economy. The findings of an applied study that examined the situation in Algeria during the period 1996–2021 demonstrated that exports of high- and medium-technology products exhibited a negative correlation and did not exert an impact on economic growth in either the short or long term. This suggests that these exports have not yet become a genuine and sustainable driving force for Algerian economic growth. This is attributable to the Algerian economic structure, which is heavily reliant on oil and gas, the limited development of technological industries, weak infrastructure, and a paucity of investment. While there is a demonstrable correlation between Gross Domestic Product (GDP) and the publication of scientific and technological articles, this correlation does not exert a direct influence on GDP. This is due to the fact that scientific research in Algeria is predominantly theoretical or academic, as opposed to being practical or economic in nature. The utilisation of scientific research findings to develop novel products or services that have commercial potential is a rarity. The correlation between patent applications submitted by residents and the subsequent impact on GDP, both in the short and long term, is indicative of a negative relationship. This suggests that local innovation may be either ineffective or more costly than its economic returns. It has been demonstrated that patents registered by residents may be economically unviable and lack the quality required to be transformed into successful, high-income commercial projects. The long-term implications of patent applications by non-residents on the GDP of the country in question are negative, with the result that the gains from innovation are retained by the country in which they are generated. Furthermore, the utilisation of this technology may necessitate the payment of licence fees, thereby conferring upon foreign companies a degree of control over the intellectual property (IP) rights of the technology employed in Algeria.

The present study seeks to explore the relationship between innovation and economic growth in Algeria. The findings of the study indicate that innovation exerts a negative and stimulatory effect on economic growth in Algeria. The study further finds that innovation indicators show a negative impact in both the long and short term. This finding suggests that innovation is not achieving its full potential in terms of economic productivity within the current structure of the Algerian economy. Consequently, decision-makers must prioritise the formulation of innovative policies that promote patents with substantial commercial viability. These policies should be oriented towards diversifying the economic structure and reducing reliance on hydrocarbons.

There is an imperative to establish mechanisms for technology transfer and to convert the findings of scientific journals into products and industries with high added value. The inflow of foreign investment that facilitates the transfer of technology without resulting in its complete monopolisation should be encouraged.

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THE DOUBLE-EDGED IMPACT OF ARTIFICIAL INTELLIGENCE ON CORPORATE REPUTATION: OPPORTUNITIES AND THREATS

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Abstract

This study examines the impact of artificial intelligence technologies on corporate reputation management focusing on the lens of threats and opportunities. Drawing on literature and current examples, it demonstrates that ethical and algorithmic bias, lack of transparency and accountability, manipulation through fake content and deepfakes, information disorganization (including misinformation, disinformation and malinformation), data privacy/security vulnerabilities, and automation failures pose significant risks to corporate reputation. In contrast, applications such as artificial intelligence-based monitoring and sentiment analysis tools, early warning and crisis simulation capabilities, data-driven decision support systems and stakeholder segmentation strengthen institutions' perception management and enable rapid and targeted intervention. The findings point to the dual nature of artificial intelligence, which can both strengthen and weaken reputations. Therefore, it is recommended that ethical compliance, strong data protection and model management, human-in-the-loop auditing, and transparent communication principles be integrated into corporate processes within a holistic management framework.

Keywords: Artificial Intelligence, Corporate Reputation, Reputation Management, Swot

1. INTRODUCTION

For organizations to gain a competitive advantage, the maintenance and sustainability of reputation are just as critically important as building reputation (Uzunoğlu & Öksüz, 2008, p. 111).

With digitalization, the networks of relationships organizations establish with their stakeholders have rapidly diversified; reputation has become a subject not only of communication outputs but also of data-driven decision-making and technology management. While Artificial Intelligence (AI), big data analytics, sentiment analysis, and real-time feedback mechanisms offer strategic contributions to reputation management, they also introduce multi-layered risks, including ethics/bias, transparency and accountability, fake content and manipulation, privacy/security concerns, automation errors. This study aims to systematically address this dual impact and develop an applicable management perspective for mitigating risks and converting opportunities into corporate value.

AI, one of the most significant technological advancements of the 21st century, is fundamentally transforming businesses processes of decision-making, production, communication, and stakeholder management. Advancements in big data, machine learning, natural language processing, and automation technologies are reshaping not only operational processes but also organizations' reputational capital. Today, AI is being utilized in numerous fields, ranging from customer relationship management to crisis communication, and from strategic planning to corporate communication which directly impacts how organizations are perceived by their stakeholders.

While the literature contains numerous studies examining the effects of AI on business performance, decision support systems, and productivity, research systematically addressing the impact of this technology within the context of corporate reputation management is limited. A notable deficiency is the lack of a comprehensive examination that holistically evaluates the dimensions of ethical management, data security, explainability, and stakeholder perception.

Starting from this identified gap, this research aims to analyze the threats and opportunities posed by AI in corporate reputation management through a systematic literature review. Thus, the study contributes at both a theoretical and practical level by synthesizing the literature on the impacts of AI technologies on organizational reputation. In line with this, the study seeks answers to the following research questions:

1. What are the main threats posed by AI technologies in corporate reputation management?
2. What opportunities and advantages does AI offer that enhance corporate reputation?

This study makes significant contributions to the literature by examining the relationship between AI and corporate reputation management within a comprehensive framework. While existing research typically focuses on the technical or performance dimension of AI, this study examines the technology's effects on ethical management, stakeholder trust, and corporate sustainability. In doing so, it integrates the social and managerial dimensions of AI within the business literature, thereby offering an interdisciplinary perspective. Furthermore, by comparatively presenting the threats and opportunities of AI for corporate reputation, the study develops a guiding analytical framework that is beneficial for both academics and managers. In this regard, the study not only fills a conceptual gap in the literature but also contributes to organizations' ability to develop ethical, transparent, and human-centered reputation management strategies during the digital transformation process.

2. ARTIFICIAL INTELLIGENCE

2.1. The Concept of AI

AI emerged as an academic discipline in the 1950s. The term 'Artificial Intelligence' was first used in 1956 at an interdisciplinary conference held at Dartmouth. This program aimed to investigate the possibility of machines mimicking human intelligence, bringing together researchers from various fields, including scientists, mathematicians, and philosophers (Benbya, Davenport & Pachidi, 2020, p.3).

Artificial Neural Networks (ANNs) enable computers to learn patterns and rules from training datasets, rather than having rules predefined. Although the idea of AI dates back many years, its use in daily life was delayed due to the lack of sufficient data and processing power in the past. However, the increase in digitalization, resulting in data abundance, advanced processing capacity, and cloud and edge computing capabilities, has established the necessary infrastructure for the development of AI (Marr, 2022, p. 44-45).

The literature contains many different definitions related to the concept of AI. These definitions vary according to researchers' approaches to the topic, the technical dimension they address, or the specific application area. Consequently, while there is no single, universally accepted definition for AI, generally accepted definitions are shaped around certain common elements. This study will also include the most frequently used and prominent definitions in the literature. The concept of AI is defined as: the science and engineering of making machines exhibit intelligent behavior (McCharty, 2007, p. 2); intelligent behavior (Nilsson, 1998, p. 1); a system's capacity to correctly interpret data from the external environment, learn from this data, and flexibly achieve specific goals (Kaplan & Haenlein, 2019, p. 17); a concept inspired by the human thinking process (Oğuz & Ağtaş, 2024, p. 348); and the entire set of technological systems that analyze data and provide real-time information by supporting human expertise (Zencir and Ağtaş, 2025, p. 483).

Russell and Norvig (2010, p. 1) define AI as the study of systems that are related to processing, reasoning, and behavior—that is, systems capable of perceiving their environment and selecting the optimal actions to achieve specific goals. According to Russell and Norvig, four basic approaches to AI (Table 1) have historically been developed by different researchers using various methods. The human-centered approach is an empirical science that relies on observing human behaviors and forming hypotheses based on these observations, whereas the rationalist approach is primarily based on the combination of mathematics and engineering. The groups adopting these approaches have, at times, criticized each other and, at other times, complementarily supported each other.

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Table 1. Some Definitions of Artificial (in Four Categories)

<p>Thinking Humanly ‘The exciting new effort to make computers think...<i>machines with minds, in the full and literal sense.</i>’ (Haugeland,1985) ‘[The automation of] activities that we associate with human thinking, activities such as decision-making, problem solving, learning...’ (Bellman, 1978)</p>	<p>Thinking Rationally ‘The study of mental faculties through the use of computational models.’ (Charniak & McDermott, 1985) ‘The study of the computationsthat make it possible toperceive, reason and act.’ (Winston,1992)</p>
<p>Acting Humanly ‘The ar of creating machines that perform functions that require intellegence when performed by people.’ (Kurzweil,1990) ‘The study of how to make computers do things at which, at the moment, people are better.’ (Rich & Knight,1991).</p>	<p>Acting Rationally ‘Computational Intelligence is the study of the design of intellegent agents.’ (Poole et al., 1998) ‘AI...is concern with intellegent behaviour in artifacts.’ (Nilsson,1998)</p>

Source: Russell & Norvig (2010, p. 2)

Human-like thinking is viewed as a process that mimics the functioning of the human mind, such as understanding and reproducing human thought. Human-like behavior aims for a system to mimic human behavior. Rational thinking is based on accurate reasoning processes based on the rules of logic. Rational behavior, on the other hand, is defined as "intelligent agents" exhibiting the most appropriate behaviors to achieve goals. A large portion of modern AI research falls into this category (Russell & Norvig, 2010, p. 1-5). Therefore, it can be said that human-like approaches are focused on imitation, while rational approaches are based on reasoning and decision-making.

2.2. AI in Businesses

AI is utilized in various aspects of business today. These include education, strategic decision-making, achieving competitive advantage, marketing, and new product development.

The introduction of AI technologies into the business world has sparked highly polarized debates about their impact on employees and workplaces. One view argues that AI will increase productivity and improve the quality of work (Spencer, 2018, p. 2), while another argues that it will lead to significant job losses (Nnamdi et al., 2023, p. 513). One factor contributing to this polarization is the misrepresentation of AI systems, often presenting new technologies to society through imaginary depictions based on science fiction (Hermann, 2023, p. 319). In this context, regardless of the purpose for which AI is used in the workplace, it can lead to negative outcomes such as job insecurity, employment risk (Arntz, Gregory & Zierahn, 2016), and employee anxiety (Frey & Osborne, 2017, p. 254). Therefore, the current state of the discourse surrounding AI in the workplace requires a holistic and systematic consideration of its impacts on individual employees, teams, and organizations (Von Krogh, 2018).

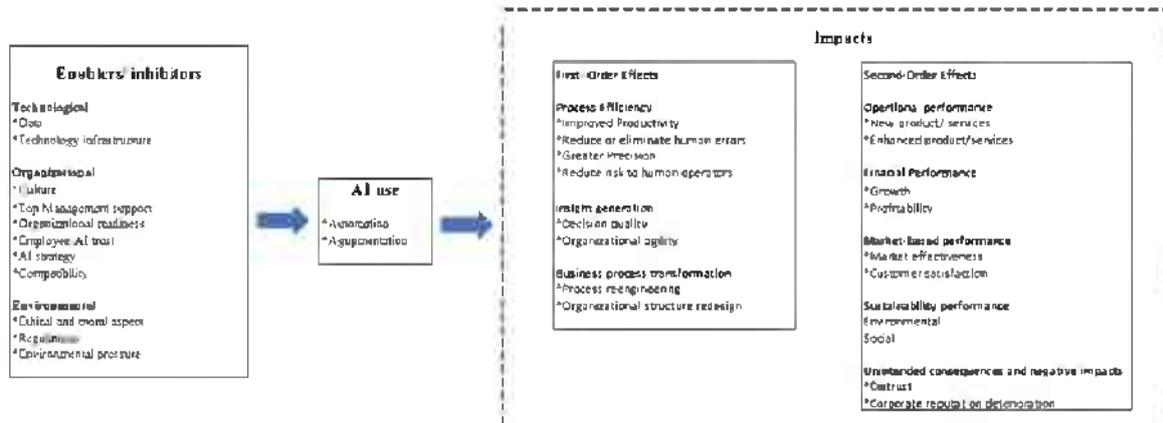
In the business world, AI applications are often designed to enhance growth and efficiency. Companies are developing new methods to improve their performance by integrating AI and machine learning (Bauer & Vocke, 2019, p.494). In many areas, from automotive to energy, finance to healthcare, and manufacturing to retail, AI automates processes, develops personalized solutions, and increases efficiency. For example, smart vehicles and predictive maintenance are prominent in the automotive. industry, smart grids in the energy sector, fraud detection in finance, data-based diagnostics in healthcare, supply chain optimization in manufacturing, and personalized customer experiences in retail. In addition, it makes significant contributions to areas such as content production, traffic management, and security in media, communication, transportation, and logistics (Bauer & Vocke, 2019, p. 495). In this context, the various commercial benefits that AI offers to businesses

are also noteworthy. Some of these benefits are; (Bharadiya., Thomas & Ahmed, 2023, p. 88-90) machine learning, cybersecurity, fraud detection, increasing efficiency throughout the supply chain activities, improving services provided to customers, providing recommendations for various products, segmenting target audiences, examining customer satisfaction levels, customer management, and case studies on businesses using AI.

The main reasons for the rapid adoption of AI include technological advances that support AI methods in recent years (e.g., long-term memory units, neural networks), increased data collection and storage capacity of businesses, decreased hardware costs, and the proliferation of cloud-based services (Von Krogh, 2018, p. 404-405).

To evaluate the potential of AI to create value for businesses, a three-level theoretical distinction has been made (Figure 1). At the first level, three core factors that shape organizations' capacity to adopt and use AI stand out: technological readiness (e.g., data and infrastructure), organizational conditions (corporate culture, top management support, employee trust, and strategic alignment), and environmental elements (ethical, legal, and societal pressures). The second level covers the forms of AI utilization. Two main categories are defined here: automation, which is the takeover of human activities by machines, and augmentation, which is the support of human capabilities through AI. The third level concerns the impacts generated by AI. These impacts are divided into first-order and second-order effects. First-order effects encompass direct outcomes including process efficiency, decision quality, and organizational transformation. Second-order effects encompass broader ramifications like operational and financial performance, market success, sustainability outcomes, and sometimes emergent negative consequences (e.g., pressure on the workforce, ethical issues and reputation loss).

Figure 1. Organizational Framework of AI and Business Value



Source: Enholm et al., 2022, p. 1716

In today's business world, companies use AI to save labor and time, support human activities, and leverage capabilities that exceed human capacity, particularly in big data analysis (Kılınc & Unal, 2019, p. 241). Battaller & Harris (2016) categorized AI technologies and proposed various business solutions that add value to businesses. Battaller & Harris (2016, p. 5) highlight three categories for the potential integration of AI technologies into business solutions: *perception, comprehension, and action*.

- Three fundamental categories stand out in the domain of AI applications related to *perception*. Computer vision encompasses the acquisition, processing, analysis, and interpretation of images. This technology enables businesses to gain situational awareness regarding risk, security, and safety through video analytics derived from surveillance cameras. Furthermore, it contributes to understanding customer behavior in the retail sector. Speech processing focuses on the identification, discrimination, and analysis of sounds and speech. Specifically, speech recognition technologies used in call centers make it possible to automatically

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determine the identity of callers. Sensor processing, on the other hand, relies on the analysis of information obtained from sensors other than cameras and microphones. For instance, sensors used in agricultural processes collect data such as temperature and humidity to support "precision agriculture" applications, thereby enabling more careful and efficient crop management.

- AI applications in the domain of *comprehension* are discussed under two main headings. Natural language processing (NLP) refers to the process of understanding and reproducing spoken or written language. This technology provides guidance and services to users through natural language via personal assistants on smartphones. Today, it goes beyond merely recognizing keywords to enable a more comprehensive understanding of what individuals are saying. Information presentation, on the other hand, encompasses the process of defining and conveying knowledge to facilitate inference and decision-making. Knowledge-based tools developed within this framework enable a specific search to be linked to other related content on the web. For example, a search for "Da Vinci" can direct the user not only to specific paintings but also to broader content such as Italy and the Renaissance.
- AI applications in the domain of action are explained through three main approaches. Inference engines generate decisions by utilizing fixed knowledge bases (e.g., business rules). These systems can be applied in processes such as automated loan approval, credit allocation, or visa processing, ensuring that decisions are made consistently within a specific time frame. Expert systems aim to mimic the decision-making ability of human experts and can solve complex problems using knowledge bases. Important examples of these systems include diagnosing in medicine or examining and synthesizing millions of data points in legal research to provide users with meaningful information. Machine learning, on the other hand, is based on changing the thought process by learning from experience. Software tools and personal digital assistants developed within this scope increase productivity by learning user behavior and can perform functions such as classifying emails or automatically processing calendar entries.

Kılınç and Ünal (2020) examined the impact of AI on boards of directors and evaluated his findings under three categories: "views on AI," "common perspectives," and "measures and recommendations." The author's key points can be summarized as follows:

- Views on AI focus not only on its facilitating benefits but also on potential threats such as job losses and global risks.
- Although the benefits of narrow AI are undeniable, there are significant concerns regarding short-term labor displacement and long-term risks associated with superintelligence.
- While a decrease in the workforce is expected in the near future, not all participants believe this will lead to chaos.
- The optimistic perspective suggests that AI will introduce new job descriptions and roles, allowing people to be liberated and dedicate more time to social welfare. Conversely, the pessimistic view posits that, similar to other revolutions in human history, the transformation in the workforce could lead to chaos and even trigger global conflicts.
- Serious concerns regarding superintelligence are being voiced for the distant future; notably, Elon Musk has expressed anxieties that this technology could dominate or even destroy humanity.
- It is proposed that, for the future welfare of humanity, the power of AI must be decentralized, government regulations should be increased, and universal basic income should be adopted.
- In conclusion, a consensus appears to have been reached that narrow AI facilitates human work and provides organizations with a competitive advantage, that job losses will occur in the near future, that management needs to be redefined, and that the necessary characteristics for CEOs should be determined.

3. CORPORATE REPUTATION

3.1 The Concept of Corporate Reputation

Reputation is a widely accepted concept across the fields of strategy, corporate social responsibility, management, and marketing. While early studies were predominantly influenced by marketing and communication disciplines, today it is addressed in an integrated manner with various fields such as strategic management, human resources, and corporate strategy. It is accepted that corporate reputation originates internally and extends to the external environment, and it is specifically emphasized that corporate identity and reputation play a critical role in securing a competitive advantage and increasing profitability (Yüncü & Koparal, 2019, p. 1044). There are various definitions of corporate reputation in the literature. Corporate reputation is a concept that is shaped by an organization's level of meeting its stakeholders' expectations and demands, and it is formed by the synthesis of stakeholders' perceptions on this matter. Stakeholders encompass groups that are located in the internal and external environment of the organization, such as employees, customers, consumers, competitors, suppliers, shareholders, and investors, and are affected by the organization (Wartick, 1992, p. 34). Corporate reputation is also defined as a concept that not only focuses on individuals but also aims to shape their perceptions by providing them with strong indicators about the organization (Black & Carnes, 2000, p. 33), a collective representation of multiple elements, which the company has built over time and is the summation of all perceptions towards the organization (Karatepe & Ozan, 2017, p. 88), the emotional value attributed to a business by society compared to others (Cable & Graham, 2000, p. 929), a concept that reflects the totality of all activities performed by an organization throughout its life and is linked to the organization's history (Herbig & Milewicz, 1993, p. 18), and a prediction made by others regarding the positive or negative evaluation of a person, object, or activity (Mahon, 2002, p. 417). Barnett et al. (2006) examined online books and papers published on corporate reputation between 2000 and 2003 and identified three distinct clusters of meaning in the definitions provided. Accordingly, reputation is addressed as a state of awareness, an evaluation, or an organizational asset (Yüncü & Fidan, 2017, p. 136). Although the authors defined the concept of corporate reputation from different perspectives, the common thread in all these definitions is the perception and correct interpretation by specific stakeholders of what the business represents. Therefore, there is a consensus that corporate reputation is a collective phenomenon and a construct (Sumer & Pernsteiner, 2014, p. 30, as cited in Yüncü, 2016, p. 257).

Walker (2010) examined the concept of corporate reputation within the scope of organizational theories, focusing on three core theories: institutional theory, signaling theory, and the resource-based view (Yüncü & Koparal: 2017, p. 60). According to institutional theory, the structure and processes of organizations are shaped by their efforts to adapt to their environment. Organizations must conform to the institutions in their surroundings not only to be efficient but also to gain legitimacy. Consequently, organizations in the same field tend to become structurally similar over time (Özen, 2007). Institutionalization and the acquisition of legitimacy play a critical role in the formation of reputation for companies. Signaling theory helps analyze the relationship between the quality of a signal sent by a sender and how the receiver interprets that signal. Furthermore, it enables the understanding of behaviors exhibited when parties possess different information (Connelly et al., 2011, p. 40). Individuals send various signals to their environment during the process of forming and sustaining reputation. These signals carry clues regarding how others perceive them and encompass efforts to influence the processes of perception and interpretation (Spence, 1974, p. 357). The Resource-Based View (RBV) posits that a firm's unique tangible and intangible assets are the fundamental source of market competition (Gottschalk, 2011, p. 29). These resources are categorized as tangible assets (buildings, machinery, raw materials), intangible assets (reputation, brand, knowledge), and organizational capabilities (the capacity to perform activities better than competitors) (Collis & Montgomery, 1998). Feldman et al. (2014, p. 56) explain the benefits of corporate reputation for businesses under the following headings:

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- It supports sales growth and positive word-of-mouth communication by enhancing the perception of quality regarding products and services.
- It facilitates the recruitment of qualified employees and their long-term retention within the organization.
- It preserves organizational value by mitigating negative impacts during institutional audits, crises, and competitor attacks.
- It facilitates international expansion and paves the way for collaborations in key communities.
- It ensures that more investors are attracted; consequently, corporate value increases, and risks decrease.
- It secures a strong market positioning by differentiating the firm from its competitors.
- It allows capital to be obtained under more favorable conditions.
- It increases employee morale and, consequently, their productivity.

While a strong corporate reputation provides businesses with a significant competitive advantage, a weak reputation can cause organizations to lag behind their competitors. Bowd & Bowd (2001, p. 6-7) list the main indicators of a negative reputation emerging in organizations as follows:

- Employees' lack of suggestions and contributions,
- High employee turnover,
- Low vendor reliability,
- Loss of important customers,
- Rapid declines in stock values,
- Poor relations with the government,
- Media's indifference to the organization's views,
- Rare references within the organization's field of activity.

3.2. Corporate Reputation Management

Today, there is a common and fundamental problem is faced by all businesses, regardless of their size. This problem relates to how they should build a corporate reputation in the minds of their stakeholders, decision-making actors, and opinion leaders in markets dominated by intense competition and delicate balances. At the core of reputation management lie the principles of integrity, consistency, permanence, and sustainability (Kuyucu, 2003, p. 15). A strong corporate reputation is only possible through effective corporate reputation management (Jones et al., 1998, p. 26).

Conceptually, we encounter various definitions of corporate reputation in the literature. According to some of these definitions, corporate reputation is defined as: reflecting the shared evaluation formed by a firm's stakeholders (Navarro-García, Ramón-Llorens & García-Meca, 2022, p. 352), the general assessment formed in the minds of stakeholders based on a firm's past activities and future expectations (Fombrun, 1996), the long-term integrated outcome of stakeholders' evaluations concerning "what the organization is," "how it fulfills its responsibilities," "to what extent it meets expectations," and its "performance in adapting to the socio-political environment" (Uzunoğlu & Öksüz, 2008, p. 112), and the total image formed in the minds of the organization's stakeholders (Gray & Balmer, 1998). As can be understood from these definitions, corporate reputation is regarded as a strategic asset for firms and is considered a critical factor that directly affects long-term success.

Davies (2006) lists the following elements to consider in reputation management:

- A proper understanding of reputation in its essence,
- A thorough understanding of key stakeholders, their expectations, and sensitivities,
- Using realistic information in decisions regarding corporate behavior and considering the organization's values, vision, and brand identity in this process,
- Being meticulous in implementing decisions; in other words, carefully assessing the commercial potential of each issue and value,

- Being prepared for new or developing issues, trends, and claims that may arise and responding professionally, even proactively, when necessary,
- Developing the ability to respond quickly and accurately to questions or aggressive allegations from the media.

These points demonstrate that corporate reputation management is not limited to presenting a positive image to the outside world. It requires a strategic approach and is central to the organization's relationships with all its stakeholders. These requirements outlined by Davies demonstrate that corporate reputation management is a comprehensive, multidimensional, and dynamic process.

One of the most crucial benefits of corporate reputation is gaining customer trust. Businesses with strong reputations achieve greater success in selling their products and services by building customer trust (Keh, & Xie, 2009, p. 732–742). Businesses with high reputations stand out in customer product and service preferences, become preferred employers for job seekers, and are considered reliable investment vehicles by long-term investors. This provides businesses with strong stakeholder support, providing them with significant resources. Indeed, companies with high reputations increase their profitability by appealing to customers; enhance efficiency and productivity by attracting more qualified employees; access credit from financial institutions at lower costs; and strengthen their stock values by attracting investors. Therefore, stakeholder support is directly reflected in business performance and has a positive impact on profitability (Fombrun, 2012, p.106). Another important aspect is competitive advantage. Companies with a high reputation are in a more advantageous position in the market compared to their competitors (Smith, Rupp & Motley, 2023; Sarjana, 2017). Institutions with a high corporate reputation strengthen employee commitment (Alniacık et al., 2011; Esenyel, 2020). Institutions with a high corporate reputation are able to overcome this process with less damage during crises (Nuortio, Harkonen & Breznik, 2024). Corporate reputation plays a decisive role in financial performance and investor relations; Institutions with a favorable reputation may have advantages such as demonstrating sustainable profitability and access to credit and investment resources with lower capital costs (Roberts & Dowling, 2002, p. 1089-1091; Yang et al., 2025, p. 6; Blajer-Gołębiewska & Kozłowski, 2016, p. 136-138).

4. THE THREATS ARISING FROM AI IN CORPORATE REPUTATION MANAGEMENT

AI has become an increasingly widely used tool in corporate reputation management. While it provides strategic advantages to organizations through big data analytics (Çataldaş, 2024), sentiment analysis (Açıkgöz, 2025), and real-time feedback mechanisms (Marler and Boudreau, 2017), the literature reveals that this technology also poses serious risks and threat, presented below.

4.1. Ethics and Bias

AI models can reproduce the biases present in the data on which they are trained, leading to a perception of discrimination, loss of trust, and erosion of reputation. It is clearly evidenced in the literature that unethical practices by human resources (HR), such as discrimination, favoritism, and non-transparent decisions, damage corporate reputation, especially in recruitment processes (Villegas et al., 2019; Aturu, 2005; Sang & Ngure, 2018). Organizations must therefore regularly audit their algorithms, ensure transparency, and integrate human oversight into the process.

4.2. Lack of Transparency and Accountability

Transparency plays a critical role in the reliable adoption of AI in both markets and society (Larsson & Heintz, 2020, p. 10). AI-based applications necessitate that decision-making processes, both in public administration and the private sector, be conducted in a more transparent, effective, and accountable manner (Güven, 2024, p. 142). These features hold the potential to increase stakeholder trust in organizations. However, issues such as data privacy, algorithmic biases, and security vulnerabilities raise ethical concerns and pose a risk to corporate reputation when AI is not used in a transparent and accountable manner (Banazılı, 2025, p. 540).

4.3. Fake Content, Manipulation, Deepfakes, Misinformation, Disinformation, Malinformation

The development of AI technologies has facilitated and accelerated the production of remarkably realistic fake content. While in the past, only images could be manipulated using software like Photoshop, today, much more convincing fabricated content can be created by adding realistic faces or voices to video and audio recordings (Sönmez, 2025, p. 320). Since such content is often perceived as legitimate pieces of information, the question of whose interests the generated fake content serves and how it shapes public perception becomes critical (Sönmez, 2025, p. 320).

Deepfakes are fabricated media products created using AI and specifically deep learning techniques that imitate the voice, image, or expressions of real people, and are often utilized for manipulative purposes (Yurdigül & Gülsün, 2024, p. 135; Chesney & Citron, 2019, p. 4). Deepfake technologies facilitate the production of highly realistic fake content, and this content carries the potential for propagandistic use by misleading large audiences through trending topics (Lundberg & Mozelius 2024, p. 2160; Veerasamy, 2022, p. 345; Nasiri & Hashemzadeh, 2025, p. 230).

AI-powered content generation tools constitute a significant threat to corporate reputation, particularly due to the risk of manipulation. Deepfake technologies have the potential to alter the public perception of individuals and organizations by generating highly realistic fake video and audio recordings (Lundberg & Mozelius, 2024, p. 2164; Köçeri, 2023, p. 257). Furthermore, the evolution of AI-powered disinformation processes from fake news to deepfake content allows manipulation to be conducted in a more organized manner, aligned with both material and socio-political interests (Nasiri & Hashemzadeh, 2025, p. 231).

It is important to address the concepts of misinformation, disinformation, and malinformation, which pose threats to the corporate reputation of businesses. Misinformation is the dissemination of incorrect information without the intent to cause harm. Disinformation, on the other hand, refers to false information deliberately produced and circulated with the intent to harm an individual, organization, social group, or nation. Malinformation is the use of information that is essentially true but taken out of context or distorted with the intent to harm specific individuals or organizations (Wardle & Derakhshan, 2017, p. 20).

4.4. Data Privacy and Security

Privacy has become a significant societal issue today with the proliferation of advanced data discovery methods. It is becoming increasingly easier to identify individuals, profile them, and target them directly without their consent or knowledge. As more advanced AI systems are developed, these processes gain speed, and concerns regarding privacy are increasing (Eryılmaz, 2023, p. 8).

While AI offers solutions to numerous problems, the ways in which it collects, utilizes, and protects data remain a significant subject of debate. However, these issues are relatively neglected while their benefits are being highlighted. This situation can transform AI systems into platforms that pose a risk of unlawful processing of personal data. The unauthorized collection and storage of personal data can harm data subjects through disclosure or unauthorized sharing by malicious individuals. Therefore, AI systems must strictly adhere to data privacy principles (Başkaya and Karacan, 2022, p. 484). Consequently, the violation of data privacy principles not only harms individuals but also damages the credibility of organizations among their stakeholders, which constitutes a serious threat to corporate reputation.

4.5. Automation Errors

While AI-based chatbots and automated response systems enable organizations to communicate quickly with stakeholders, they can pose serious risks, such as eroding customer trust, causing reputation loss, incurring legal liability, and damaging brand loyalty when they generate inaccurate or empathy-lacking responses (Cai, Heo & Yan, 2025, p. 1; McGuire et al., 2023, p. 2). Although AI presents strategic opportunities for corporate reputation management, it also introduces significant risks. Ethical and bias issues, lack of transparency and accountability, manipulation through

fake content and deepfakes, information disorder (misinformation, disinformation, malinformation), data privacy and security vulnerabilities, and automation errors pose serious threats to corporate reputation. These threats have the potential to damage not only the trust of individual stakeholders but also the long-term legitimacy and sustainability of organizations. Therefore, for AI-based applications to be used effectively and reliably in reputation management, it is imperative that transparency, adherence to ethical principles, robust data protection policies, and human oversight are integrated into the process through a holistic approach.

5. OPPORTUNITIES PRESENTED BY AI FOR CORPORATE REPUTATION MANAGEMENT

AI technologies are considered not only as a risk factor but also as a significant strategic opportunity in organizations' reputation management processes. This section will address the core opportunities presented by AI for strengthening corporate reputation.

5.1. Real-Time Reputation Monitoring and Perception Tracking

AI-powered tools can analyze vast data sources such as social media posts, news content, and customer reviews to identify potential issues and trends that may affect a brand's reputation. Furthermore, AI provides the opportunity for rapid intervention to minimize potential reputational damage by generating real-time alerts when negative comments or statements emerge in the online environment (Moukdad & Juidette, 2024, p. 502). Thus, organizations can ensure that reputation crises are identified at an early stage and that potential reputational loss is prevented through effective interventions.

5.2. Emotion / Sentiment Analysis

AI models can analyze social media and text data to extract positive, negative, and neutral sentiments, and they can also track trend changes over time. Merchant et al. (2023) demonstrate in their study that AI is transforming online reputation management through the layers of sentiment analysis, brand monitoring, and early warning systems. Furthermore, an article by the Forbes Business Council (2025) titled "AI in Reputation Management" emphasizes that AI-powered real-time monitoring technologies can significantly reduce the risk of reputational damage for brands by detecting crises early.

Açıkgöz & Kayakuş (2025) evaluated customer reviews regarding the mobile applications of supermarket chains in Turkey using AI-based sentiment analysis and demonstrated that this method is an effective tool in measuring and guiding online reputation. In another study conducted in Turkey by Kayakuş, Açıkgöz and Erdoğan (2024), following the evaluation of online comments regarding private educational institutions using the sentiment analysis method, it was determined that AI-powered analyses provide reliable and rapid results in corporate reputation measurement.

Today, technologies such as sentiment analysis, predictive analytics, chatbots, and natural language generation (NLG) are among the most prominent examples of the tangible effects of AI on the field of public relations. These tools enable organizations to establish more personalized and rapid interactions with their target audiences; simultaneously, they support the derivation of data-driven strategic decisions (JelJeli et al., 2024, p. 1817).

5.3. Corporate Communication and Public Relations (PR) Integration

Research has revealed that corporate communication and public relations (PR) practices, along with the integration of AI, generate significant effects on corporate reputation. In line with this, JelJeli et al. (2024) investigated the role of public relations practices and AI technologies in reputation management within online retail businesses operating in the United Arab Emirates. The study, constructed on the basis of social change theory, analyzed data obtained from 330 participants using the Structural Equation Modeling (SEM) method. The findings demonstrate that public relations

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practices have significant effects on competitive value, online communication, and behavioral change; similarly, AI technologies also have a statistically significant effect on these variables. Furthermore, it was determined that online communication and behavioral change factors, in particular, are determining elements that strengthen corporate reputation management.

Kim and Bhalla (2022) state that the rapid advancements in AI technologies offer public relations professionals the opportunity to focus on more creative and strategic tasks. According to the researchers, the automation of routine tasks by AI enables experts to use their time more efficiently, thereby contributing to their ability to concentrate on creative activities such as developing compelling messages and organizing effective media communication.

Tools such as sentiment analysis, predictive analytics, chatbots, and natural language generation (NLG) enable organizations to establish more personalized and rapid interactions with their target audiences, while simultaneously supporting data-driven strategic decision-making processes. It is emphasized that this transformation necessitates technology being viewed as a tool that fosters creative thinking and facilitates the implementation of innovative ideas within the field of public relations (Marakova, Wolak-Tuzimek & Tuckova, 2021).

5.4. Competitive Advantage, Cost Optimization, and Increased Efficiency

AI technologies generate a significant competitive advantage for businesses by providing increased efficiency and cost optimization. The automation of routine and repetitive tasks reduces labor costs, allowing employees to focus on more strategic and creative assignments. For instance, AI-powered chatbots in call centers handle a large portion of customer requests, thereby reducing the workload on human employees; similarly, AI-based software utilized in accounting and finance departments accelerates business processes by automating tasks such as invoice processing, payroll calculation, and tax reporting. Similarly, in the manufacturing and service sectors, AI applications enhance efficiency by providing speed and accuracy. In parallel, AI-powered systems ensure cost control by reducing unnecessary expenditures; they optimize inventory management in retail businesses while preventing waste by analyzing consumption data through sensors in the energy sector. Furthermore, AI applications that aim for flawless production on the first attempt reduce recall costs by detecting defective products early in quality control processes by minimizing human errors. These technologies also prevent potential financial losses through fraud detection systems in the finance sector. All these advantages enable businesses to differentiate themselves in the market by developing innovative solutions. For instance, Tesla distinguishes itself from its competitors in the automotive sector through AI-powered autonomous driving technologies; similarly, Amazon gains a sustainable competitive advantage by delivering orders to customers faster through AI-based logistics and supply chain management (Yıldız, 2025, p. 150-151).

In the report titled "AI and the Future of Reputation Management," published by StatusLabs (2024), investments in AI infrastructure, although initially appearing high-cost, yield high returns in the long term by reducing the risks of reputational loss, maintaining customer trust, and protecting brand value. Consequently, the integration of AI is evaluated not only as a technological innovation but also as a strategic investment tool, thus becoming a fundamental element that supports organizations' digital competitiveness and sustainable reputation.

5.5. Supporting the Relationship Between Transparency, Trust, and Reputation

In today's corporate world, establishing trust and maintaining strong management frameworks rely on transparency and effective communication with stakeholders. AI significantly contributes to this process by providing real-time access to data and enhancing the quality of communication between the organization and its stakeholders (Aladağ, 2024, p. 22).

AI technologies enable stakeholders to access accurate information instantly by collecting and analyzing large datasets from various sources. This situation gains importance today, particularly as the demand for transparency and visibility increases. AI-powered dashboards and reporting systems

allow stakeholders to monitor key performance indicators (KPIs) in real-time, thereby supporting data-informed decision-making and effective engagement (Mir, Kar & Gupta, 2022; Usman, Moinuddin & Khan, 2024).

AI enhances stakeholder communication by automating routine interactions and ensuring that information is conveyed in a clear, consistent manner. Natural language processing (NLP) tools analyze stakeholder inquiries and generate personalized responses based on up-to-date data, thus ensuring efficiency and accuracy in communication. This situation strengthens stakeholder trust and engagement while minimizing misunderstandings (Petersen et al., 2020). Thus, AI contributes to the preservation and strengthening of corporate reputation by reinforcing the relationship between the organization and its stakeholders, which is based on transparency and trust.

5.6. The Impact of AI-Based Service Integration on Corporate Reputation and Brand Image

AI-integrated services refer to the process by which organizations integrate AI technologies into their service processes to enhance customer experience, operational efficiency, or service quality. Virtual assistants and automated response systems are examples of these. The relationship between brand reputation and virtual assistants is considered a significant way to leverage technology and strengthen brand-consumer interaction ultimately achieving positive brand outcomes. Kumar et al. (2023) state that positive customer feedback regarding virtual assistants can significantly enhance a brand's reputation. Conversely, it is noted that when brands with a strong reputation for customer service use virtual assistants, a failure of interaction quality to meet expectations can lead to customer disappointment (Ouzem et al., 2024: 2261), and the generation of negative or inadequate content may cause damage not only to the virtual assistant but also to the brand's reputation (Santos et al., 2022).

In this context, AI-powered service integrations, particularly through virtual assistant applications, contribute to corporate reputation by strengthening organizations' image of technological leadership; however, it is observed that these same technological elements can lead to negative effects on reputation when the quality of interaction is insufficient.

6. Conclusions, Discussions

This systematic literature review has revealed the dual impact of AI on corporate reputation management, highlighting both threats and opportunities—within a holistic framework. Findings indicate that AI can strengthen reputational capital by enhancing decision quality and process efficiency through automation and augmentation; conversely, it can trigger reputation erosion due to ethical biases, lack of transparency, privacy/security vulnerabilities, and information disorder (deepfakes, disinformation) (Enholm et al., 2022; Larsson & Heintz, 2020; Chesney & Citron, 2019).

This study presents several important managerial implications. Primarily, organizations need to perceive AI-based systems not merely as tools for operational efficiency but also as a strategic component of reputation management. Within this scope, it is crucial for managers to institutionalize adherence to ethical principles, transparency, and accountability standards in AI processes as corporate policy (Larsson & Heintz, 2020). The regular auditing of algorithmic biases, the sustainment of human oversight, and the protection of decision-making mechanisms in the internal use of AI play a critical role in ensuring stakeholder trust. Moreover, considering data privacy and security principles at the system design stage will reinforce the organization's legitimacy and credibility by reducing potential ethical and legal risks (Başkaya & Karacan, 2022). Furthermore, organizations should establish media verification systems, crisis scenarios, and rapid response teams to address threats such as deepfakes, disinformation, and information disorder; this will increase their level of preparedness against potential reputation crises (Wardle & Derakhshan, 2017). Furthermore, the integration of real-time reputation monitoring tools and sentiment analysis systems will enable organizations to instantly track stakeholder feedback and intervene early against negative trends (Moukdad & Juidette, 2024). Finally, designing AI-based services—such as virtual assistants and chatbots—in alignment with brand identity, enhances the quality of interaction, and preserves empathetic communication ensuring that

trust and reputation are sustainable throughout an organization's digital transformation process (Kumar et al., 2023; Ouzem et al., 2024).

Furthermore, AI ethics committees can be established within the organization to ensure ethical oversight, and digital reputation awareness training can be organized for employees. Reputation and communication drills can be conducted to prepare for potential crises; a culture of transparency and learning can be encouraged organization-wide. Additionally, by adopting an approach that strengthens cooperation between humans and machines, it can be emphasized that AI-powered processes are complement to human capabilities.

7. Recommendations

Future research can investigate the effects of AI investments on corporate reputation, trust, and financial performance using causal and longitudinal research designs. Comparative studies conducted across different sectors and cultures will enrich the literature by revealing contextual differences in the relationship between AI and reputation. Crisis simulations that test the speed of intervention and the effectiveness of communication strategies in scenarios involving information disorder, deepfakes, and disinformation may contribute to the evaluation of reputation protection mechanisms. Furthermore, experimental studies analyzing the impact of chatbot and natural language generation (NLG)-based interactions on the dimensions of empathy, accuracy, and trust can clarify the quality dimension of digital touchpoints.

8. Limitations

This study has certain limitations. Primarily, since the review is confined to specific databases and time periods, it carries a risk of obsolescence in the rapidly developing field of AI. Furthermore, the generalizability of the findings may be limited, as the majority of the reviewed studies are based on specific sector or country examples.

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THE RELATIONSHIP BETWEEN OIL PRODUCTION AND RENEWABLE ENERGY CONSUMPTION IN AZERBAIJAN (2005-2024)

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Abstract: *This study investigates the relationship between oil production, renewable energy consumption, and economic growth in Azerbaijan from 2005 to 2024, offering empirical insights into the country's dual energy structure and diversification challenges. As a hydrocarbon-dependent yet renewable-resource-rich nation, Azerbaijan represents a distinctive case for assessing whether oil wealth supports or hinders the transition toward sustainable energy. The research aims to evaluate how oil production and renewable energy variables interact with each other and with economic growth, thereby determining whether the country's development trajectory reflects complementarity or substitution between fossil and renewable resources. Using annual time-series data from the State Statistical Committee of Azerbaijan and the World Bank, the study applies descriptive statistics, Pearson correlation, hypothesis testing, and linear regression analysis to examine the strength and direction of these relationships. The results reveal a statistically significant positive correlation between oil production and the share of renewables in total energy consumption, suggesting that oil revenues may be reinvested into renewable projects, indicating a complementary rather than competing dynamic between the two sectors. In contrast, the weak correlations between GDP and energy variables imply that economic growth has become partially decoupled from short-term energy fluctuations. These findings highlight the potential for resource-rich economies to leverage hydrocarbon income to accelerate renewable energy deployment. The paper concludes that integrated policy planning, institutional strengthening, and targeted reinvestment of oil revenues are essential to achieving a balanced and sustainable energy transition in Azerbaijan.*

Keywords: *Renewable energy, Oil production, Economic growth, Azerbaijan, Energy diversification*

1. Introduction

Energy resources are of paramount importance when it comes to global sustainable economic growth and development. Current trends also underscore this dependency that sustaining economic progress will require a growing demand for energy resources. This demand is further enhanced by the rapid population growth in developing countries, which in turn intensifies the aforementioned dependency on conventional energy sources within existing systems (Hajizade, 2021; Mukhtarov et., 2020). As energy sources are the primary input materials in production, exchange, and distribution across virtually all sectors, their role in supporting economic performance is undeniable. In this regard, expansion of economic activity with increased production of goods and services will come in parallel with even higher levels of energy consumption (Zhe, et., 2021).

Meanwhile, growing energy demand has also led to rising concerns over climate change issues. International Energy Agency (IEA) reports that compared to pre-industrial levels, CO₂ emissions have increased by almost 50%, mainly driven by the combustion of fossil fuels (IEA, 2025). Consequently, global warming issues are also heightened by this continuous energy demand growth (Inal et., 2022). According to the British Petroleum Energy Outlook 2025 report, global final energy consumption is currently at 511 exajoules (EJ) and will reach 572 EJ by 2050, assuming current trends prevail (BP, 2025). As mentioned earlier, the use of fossil fuels accounts for the main part of the global carbon

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dioxide emissions and contributes to the escalation of climate change issues, especially global warming. Despite their environmentally harmful effects, the traditional fossil fuels remain dominant in the global energy mix (Mukhtarov et., 2020). Whereas, renewable energy resources, such as wind, solar, hydropower, geothermal and biomass are environmentally non-degrading and naturally non-depletable. Hence, a more extensive use of these alternatives can significantly alleviate the carbon emission problem (Zhe, et., 2021). Additionally, the oil price volatility also enhances the appeal of renewable energy resources, as countries explore ways to decrease dependency on oil and manage sensitivity to price shocks (Deniz, 2019).

The use of renewable energy resources not only mitigates the effects of climate change but also enhances energy security and provides further economic and social benefits (Edenhofer et., 2011). The International Energy Agency nominates renewable energy resources as the only effective pathway to decarbonizing the energy mix and reducing reliance on fossil fuels (IEA, 2014). These resources are sustainable and continuous by their nature, derived from naturally occurring elements, which makes their wider application economically strategic. Therefore, renewable energy resources are to be a driver of long-term economic growth, boosting energy security and independence, on top of being an environmental necessity (Yuksel et., 2020).

For governments, increasing the share of green and renewable energy resources in national energy mixes can translate into reduced dependency on finite resources, a diversified economy, and contributions to the adoption of environmentally clean technologies, new employment opportunities and sustainable economic development and GDP growth (International Renewable Energy Agency, 2019; Yuksel et., 2020). Additionally, renewable energies can stimulate financial sector development and strengthen the relationship between renewable energy use and financial growth by attracting financial investments to the country (Zhe, et., 2021). Over the past four decades, rising global energy use and increasing worries about climate change, fossil fuel exhaustion, and pollution have led to a growing agreement worldwide on the necessity for alternative, clean, and renewable energy sources.

Overall, the importance of renewable energy has grown significantly due to the increasing need for energy security and addressing climate change. As energy consumption rises, it brings negative consequences like increased greenhouse gas emissions and environmental harm. In this scenario, renewable resources are emerging as a practical option for creating cleaner, more resilient global energy systems, offering a sustainable and cost-effective alternative to fossil fuels. (Alnifro et, 2017). The recent trends suggest that the share of renewables in global electricity generation and capacity installations has substantially increased. However, high initial costs, financing gaps and limited policy support continue to pose a significant challenge to their widespread use. That said, few major oil exporters have already demonstrated commitments to diversifying their energy mix by investing in solar, wind and geothermal power projects (Bahrami and Abbaszadeh, 2013).

The Republic of Azerbaijan presents a particularly compelling case study for examining the nexus between oil production and renewable energy development. Country is located in a geographically advantageous area, therefore, it is rich with both renewable and non-renewable energy resources. From the 19th century, with the discovery of oil and gas resources in offshore deposits in the Caspian Sea and onshore fields, Azerbaijan gained a major economic advantage and its economy improved over the years. During this period, the oil and gas sector was responsible for the majority of the income in the annual fiscal budget, which account for 48.35% state budget revenue and 88.21% of total export in 2024. Conversely, dependence on fossil fuels creates environmental degradation, climate change, and energy shortages. Also with global sensitive demand, fluctuations in oil prices and limited resource capacity, the sustainability of continuous development is uncertain. However, Azerbaijan has great potential for renewable energy resources due to its favorable geographical location with rich energy resources. There are wind, solar, water, and biomass resources in various regions of the country. According to calculations, the potential for renewable energy resources in the entire country is approximately 27,000 MW. (Hajizade, 2023). The share of existing energy resources in circulation is lower than the total potential, approximately only 0.5 percent of the total energy

potential. (Hajizade, 2020). Still, the country has also demonstrated significant commitment to renewable energy development, with the government setting ambitious targets to generate 30% of electricity from renewable sources by 2030 (Ministry of Energy of Azerbaijan, 2023). This provides additional context for renewable energy development possibilities. This dual energy profile makes Azerbaijan an ideal laboratory for understanding whether oil wealth facilitates or constrains renewable energy adoption.

Despite the growing literature on energy transitions in resource-rich economies, the relationship between oil production and renewable energy development remains theoretically ambiguous and empirically underexplored, particularly in the context of post-Soviet oil producers. For Azerbaijan specifically, an insufficient amount of empirical research exists on the quantitative relationships between these energy variables and economic performance. Shifting to renewable energies is crucial, especially for oil-producing nations in order to mitigate ecological and economic issues created by reliance on fossil fuels (Belloumi and Aljazeera, 2024). Renewable energy technologies offer a solution to decrease energy costs and emissions, and preserve oil and gas resources for higher-value uses. Hence, it is vital to investigate renewable energy consumption and drivers influencing its trajectory. The main agents affecting countries' renewable energy consumption levels are country-specific macroeconomic factors, such as crude oil prices, oil rents, oil production, and net energy imports (Makki, 2024).

The purpose of this research paper is to understand the dynamics of renewable energy consumption, within the broader context of economic and energy production variables, specifically examining the interrelationships between Gross Domestic Product (GDP), oil production, and renewable energy consumption in Azerbaijan. The analysis is conducted within the time frame of 2005 to 2024, capturing both the oil boom years and the recent renewable energy expansion phase, helping to understand how these factors interact and influence one another in the evolving energy consumption ecosystem and economic development.

The paper investigates the following research questions: (1) What is the nature and strength of the relationship between oil production levels and renewable energy consumption in Azerbaijan? (2) How do oil production and renewable energy variables correlate with economic growth as measured by GDP? (3) Does oil production suppress or complement renewable energy development? Based on these questions, subsequent hypothesis questions are formulated:

- H₁ - Is there a statistically significant correlation between Azerbaijan's GDP and oil production levels during 2005 _2024?
- H₂ - Does GDP have a significant correlation with renewable energy generation in Azerbaijan over the study period?
- H₃ - Is there a meaningful linear relationship between GDP and the share of renewable energy in total energy consumption?
- H₄ - Is oil production significantly correlated with renewable energy generation in Azerbaijan between 2005 and 2024?
- H₅ - Does oil production show a statistically significant correlation with the renewable energy share in the national energy mix?
- H₆ - Is there a significant relationship between renewable energy generation and its share of total energy supply in Azerbaijan?

This study makes several contributions to the energy economics literature. First, it provides the quantitative analysis of the oil-renewable energy nexus in Azerbaijan using two decades of data (2005-2024), offering empirical evidence for theoretical debates about resource complementarity versus substitution. Second, it employs different statistical methods including correlation analysis and regression modeling to establish the strength and significance of relationships between energy variables and economic performance. The rest of the paper is organized as follows: Section 2 reviews the relevant literature; Section 3 describes the data and the methodology; Section 4 presents the findings and discussion; Section 5 gives a conclusion and Section 6 lists references.

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2. Literature Review

The global transition to renewable energy has stimulated a large amount of empirical literature studying the determinants of renewable energy consumption (REC), the association between REC and financial development, oil dependence and economic growth. The literature reviewed shows considerable variations in the results across country groups, which is consistent with differences in institutional quality, technological capacity, and resource endowment. This section combines the findings of 17 empirical studies (see Table 1), focusing largely on oil-exporting and resource-dependent economies.

Table 1. *Summary of the empirical studies*

Study	Time Period	Country	Method(s)	Variables	Results
Li et al. (2021)	1990-2015	Turkey	VAR	REC, FD, GDP	Bidirectional causality between FD and REC
Ericson, Engel-Cox and Arent (2019)	N/A	Oil & gas operations (global)	Qualitative case analysis	RE technologies	REC reduces costs and CO ₂
Inal et al. (2022)	1990-2014	10 African oil-producing countries	Panel econometric tests	GDP, REC, CO ₂	No significant LR effect on REC and CO ₂
Awodumi and Adewuyi (2020)	1980-2015	5 African oil-producing economies	NARDL	Petroleum and natural gas consumption, GDP, CO ₂	LR asymmetric effects between oil prices and REC
Belloumi and Aljazeera (2024)	1990-2020	13 major oil-exporting countries	PMG-ARDL, DOLS	GDP growth, REC, FD, CPI	Positive LR relationships, SR insignificant
Aidarova et al. (2024)	1990-2024	OPEC member countries	Panel ARDL (PMG)	GDP pc, Oil exports, REC	Positive LR between Oil export and GDP, negative LR between REC and GDP
Makki et al. (2023)	2004-2015	44 countries	FMOLS, DOLS, Granger	REC, FDI, GDP	Positive
Ackah and Kizys (2014)	1980-2010	12 African oil-producing countries	FE/RE ₁ , GMM	REC, CO ₂ , GDP, labor, caapital, energy price	Presence of asymmetric relationship between variables
Guliyev (2024)	2004-2022	Azerbaijan and Kazakhstan	Comparative policy analysis	GDP, FDI, Energy transition policy	Positive link between governance quality and RE share, stronger in KZ
Rong G. and Qamruzzaman M. (2022)	1990-2021	U.S., China, India, Japan and S.Korea	Linear & NARDL, Bayer-Hanck, Granger	REC, EPU, Oil price volatility, tech innovation	Bidirectional causality, Positive effects of oil prices and innovation on REC, EPU negative
Pagliari et al. (2021)	2013-2019	Russia	Qualitative analysis	Energy transition, EV uptake, Storage innovation	Slow RE growth; fossil dominance and institutional barriers persists
Deniz (2019)	1995-2014	Oil-importing countries	FE (LSDV), GMM, Panel VAR	Oil price, GDP pc, CO ₂ , trade openness, REC	Asymmetric effects across countries
Bahrami and Abbaszadeh (2014)	1971-2010	Iran	Descriptive analysis	Installed renewables capacity, policy targets	RE growth slow, limited diversification
Makki et al. (2024)	1990-2018	24-country panel	Panel regression (FE, SUR)	REC, GDP growth, oil price, inflation, income	Asymmetric effects across variables
Zhang et al. (2020)	1990-2018	Germany	ARDL, Cointegration	Crude oil imports, REC, trade openness	Transport and industry raise oil imports; REC lowers oil dependence
Tambari, Failler, and Jaffry (2023)	1990-2021	10 African countries	P-VECM, System GMM	RE generation, GDP, oil prices, interest & exchange rates	Asymmetric effects of oil prices, Positive relationship between GDP and RE
Mukhtarov et al. (2020)	1993-2018	Azerbaijan	ARDL, VECM, Toda-Yamamoto	REC, FD, GDP pc, CPI	Bidirectional causality between GDP, FD and REC

Legend: ARDL = Autoregressive Distributed Lag; CO_2 = Carbon Dioxide Emissions; CPI = Consumer Price Index; DOLS = Dynamic Ordinary Least Squares; EPU = Economic Policy Uncertainty; FDI = Foreign Direct Investment; FD = Financial Development, FE = Fixed effects, FMOLS = Fully Modified Ordinary Least Squares; GMM = Generalized Method of Moments; GDP = Gross Domestic Product; LSDV = Least Squares Dummy Variable model; LR = Long-run, NARDL – Nonlinear Autoregressive Distributed Lag; *pc* = per capita; P-VECM = Panel Vector Error Correction Model; PMG = Pooled Mean Group; RE = Renewable Energy; REC = Renewable Energy Consumption; RE_1 = Random Effects; SR = Short-run; SUR = Seemingly Unrelated Regression; VAR = Vector Autoregression; VECM = Vector Error Correction Model

2.1 Financial Development, Economic Growth, and Renewable Energy Nexus

An increasing number of studies have examined the relationship between financial and economic development and renewable energy consumption (REC).

Li et al. (2021) addressed the interrelationships between REC, financial development, and economic growth in Turkey for the years 1990–2015 using a VAR framework. Their findings showed bidirectional causality between financial development and REC, but neither had a significant impact on economic growth, indicating that the financial systems have limited integration in supporting renewables. Likewise, Belloumi and Aljazeera (2024) examined 13 oil-exporting countries for the years 1990 and 2020 by applying PMG-ARDL and DOLS, and found that in the long-run both economic growth and financial development have a positive impact on REC but in the short-run both impacts are statistically insignificant

Mukhtarov et al. (2020) produced country-specific results for Azerbaijan using ARDL bounds testing and Toda-Yamamoto causality analysis for 1993 – 2015. They found both financial development and economic growth increases REC significantly and increases in energy prices constrain it. Additionally, they identified bidirectional causation between financial development and renewable consumption, providing emphasis on the importance of financial inclusivity to energy transition policy actions.

These studies indicate a stable long-term relationship between financial deepening and renewable energy growth. However, this relationship varies in strength across countries based on economic structure and policy alignment.

2.2 Oil Dependence, Resource Dynamics, and Renewable Transition

A large number of studies have looked at the role of oil rents, prices, and dependence in renewable energy development, especially in resource-rich countries.

Aidarova et al. (2024) examined nine OPEC countries from 1990-2024 using a Panel ARDL model and wrote that oil exports exert a meaningful positive long-run impact on economic growth, while REC has a negative long-run effect. This implies that sustained structural dependence on hydrocarbons could impede the renewable transition. On the other hand, Deniz (2019) utilized data for 24 oil dependent nations (1995-2014) and found that oil prices stimulate REC in oil importers, but crowd it out for oil exporters, demonstrating asymmetric policy effects.

Makki et al. (2024) analyzed 24 countries (12 oil exporters and 12 oil importers) from 1990-2018 using panel multiple regression and found that oil rents and GDP growth decrease REC for oil exporters, but increase for importers, which suggests that energy dependence strongly conditions the direction of causality. Equally, Tambari et al. (2023) used a Panel Vector Error Correction Model (P-VECM) with ten African countries (1990-2021) and found that oil prices have a positive relationship for renewable development in oil-importing countries, but are insignificant to exporters, while GDP positively and consistently affects renewable development for both groups.

Another study by Makki et al. (2023) using a dataset of 44 nations from 2004-2015 also confirms this pattern: oil rents positively affect REC, fiscal incentives (such as investment taxes) motivate renewable investments, while oil prices themselves have little direct impact. Similarly, Awodumi and Adewuyi (2020) share that petroleum and natural gas consumption have asymmetric

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effects on growth and CO₂ emissions in five oil-producing African economies (1980-2015), where positive shocks of non-renewable energy generally support growth but also increase emissions.

Descriptive studies also echo these econometrics. In their study of Iran's renewable policies between 2004-2014, Bahrami & Abbaszadeh (2013) reported that Iran made only little progress on capacity expansion despite the significant potential due to institutional and fiscal dependence on fossil fuels. Contextually, Guliyev (2023) researched on Azerbaijan and Kazakhstan between 2004-2022 and found Kazakhstan's earlier reforms and stronger governance led to greater share of renewable energy, while oil still dominates Azerbaijan's energy mix.

Overall, these studies suggest that oil-rich economies are restrained in the renewable transition by long-standing dependency on fossil fuels, weak institutions, and reliance on oil revenue. In contrast, oil-importing countries have stronger economic and policy motivations to pursue a diversification of energy sources.

2.3 Drivers of Technological Innovation, Policy and Governance

A separate line of research has examined how technological innovations, quality of governance, and policy integration can support the development of renewable energy.

Ericson, Engel-Cox, and Arent (2019) provided a global technical review of integrating renewables into oil and gas operations, concluding that solar, wind and geothermal technologies could reduce operational costs, emissions, and energy intensity. Pagliaro (2020) offered a critical analysis of Russia's renewable transition in 2013–2019, noting that technological innovation increased wind and solar capacity but fossil fuels continue to dominate markets due to structural inertia and institutional barriers.

At the country level, Rong and Qamruzzaman (2022), identified factors that determine REC across the U.S., China, India, Japan, and South Korea during 1990–2021 using linear and nonlinear ARDL models. Their analysis showed that oil prices and technological innovation had a positive effect on REC, while economic policy uncertainty demonstrated a negative effect. Bidirectional causality was also found among their key variables in several countries, demonstrating the importance of stable policy environment. Zhang et al. (2022) studied Germany using ARDL cointegration with time series data (1990-2020) and concluded that renewable expansion significantly reduces crude oil imports, providing evidence that adopting clean sources can effectively reduce dependence on imported oil.

Ackah and Kizys (2015) offered another perspective by conducting analysis using data from 12 oil-producing African countries (1985 – 2010). They determined that economic growth and energy depletion are positively linked to renewable energy demand, whereas higher energy prices and CO₂ emissions are negatively linked. These nuances suggest that structural and environmental factors, such as technology and policy effectiveness operate simultaneously to define the speed of renewables adoption.

In summary, three main findings arise from the literature. First, financial development and economic growth have long-run positive links to renewable energy adoption, short-run links are generally weak. Second, oil-exporting economies face structural barriers in separating growth from hydrocarbons, while oil-importing countries seem to be more motivated to employ renewable technologies as a hedge against price volatility and supply insecurity. Third, technological innovation and governance quality are the key enabling factors of energy transition, rather than the abundance of resources.

While many studies in relation of oil production, renewable energy and economic factors have accumulated, there is a narrow literature focus on Azerbaijan specifically. The current literature highlights complexity and evidence surrounding different results dependent on group of countries, tests and methods. In this regard, studying Azerbaijan's case in terms of how oil production and adaptation of renewable energy sources relate to the country's economic performance will provide useful information to academia and policy-makers.

3. Methodology

3.1 Data

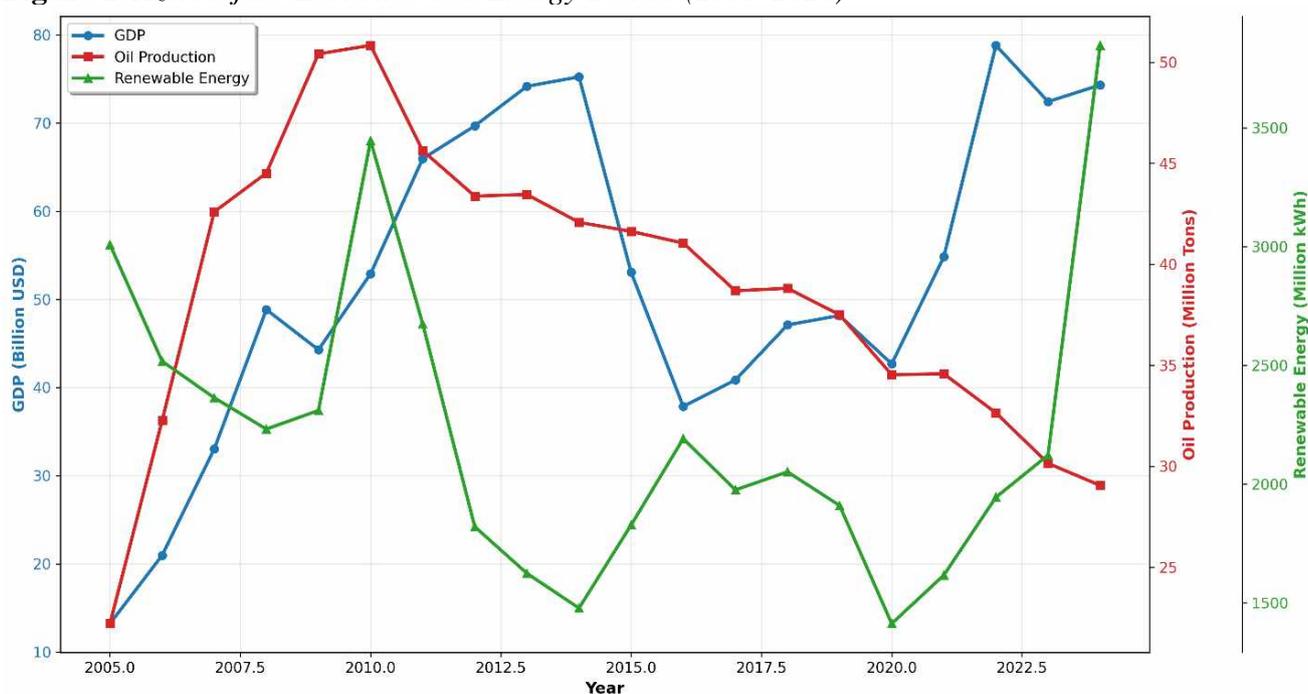
In order to accomplish the objectives of the research, corresponding data had been obtained from The State Statistical Committee of the Republic of Azerbaijan (oil production, renewable energy consumption and renewable energy share) and World Bank database (Gross Domestic Product). The research was conducted using data spanning the period from 2005 to 2024 (n = 20).

Table 2. Nature and data sources of the variables

Variable	Unit	Description	Role	Source
GDP	USD (billions)	Gross Domestic Product	Economic indicator	World Bank database
Oil production	Million tons	Annual oil production	Traditional energy	The State Statistical Committee of the Republic of Azerbaijan
Renewable energy consumption	Million kWh	Annual renewable energy output	Clean energy	
Renewable energy share	Percentage	Share of total energy consumption	Transition indicator	

Table 2 summarizes the variables used in the analysis, providing brief information about each one. Initially, for the purpose of determining the obtained dataset whether distributed normally or not, the Shapiro–Wilk Test is executed. The integrated graphs of the used variables are given in Figure 1.

Figure 1. Azerbaijan: Economic and Energy Trends (2005-2024)



3.2 Methods

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3.2.1 Descriptive Statistics

Descriptive statistics were used to know central tendency and variability in Azerbaijan's economy and energy indicators from 2005 to 2024. The statistical analysis employed standard descriptive measures including central tendency (mean and median), variability (standard deviation, range, and interquartile range (IQR)), and relative dispersion (coefficient of variation (CV)). The CV was calculated as the ratio of standard deviation to the mean multiplied by 100, providing a normalized measure of variability between various units of measurement. The IQR range (Q3-Q1) was used to assess the spread of the middle 50% of observations, offering insights into data distribution and potential outliers. The prior analysis helped assess data suitability and provided a foundational overview of the dataset for further regression and correlation analysis.

3.2.2 Time Trend Analysis

Additionally, the time trend analysis with a linear regression model used to examine changes in key economic and energy variables over selected period of time. The employed regression analysis:

$$\text{Variable} = \beta_0 + \beta_1(\text{Year}) + \varepsilon,$$

In this model, β_1 represents the annual rate of change for each variable. Statistical significance was assessed at $\alpha = 0.05$ level, with trend strength evaluated using R^2 values. The time trend regression analysis quantified annual change rates, trend coefficients (R^2), p-values, and provided binary significance classifications (Yes/No) along with directional interpretations (increase/decline/no significant trend) to uncover statistically relevant temporal trends for each variable.

3.2.3 Correlation Analysis

Besides that, to examine the linear relationships among the selected economic and energy variables, the Pearson Product-Moment Correlation Coefficient was applied.

$$r = \frac{\Sigma(x-\bar{x})(y-\bar{y})}{\sqrt{[\Sigma(x-\bar{x})^2\Sigma(y-\bar{y})^2]}}$$

This method measures the strength and direction of the linear association between two continuous variables. The values ranging from -1 (perfect negative correlation) to +1 (perfect positive correlation) with ineligible ($|r| < 0.1$), weak ($0.1 < |r| < 0.3$), moderate ($0.3 < |r| < 0.5$), strong ($|r| > 0.5$) interpretations.

3.2.4 Hypothesis Testing

Following the correlation analysis, hypothesis testing for Pearson correlation coefficients was performed to determine whether the observed relationships were statistically significant. The null hypothesis (H_0) assumes no correlation ($\rho = 0$), while the alternative hypothesis (H_1) assumes a correlation exists ($\rho \neq 0$). The t-test for correlation significance was applied at the 5% significance level ($\alpha = 0.05$). For each variable pair, the computed p-value determined whether the correlation coefficient differed significantly from zero. Cohen's conversions are a standardized way to describe the magnitude of correlation. Effect sizes were also evaluated to classify the magnitude of correlations as small, moderate, or large.

3.2.5 Linear Regression Analysis

The study employed linear regression analysis to examine the relationships between economic and energy variables across six distinct model specifications.

$$Y = \beta_0 + \beta_1X + \varepsilon$$

In the equation, β_0 is the intercept, β_1 is the slope, which gives the expected change in the dependent variable (Y) for a unit change in the independent variable (X), and ϵ is the random error term. For each model, key statistical measures were calculated: The explanatory power of the regression model was determined by the coefficient of determination (R^2) and adjusted R^2 which indicates the proportion of the variation in the dependent variable which is caused by the independent variable. The F-statistic was used to test the overall significance of the regression model. The standard error was used to evaluate the precision with which the predictions and parameters estimates are made. The study employed linear regression analysis to examine the relationships between economic and energy variables across six distinct model specifications.

All statistical analyses were conducted by using the software of Python 3.8 (scipy, statsmodels, sklearn).

4. Results

4.1 Descriptive Statistics Summary

The descriptive analysis presented in Table 3. highlights notable variability across Azerbaijan's key economic and energy indicators during the 2005-2024 period. GDP exhibited substantial growth alongside pronounced volatility, averaging $\$52.4 \pm 18.5$ billion with a median of $\$50.9$ billion. Oil production remained more stable, averaging 38.8 ± 7.3 million tons with a median of 39.9 million tons and a moderate CV of 18.7%, though the range of 28.6 million tons. Renewable energy generation averaged $2,219 \pm 633$ million kWh, with a CV of 28.5%. Meanwhile, the renewable energy share remained consistently low, averaging $1.86 \pm 0.42\%$, with minimal variation and narrow range of 1.8%.

Table 3. Descriptive Statistics Summary (2005–2024 Azerbaijan Economic and Energy Data)

Variable	Mean ± SD	Median	[min, max]	Range	CV%	IQR
GDP (Billion USD)	$\$52.4 \pm 18.5B$	$\$50.9B$	[13.2, 78.8]B	$\$65.6B$	35.30%	$\$28.1B$
Oil Production (Million Tons)	38.8 ± 7.3 MT	39.9 MT	[22.2, 50.8] MT	28.6 MT	18.70%	9.3 MT
Renewable Energy (Million kWh)	2219 ± 633 MkWh	2087 MkWh	[1413, 3848] MkWh	2435 MkWh	28.50%	576 MkWh
Renewable Share (Percent)	$1.86 \pm 0.42\%$	1.80%	[1.3, 3.1]%	1.80%	22.80%	0.35%

Units: B\$ =billion USD; MT= Million Tons; MkWh= Million kilowatt-hours;%=Percent

CV% = Coefficient of Variation (standard deviation ÷ mean × 100) — measures relative variability.

IQR = Interquartile Range (Q3 – Q1) — measures middle 50% spread.

4.2 Time Trend Analysis Results

The time trend analysis in the Table 4. reveals contrasting trajectories in economic growth and energy transition patterns. GDP demonstrated a significant positive trend with an annual increase of $\$1.753$ billion ($p = 0.0102$, $R^2 = 0.313$). The renewable energy share showed a significant declining trend of -0.036% per year ($p = 0.0232$, $R^2 = 0.255$). Neither oil production nor absolute renewable energy generation showed statistically significant trends ($p = 0.1404$ and $p = 0.3672$, respectively).

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Table 4. *Time Trend Analysis with Linear Regression Model*

VARIABLE	ANNUAL CHANGE	TREND R ²	P-VALUE	SIGNIF.	INTERPRETATION
GDP (Billion USD)	\$1.753 B/year	0.313	0.0102	Yes	Significant increase
Oil Production (Million Tons)	-0.420 MT/year	0.117	0.1404	No	No significant trend
Renewable Energy (Million kWh)	-22.780 MkWh/year	0.045	0.3672	No	No significant trend
Renewable Share (%)	-0.036 %/year	0.255	0.0232	Yes	Significant decline

Model: $Variable = \beta_0 + \beta_1(Year) + \varepsilon$

Note: Significance tested at $\alpha = 0.05$ level. R^2 indicates trend strength.

4.3 Correlation Analysis Results

4.3.1 Economic Energy Relationships

In Table 5, the results of the correlation analysis revealed predominantly weak linear relationships between variables, highlighting several noteworthy patterns. GDP showed weak positive correlation with oil production ($r = 0.187$) and weak negative correlation with renewable energy ($r = -0.161$) and renewable share ($r = -0.033$). Oil production exhibited a moderate positive association with renewable share ($r = 0.557$). The strongest relationship observed was between renewable energy generation and renewable share ($r = 0.679$).

Table 5. *Pearson Correlation Matrix*

Variables	GDP	Oil Prod.	Renew. Energy	Renew. Share
GDP (Billion USD)	1	0.187	-0.161	-0.033
Oil Production (Million Tons)	0.187	1	-0.121	0.557
Renewable Energy (Million kWh)	-0.161	-0.121	1	0.679
Renewable Share (%)	-0.033	0.557	0.679	1

Interpretation: $|r| < 0.1$ (negligible), $0.1-0.3$ (weak), $0.3-0.5$ (moderate), > 0.5 (strong)

4.3.2 Statistical Significance Testing

In Table 6, the hypothesis testing results show that most relationships among Azerbaijan's macroeconomic and energy indicators in 2005–2024 are statistically insignificant at the 5% level, indicating limited linear relationships or insufficient evidence for a relationship. The relationships of GDP with all energy related variables: oil production, renewable energy consumption, and renewable energy share, show non-significant correlation coefficient ($p > 0.05$). The same applies to the relationships of oil production and renewable energy consumption, which show no significant interaction. Only two of the statistically significant relations could be identified, these being: oil production with renewable share ($r = 0.5573$, $p = 0.0107$) and renewable energy with renewable share ($r = 0.6786$, $p = 0.0010$) both showing large effect sizes.

Table 6. Hypothesis Testing for Correlations

HYPOTHESES	VARIABLES	TEST STATISTIC	P-VALUE	DECISION	EFFECT SIZE
H _{1.0} : $\rho = 0$	GDP vs Oil Production	r = 0.1870	0.4299	Accept H ₀	Small
H _{2.0} : $\rho = 0$	GDP vs Renewable Energy	r = -0.1608	0.4982	Accept H ₀	Small
H _{3.0} : $\rho = 0$	GDP vs Renewable Share	r = -0.0330	0.8903	Accept H ₀	Negligible
H _{4.0} : $\rho = 0$	Oil Production vs Renewable Energy	r = -0.1214	0.6102	Accept H ₀	Small
H _{5.0} : $\rho = 0$	Oil Production vs Renewable Share	r = 0.5573	0.0107	Reject H ₀	Large
H _{6.0} : $\rho = 0$	Renewable Energy vs Renewable Share	r = 0.6786	0.001	Reject H ₀	Large

H₀: No correlation ($\rho = 0$) vs H₁: Correlation exists ($\rho \neq 0$)

4.4 Regression Analysis Findings

The regression results presented in Table 7 reveal that most models exhibit poor predictive power, with R² values below 0.04 and p-values exceeding 0.05, indicating no statistically significant linear dependence between GDP and the examined energy variables. Only the models of oil production versus renewable share and renewable energy versus renewable share showed relatively moderate results, with R² values of 0.31 and 0.46, respectively.

Table 7. Linear Regression Analysis Summary

REGRESSION	R ²	ADJ. R ²	F-STAT	P-VALUE	SLOPE (SE)	QUALITY
GDP vs Oil Production	0.035	-0.0186	0.652	0.4299	0.0733 (0.0908)	Poor
GDP vs Renewable Energy	0.0259	-0.0283	0.478	0.4982	-5.4920 (7.9448)	Poor
GDP vs Renewable Share	0.0011	-0.0544	0.02	0.8903	-0.0008 (0.0054)	Poor
Oil Production vs Renewable Energy	0.0147	-0.04	0.269	0.6102	-10.5697 (20.3698)	Poor
Oil Production vs Renewable Share	0.3106	0.2723	8.11	0.0107	0.0326 (0.0114)	Moderate
Renewable Energy vs Renewable Share	0.4606	0.4306	15.368	0.001	0.0005 (0.0001)	Moderate

Model: $Y = \beta_0 + \beta_1 X + \varepsilon$

5. Discussion

In the section the findings from applied statistical methods were interpreted, limitations, future recommendations and policy implementations were mentioned.

5.1 Interpretation of results

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During the descriptive analysis the relatively symmetric distribution and a high coefficient of variation (35.3%) in GDP may indicate considerable economic fluctuations, largely reflecting shifts in global oil prices and external shocks. Also oil production demonstrated a relatively consistent trend over the analyzed period showing some variations linked to the market conditions. Renewable energy generation remained moderately variable, possibly due to hydrological changes or project-level developments. The proportion of renewable energy in the total energy mix remained persistently low, indicating limited structural transformation within Azerbaijan's energy sector. Overall, these results illustrate that while Azerbaijan's economy has experienced dynamic expansion, its energy sector—especially the renewable component—has undergone limited structural transformation over the past two decades.

In the time trend analysis, the sustained upward movement in GDP indicates sustained economic growth over the study period. Despite this economic expansion, the share of renewable energy displayed a downward trend. This may suggest that economic growth has not translated into increased renewable energy adoption. Both oil production and overall renewable energy output remained comparatively stable over the study period. This finding implies that, while the economy continues to grow, the share of renewable energy within the energy mix has shrunk, reflecting limited progress towards the goals of global energy transition. The stable output in oil and renewable energy also indicates that the changes in production for these two energy sources were probably the result of short-term market and policy factors rather than a long-term structural shift.

The correlation analysis revealed that the weak relationships between GDP and energy variables. This may suggest that country's economic growth from 2005 to 2024 was largely independent of short-term fluctuations in either oil or renewable energy output, possibly due to the country's broader economic diversification efforts beyond the energy sector. This pattern possibly reflecting that Azerbaijan's economy has decoupled from oil production. The outcome of strong relationship between renewable energy generation and renewable share is logically expected, as increases in renewable generation directly improve its proportion in the total energy mix. Additionally, the limited interaction between fossil fuel production and renewable energy consumption further implies that changes in oil output do not directly influence renewable deployment. However, the result of moderately significant and positive relationship between oil production and the share of renewables is quite counterintuitive, as periods of higher oil output coincided with a greater presence of renewables in the energy mix. The observed relationships indicate that Azerbaijan's energy-economy dynamics are complex and not strictly linear, suggesting the need for more advanced analytical approaches to capture the mechanisms driving the energy transition. Overall, the findings point to a compatible internal relationship within the energy sector, where variations in renewable generation are mirrored in their share of total energy use, and rising oil production may indirectly support renewable development through reinvestment and policy-driven diversification.

The positive correlation between oil production and renewable energy share ($r = 0.5573$, $p = 0.0107$) found in this study aligns with emerging evidence from the literature on resource-rich countries' energy transitions. This suggests variations in oil output possibly reflect a positive association with renewable share. This also aligns with the findings of the research done by Mukhtarov et al. (2020). They demonstrated that financial development and GDP growth in Azerbaijan enable greater renewable energy consumption, indicating that oil revenues may facilitate the financial capacity needed for renewable investments.

The positive correlation could emerge from several factors: strategic government planning that views renewables as complementary to oil exports, the maturation of oil fields necessitating economic diversification, or the reinvestment of oil revenues into sustainable energy infrastructure. Additionally, international commitments and climate policies may have created incentives for simultaneous oil production and renewable development. That's why, energy diversification strategy can be pursued without immediately sacrificing oil revenues. This finding contrasts with traditional resource curse

theories, where traditional theory suggests that rich oil resources would discourage renewable energy investments.

However, this positive relationship should be interpreted cautiously within Azerbaijan's specific policy context. The moderate R^2 value (0.31) from regression analysis suggests that while statistically significant, oil production explains only 31% of the variance in renewable share, indicating that other policy, institutional, and technological factors play crucial roles in renewable energy deployment.

5.2 Limitation of research

The results should be interpreted based on several limitations. First, the analysis is constrained to linear relationships which may not capture possible non-linear relationships or other effects present in the oil-renewable energy interrelationship. Second, while the 20-year time series is exhaustive for the recent time period of the development of Azerbaijan, it may be inadequate to capture long-term structural shifts or cyclical aspects of energy transitions. Third, renewable energy is not classified by technology (solar, wind, hydro) which may reveal different relationships with oil production. Institutional factors, the quality of governance and some policy variables are not explicitly modeled even though they have been shown in the literature to be very significant in the explanation of resource-renewable interrelationships.

Overall, the relationships between economic output and energy variables are more complex and there is a need for more sophisticated modeling approaches or additional explanatory variables to better understand these multifaceted relationships.

5.3 Policy implementation and recommendations

The findings of this study suggest that Azerbaijan's oil production and the share of renewable energy consumption can proceed in a complementary manner, providing a strategic opportunity to convert hydrocarbons into a sustainable energy future. Realization of such a possibility will require an integrated policy approach that combines fiscal planning, structural reform, human capital development and the involvement of communities.

5.3.1 Strategic Revenue Allocation

To secure long-term financing for renewable energy, Azerbaijan should reinvest a certain proportion of its oil revenues into renewable energy projects. This investment will directly support solar and wind power projects, technology transfer partnerships and the local manufacture of renewable energy components, and will also boost research and innovation in technologies to exploit renewables. Constant investment ensures that oil income accelerates rather than delays the green transition.

5.3.2 Integrated Energy Portfolio Management

The energy policy should adopt an integrative portfolio approach, which will see oil and renewable sectors as mutually reinforcing. Oil revenues may be used to de-risk private sector renewable investment by way of government guarantees and fiscal incentives, diversifying the same into hybrid energy and smart grid developments which will aid system efficiency and stability.

5.3.3 Institutional and Regulatory Reforms

Azerbaijan has already established the Azerbaijan Renewable Energy Agency (AREA) under the Ministry of Energy, which plays a key role in promoting renewable energy development. To ensure more effective coordination of the national energy transition, the institutional framework should be strengthened by expanding AREA's mandate and operational capacity. AREA could evolve into a comprehensive coordination body responsible for integrating oil revenues into renewable investments, overseeing the implementation of incentive schemes such as feed-in tariffs, renewable energy

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certificates, and net metering policies, and streamlining the permitting and licensing processes for new renewable projects. Strengthening AREA's analytical and regulatory capabilities would enable more consistent monitoring of progress toward Azerbaijan's 30% renewable electricity target by 2030 and enhance transparency in investment management. Additionally, introducing competitive bidding frameworks, tax incentives, and carbon trading mechanisms would stimulate private sector participation and align Azerbaijan's regulatory framework with international standards of sustainable energy governance.

5.3.4 Human Capital Development

Developing skilled professionals is key to sustaining transition. Retraining oil-sector specialists, launching clean-energy programs at universities, and establishing vocational centers for solar and wind technologies will ensure a qualified workforce. Partnerships between academia and industry and international exchange programs will also help develop technical skills.

5.3.5 Economic Diversification and Innovation

Diversification should extend beyond the energy sector. Green hydrogen production, local manufacture of renewable energy equipment, carbon trading mechanisms, and digital energy management systems are some of the priority areas to be developed to improve the country's industrial capacity and make it a hub for renewable energy in the region.

5.3.6 International Cooperation and Technology Transfer

Cooperation with the European Union, United Nations and other multi-lateral organizations will provide Azerbaijan with access to advanced technologies and funding to implement them. Together, joint projects can facilitate technology transfer, infrastructure modernization and the adoption of best practices for Azerbaijan.

5.3.7 Community Engagement and Social Inclusion

The long-term success of renewable energy initiatives depends on local community involvement. Community based projects can increase energy access in rural areas, generate employment, and contribute to social inclusion. Integrating local input into project planning will foster sustainability and public acceptance of the energy transition process. For the long-term sustainability of renewable energy projects, they need to involve and engage the local communities where they are being implemented.

6 Conclusion

The paper studied the relationships between oil production and renewable energy consumption in Azerbaijan in time period of 2005 – 2024. Among the six hypotheses tested, only H₅ and H₆ were statistically significant. It was observed that, there is a positive and significant correlation between oil production and renewable energy share ($r = 0.5573$, $p = 0.0107$). This may be interpreted as Azerbaijan's oil production and renewable energy development have followed the complementary relationship, rather than competing during selected period. Based on that, it can be suggested that an energy diversification policy can be implemented without immediately sacrificing carbon oil gas revenues.

These findings have important implications both theoretically and practically for resource rich countries. From a theoretical perspective, the positive relationship between oil and renewable energy highlights the potential for strategic energy portfolio management in oil-dependent economies. Practically, the results suggests that countries like Azerbaijan can utilize oil revenues to finance transitions to renewable energy sources, creating a sustainable track both for long-term diversification of economic activity and short-term fiscal stability from hydrocarbon exports.

The realization of this goal will require persistent commitment to implementation of policy decisions, strong institutional structures and a continuous partnership among the government, the private sector, and civil society.

Overall, analyzing how economic and energy components affecting renewable energy in oil-dependent economies is significantly important to maintain sustainable economic growth and build strategic policy framework.

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APPENDIX

Figure 2. Time trend analysis with linear regression model

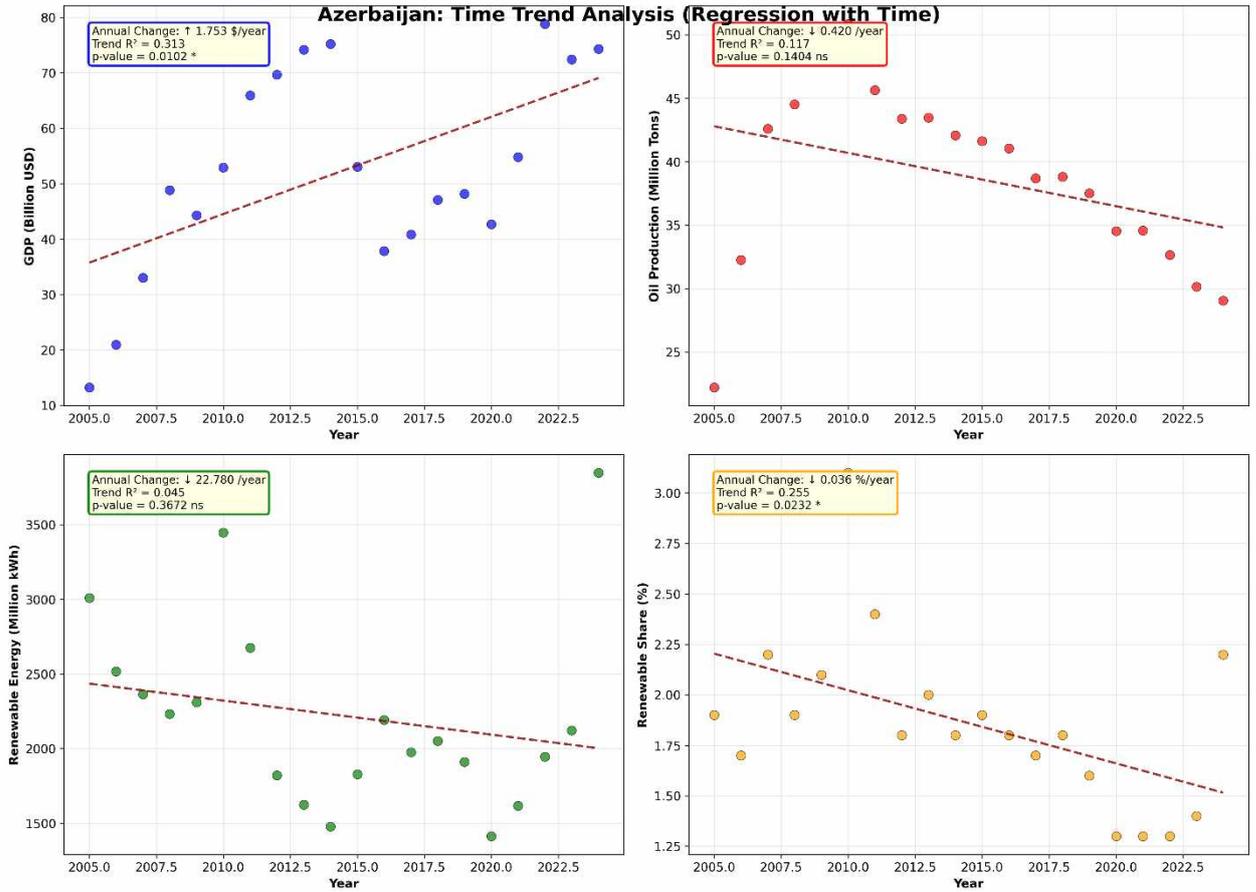
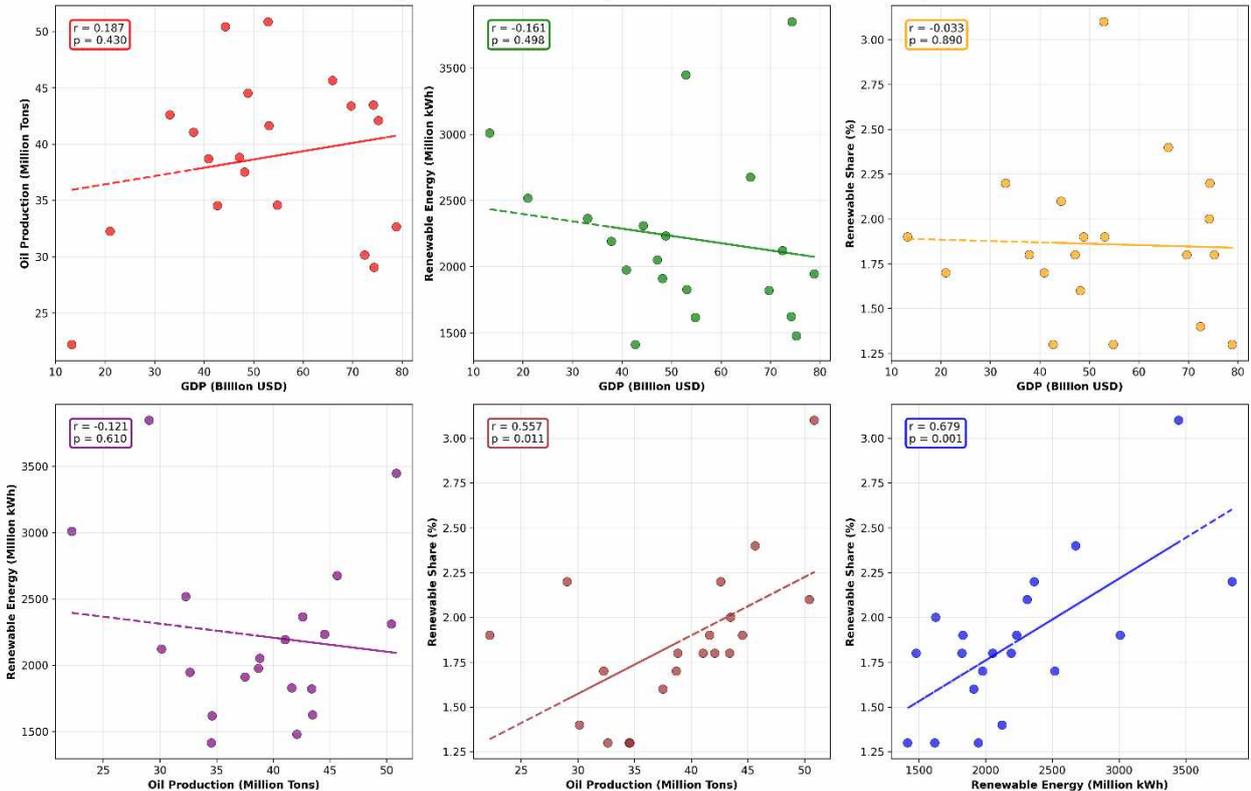


Figure 3. Correlation analysis- substantive variables only

Azerbaijan: Correlation Analysis - Substantive Variables Only



DIGITAL TRANSFORMATION AND EMERGING HR COMPETENCIES: AN EMPIRICAL STUDY OF SLOVENIAN ORGANIZATIONS

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Abstract: *The accelerating pace of digitalization is fundamentally redefining the role, competencies, and strategic importance of human resource management (HRM). This study investigates how digital technologies—such as artificial intelligence (AI), analytics, and automation—transform human resource (HR) functions and generate new competency requirements, including digital agility, data fluency, and strategic capability. Building on theories of digital HRM, competency-based management, and sustainable HRM, the study develops an integrated conceptual framework linking digital transformation, HR competencies, and organizational sustainability. Empirical data were collected through a survey of more than 100 Slovenian organizations across different sizes and industries, yielding 82 valid responses for analysis. The findings indicate a relatively high level of HR formalization, alongside persistent difficulties in recruiting qualified HR professionals. Key competency gaps were identified in employee development, HR analytics, and strategic HRM. The results further show that larger organizations are significantly more likely to have established HR functions, while organizations with more mature HR structures recruit HR specialists more frequently and attribute greater importance to developing a national HR management system. Moreover, organizations that recruit HR professionals more intensively report greater difficulty in identifying suitable candidates, pointing to a growing skills mismatch in the HR labor market. Overall, the findings demonstrate that successful digital transformation in HRM depends not only on technology adoption but also on the integration of digital, analytical, and ethical competencies. The study contributes to HRM theory and practice by offering a combined conceptual and empirical model linking digital agility, HR analytics, and sustainable HRM outcomes, providing practical insights for organizations and policymakers seeking to strengthen HR capability development in the digital era.*

Keywords: *Digital transformation, Human resource management (HRM), HR competencies, Digital agility, HR analytics, Competency-based HRM (CBHRM), Sustainable HRM, Future of work, Slovenia.*

1 Introduction

The accelerating pace of digital transformation is redefining the nature of work and reshaping how organizations manage people, processes, and performance. Industry 4.0—marked by automation, AI, data analytics, and interconnected systems—has placed HRM at a strategic turning point (Adeosun & Adegbite, 2022; Herman et al., 2024). No longer limited to administrative tasks, HR departments are increasingly expected to drive innovation, organizational adaptability, and resilience, where the capacity to use technology and data becomes a source of competitive advantage in the digital economy (Folarin, 2021; Timane & Wandhe, 2023).

As organizations transition to technology-enhanced structures, new competencies are critical for survival and growth in volatile environments. Rakowska and Cichorzewska (2016) highlight digital literacy, adaptability, collaboration, and innovation as core future competencies, while Coetzee and Veldsman (2025) identify digital agility—the capacity to anticipate and respond to technological

change—as essential for HR professionals. Alongside technological proficiency, HR leaders must also demonstrate strategic insight, ethical awareness, and emotional intelligence to manage the human element of digital transformation (Ren et al., 2023).

The integration of AI and machine learning (ML) into HR processes intensifies these demands. Automated systems increasingly support recruitment, training, performance evaluation, and workforce planning (Okatta et al., 2024), offering efficiency and precision but also raising concerns regarding privacy, transparency, and fairness. Consequently, modern HR professionals must combine digital expertise with human-centric management, ensuring that technological innovation aligns with ethical responsibility and sustainable people practices.

Within this context, competency-based human resource management (CBHRM) has re-emerged as a strategic approach that aligns organizational performance with clearly defined competencies (Aunguroch et al., 2021; Judrups et al., 2015). McCartney, Murphy, and McCarthy (2021) propose a six-dimensional model for HR analysts—encompassing consulting, technical expertise, analytical fluency, research skills, business acumen, and communication—illustrating a hybrid competency profile that merges data science with human insight. Yet, the extent to which HR professionals possess these emerging competencies varies significantly across regions and organizational settings.

In Central and Eastern Europe, research on HR digital transformation remains limited. While multinational corporations are increasingly adopting digital HR tools, many local organizations, especially SMEs, continue to rely on traditional personnel practices. Slovenia exemplifies this discrepancy: despite strong technological infrastructure and a well-educated workforce, numerous organizations report challenges in developing advanced HR capabilities, particularly in HR analytics, digital tools, and strategic workforce planning.

To further explore these challenges, an empirical survey was conducted among 82 Slovenian organizations of different sizes and industries. The findings indicate that a substantial proportion of organizations operate with a formally established HR function, reflecting a relatively high level of HR professionalization. At the same time, a considerable share of respondents report difficulties in recruiting qualified HR professionals, with a notable number also identifying critical skill gaps in areas such as HR analytics and strategic HR management. Legal expertise and digital literacy emerge as core HR competencies, while emotional intelligence and change management are increasingly recognized as essential for managing complexity and organizational change. Moreover, there is strong and consistent agreement across respondents regarding the importance of developing a systematic national HR management framework. Based on the descriptive statistics obtained from the survey, this article proposes five hypotheses examining the relationships between company size, HR function maturity, recruitment practices, and perceived competency shortages:

- Hypothesis 1: Larger companies (with more than 250 employees) are statistically more likely to have an established independent HR function compared to smaller companies (with fewer than 250 employees).
- Hypothesis 2: Organizations with an established HR function are statistically more likely to recruit HR specialists.
- Hypothesis 3: Respondents from organizations with an established HR function attribute statistically significantly greater importance to the development of a national HR management system in Slovenia.
- Hypothesis 4: Organizations that have recruited HR professionals more frequently over the past five years perceive significantly greater difficulty in finding suitable HR personnel than organizations that have recruited HR professionals less frequently.

These hypotheses reflect a broader concern about the maturity of HR functions and digital readiness across Slovenian organizations. They suggest that the capacity to adapt to digital transformation is not evenly distributed and may depend on structural characteristics such as size, professionalization, and strategic orientation. Consequently, this study contributes to the growing

literature by connecting the macro-level dynamics of digital transformation with micro-level organizational competencies relevant to HRM. The novelty of this research lies in its integration of theoretical perspectives on digital agility, HR analytics, and sustainable HRM with empirical evidence from a post-transition European economy. It offers a context-sensitive analysis of how HR competencies evolve under digital pressure and how these competencies relate to organizational preparedness for the future of work. The results provide both academic and practical implications: academically, they extend existing models of HR competency development by incorporating regional and structural factors; practically, they inform HR practitioners and policymakers about the areas requiring targeted capacity building.

In summary, as organizations navigate the complexities of technological disruption, HRM stands at the forefront of enabling adaptive, data-driven, and ethically responsible change. Understanding the relationship between organizational characteristics, HR function maturity, and competency development is essential for designing effective strategies that ensure both digital competitiveness and human sustainability. The following sections of this paper therefore develop a comprehensive theoretical framework linking digital transformation, HR competencies, and organizational outcomes, and present the empirical results that validate this model within the Slovenian context.

2 Theoretical Framework

Understanding the future of HRM requires examining how digital technologies, emerging competencies, and sustainability jointly reshape the profession. This study builds on complementary perspectives, including digital transformation theory, agility models, competency-based HR frameworks, and sustainable HRM principles. Together, they provide an integrated lens for analyzing how organizations and HR professionals respond to technological disruption and how related competencies evolve.

The following sections address four core dimensions of this framework: (1) the digital transformation of HRM, (2) digital agility as a key HR competence, (3) HR analytics and competency-based HRM (CBHRM), and (4) sustainability and ethics as foundations of future HR practices.

2.1 Digital Transformation and the Rise of Digital Agility in HRM

The starting point of this framework lies in understanding how digital transformation reconfigures organizational structures and managerial paradigms. Digital transformation refers to the integration of advanced technologies — such as AI, ML, big data analytics, and automation — into all areas of business operations, fundamentally altering how value is created and delivered (Adeosun & Adegbite, 2022; Herman et al., 2024).

For HRM, this shift brings both opportunities and challenges. While HR traditionally focused on administrative tasks such as compliance, recruitment, and payroll, it is now expected to function as a strategic partner that drives innovation, talent development, and organizational adaptability (Folarin, 2021; Timane & Wandhe, 2023). This evolution requires HR professionals to master digital tools, apply analytics, and contribute to strategic decision-making. Consequently, HR becomes a leader of digital change, promoting technological advancement while protecting the human dimension of work, ensuring technology supports rather than replaces people.

Digital transformation depends on agility. Digital agility reflects the ability of individuals and organizations to adapt rapidly to technological change while maintaining strategic direction and a human-centered approach. Coetzee and Veldsman (2025) define it as a dynamic blend of digital literacy, adaptive learning, innovation orientation, and collaboration skills.

For HR professionals, digital agility means integrating technology into daily practice, responding to emerging challenges, and supporting continuous improvement. Herman et al. (2024) note that it functions as a performance multiplier, strengthening decision-making, employee

engagement, and organizational resilience. This competence requires not only technical expertise but also experimentation, tolerance for uncertainty, and the ability to quickly learn and unlearn. Rakowska and Cichorzewska (2016) stress that agility must also be built at the organizational level through leadership, flexible structures, and collaborative cultures.

Thus, digital agility serves as the bridge between technological disruption and human capability, enabling HR professionals to convert digital change into organizational growth.

2.2 HR Analytics and Competency-Based HRM (CHRM)

As organizations generate growing volumes of workforce data, the ability to interpret it has become essential. HR analytics applies data science and statistical techniques to support evidence-based decisions in recruitment, performance management, training, and retention (Karwehl & Kauffeld, 2021; Puli & Sagi, 2022). With predictive analytics and AI, HR can anticipate turnover, identify patterns, and design interventions that enhance employee experience (Okatta et al., 2024).

Yet analytics requires a guiding structure that defines which competencies should be developed. CBHRM provides this alignment by linking human capital to organizational strategy (Aunguroch et al., 2021; Judrups et al., 2015). CBHRM views competencies as integrated clusters of knowledge, skills, abilities, and other characteristics (KSAOs) that drive performance.

McCartney, Murphy, and McCarthy (2021) propose a six-dimensional model for HR analysts encompassing consulting capability, technical and analytical proficiency, business and HR acumen, research orientation, communication and storytelling, and ethical awareness. This hybrid model shows that HR professionals must pair data fluency with human sensitivity—using analytics to support rather than replace judgment. Within this study’s conceptual framework, HR analytics and CBHRM act as operational enablers that transform digital agility into measurable organizational performance.

2.3 Sustainable HRM and Ethical Considerations

While digital technologies enable efficiency and innovation, they also introduce ethical concerns. Sustainable HRM emphasizes not only economic outcomes but also environmental responsibility, social equity, and employee well-being (Ren et al., 2023). As automation and algorithmic decision-making expand, HR professionals must ensure that human dignity remains central to technological progress.

Ren et al. (2023) highlight that sustainable HRM requires balancing productivity with ethics by promoting fairness, inclusivity, transparency, and trust. Ethical stewardship therefore includes responsible data use, protecting privacy, and addressing algorithmic bias in recruitment and evaluation. Thus, sustainability becomes a guiding principle of digital HR transformation rather than a secondary objective.

Consequently, future HR professionals must be both digitally skilled and ethically grounded. Incorporating sustainability into HR competencies ensures that digital transformation strengthens organizational legitimacy and broader societal well-being.

2.4 Conceptual Model and Synthesis

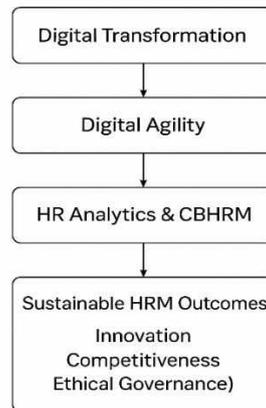
Synthesizing these theoretical dimensions, the present study proposes a conceptual model that explains how HR competencies mediate the relationship between digital transformation and organizational sustainability. The model assumes that digital transformation creates new demands for HR agility and analytical competence, which, when effectively managed, lead to sustainable and innovative HR outcomes.

Specifically, the framework posits that:

- Digital transformation acts as the external catalyst, redefining HR roles and processes.
- Digital agility functions as the mediating competence that enables HR professionals to adapt to change.

- HR analytics and CBHRM serve as implementation mechanisms that operationalize digital agility into strategic HR actions.
- Sustainable HRM emerges as the desired outcome, encompassing innovation, competitiveness, and ethical governance.

Figure 1. *Conceptual framework of digital transformation and HR competencies*



Source: Developed by the authors based on Adeosun & Adegbite (2022); Coetzee & Veldsman (2025); McCartney et al. (2021); Okatta et al. (2024); Ren et al. (2023); and Rakowska & Cichorzewska (2016).

This conceptual structure provides the foundation for the empirical analysis presented later in the paper. It connects macro-level technological change with micro-level human capabilities, offering a multidimensional explanation of how HR maturity and organizational characteristics influence readiness for digital transformation.

In summary, the theoretical framework integrates technological, behavioral, and ethical perspectives into a cohesive model of HR transformation. It suggests that the effectiveness of digital transformation depends not solely on technology adoption but on the human capacity to interpret, adapt, and act upon digital opportunities.

For this reason, HR competencies such as digital agility, analytical literacy, and ethical awareness emerge as the key determinants of organizational sustainability. The following methodological section translates this theoretical structure into a testable empirical model based on evidence from Slovenian organizations.

3 Methodology

Understanding the evolving role of HR competencies in the context of digital transformation requires a methodological approach that captures both organizational characteristics and behavioral patterns in workforce management. To achieve this, the present study employed a quantitative research design using a structured online questionnaire administered to organizations operating in Slovenia. The methodology was designed to test the relationships between company size, HR function maturity, recruitment behavior, and perceived competency gaps in line with the proposed hypotheses.

3.1 Research Design and Instrument Development

The study employed a descriptive and correlational quantitative design, appropriate for examining associations between organizational characteristics and HRM practices. The questionnaire incorporated both closed-ended and open-ended questions to gather statistical as well as contextual information. The research aimed to determine whether the digital readiness and HR competency structures of Slovenian organizations differ according to company size and the formalization of the HR function, in line with the hypotheses developed and justified in the introductory section of the article.

The survey was conducted over a period of four weeks in May 2025. Data were collected using a structured questionnaire created in the 1KA survey platform, which is widely used for academic research in Slovenia. The instrument consisted of 15 questions organized into three main sections:

1. Organizational profile: sector, size, ownership type, and presence of a formal HR function;
2. HR practices and recruitment behavior: frequency of HR hiring, challenges in recruiting qualified HR professionals, and areas of perceived skill shortages;
3. Perceptions and attitudes: perceived importance of HR development for Slovenia and assessment of key HR competencies.

Most questions were closed-ended and used Likert-type scales (from 1 = “strongly disagree” to 5 = “strongly agree”), along with categorical response options to enable quantitative analysis. Several items also included optional open comments to provide additional qualitative context

3.2 Sample and Population

A non-probability purposive sampling approach was applied to reach organizations across different industries and sizes. The questionnaire was distributed via professional HR networks, industry associations, LinkedIn groups, and direct email invitations.

The final sample consisted of 102 responses, of which 82 valid responses were retained after excluding incomplete entries. The sample structure was as follows:

- Large companies (>250 employees): 51.2%
- Medium-sized companies (50–249 employees): 34.1%
- Small companies (10–49 employees): 12.2%
- Micro companies (<10 employees): 2.4%

Organizations operated in diverse sectors, including manufacturing, IT services, education, telecommunications, energy, and pharmaceuticals, ensuring a representative cross-section of the Slovenian economy.

3.3 Data Analysis, Reliability, and Validity Procedures

Participation was voluntary and anonymous. Before distribution, the questionnaire underwent pilot testing with five HR experts to ensure clarity, face validity, and relevance of items. Minor adjustments were made based on feedback regarding wording and sequencing.

Data were analyzed using IBM SPSS Statistics software. The following statistical techniques were applied:

- Descriptive statistics (frequencies, percentages, means, and standard deviations) were used to summarize the data.
- Chi-square tests of independence (χ^2) were applied to test relationships between categorical variables (e.g., company size and existence of HR function, HR function and recruitment frequency).
- Cross-tabulations were performed to examine conditional relationships among variables relevant to hypotheses 1–4.
- Significance level ($p < 0.05$) was adopted for hypothesis testing.
- Internal consistency reliability was evaluated using Cronbach’s alpha, yielding a coefficient of 0.726 for the broader attitudinal scale and 0.854 for the HR competency assessment scale, indicating acceptable to high reliability of the measurement instruments.

Content validity was established by expert review during the instrument development phase, and construct validity was assessed by comparing empirical trends with established theoretical expectations from the literature (Aungsuroch et al., 2021; McCartney et al., 2021).

3.4 Ethical Considerations

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The study adhered to ethical research principles, including voluntary participation, anonymity, and confidential data handling. Ethical approval was obtained from the institutional research board at B2 Ljubljana School of Business. Respondents were informed that the data would be used exclusively for academic research purposes and that no individual or organizational identifiers would be disclosed. All participants provided electronic informed consent before completing the questionnaire.

4 Results

This section presents the empirical findings derived from the applied methodological approach. By integrating descriptive and inferential statistical analyses, the study provides robust empirical evidence for examining relationships between HR function maturity, recruitment practices, and competency development in Slovenian organizations. The results reported below directly address the proposed hypotheses and translate the theoretical framework into data-driven insights.

4.1 Descriptive Statistics

The majority of surveyed organizations (86.4%) reported having a formal HR function, while only 8.6% did not have one, and 4.9% had it partially established. With respect to recruitment activity, 30.9% of organizations had frequently or occasionally recruited HR professionals in the past five years, whereas 22.2% did not recruit HR staff at all. More than half of the organizations (55.6%) reported difficulties in finding qualified HR professionals. The most significant skill gaps were identified in employee development (40%), HR analytics (36%), strategic HR management (36%), and labor law expertise (34%).

Regarding key competencies, respondents attributed the highest importance to understanding labor legislation (mean = 4.7), followed by skills in selection processes, ethics and diversity, digital literacy, and change management (all mean = 4.3). Business acumen received the lowest, yet still above-average rating (mean = 3.9). A strong majority (97%) believe that developing a national HR management system is important or very important for Slovenia.

4.2 Results of Hypothesis Testing

Testing Hypothesis 1: HR Function Formalization by Company Size

To examine whether company size is associated with establishing an independent HR function (Hypothesis 1), a chi-square test was performed. In the sample, 51.2% of organizations were large and 48.8% were small.

Table 1 shows that all large companies reported having a fully established HR function, whereas among smaller companies, only 72.5% had one, 17.5% had none, and 10% had it partially established, indicating greater HR formalization in larger organizations.

Table 1. Relationship between Company Size and Presence of an HR Function

		Do you have an established HR function?			Total	
		Yes	No	Partly		
Company Size	Small (fewer than 250 employees)	Count	29	7	4	40
		Expected Count	34,6	3,5	2,0	40,0
		% within Company Size	72,5%	17,5%	10,0%	100,0%
	Large (more than 250 employees)	Count	41	0	0	41
		Expected Count	35,4	3,5	2,0	41,0
		% within Company Size	100,0%	0,0%	0,0%	100,0%
Total		Count	70	7	4	81
		Expected Count	70,0	7,0	4,0	81,0
		% within Company Size	86,4%	8,6%	4,9%	100,0%

The chi-square test in Table 2 confirms a statistically significant association between company size and the likelihood of having an independent HR function ($\chi^2 = 13.047$; $p = 0.001$). Since $p < 0.05$, Hypothesis 1 is supported, indicating that larger companies are significantly more likely to establish an independent HR function than smaller companies. This suggests that organizational size plays a key role in the formalization of HR processes.

Table 2. Chi-Square Test Results

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	13,047 ^a	2	,001
Likelihood Ratio	17,304	2	<,001
Linear-by-Linear Association	11,264	1	<,001
N of Valid Cases	81		

a. 4 cells (66,7%) have expected count less than 5. The minimum expected count is 1,98.

Since $p < 0.05$, Hypothesis 1 is supported, meaning that larger companies are significantly more likely to establish an independent HR function than smaller companies. This indicates that organizational size plays an important role in the formalization of HR processes.

Testing Hypothesis 2: HR Specialist Recruitment and Presence of HR Function

To examine whether organizations with an established HR function recruit HR specialists more frequently, a Kruskal–Wallis test was applied (Table 3). The results indicate a statistically significant difference in recruitment frequency across organizations with a fully established HR function, a partially established function, and no HR function ($H = 8.110$; $p = 0.017$).

Table 3. Kruskal–Wallis Test Results for HR Recruitment Frequency by HR Function Status

Test	Sig. ^{a,b}
Independent-Samples Kruskal-Wallis Test	,017

a. The significance level is ,050.

b. Asymptotic significance is displayed.

Independent-Samples Kruskal-Wallis Test Summary	
Total N	81
Test Statistic	8,110 ^a
Degree Of Freedom	2
Asymptotic Sig.(2-sided test)	,017

a. The test statistic is adjusted for ties.

The post hoc analysis revealed a statistically significant difference in the frequency of recruiting HR professionals between organizations with an established HR function and those without one ($p = 0.005$), as seen in Table 4, while no significant differences were observed between organizations with a partially established HR function and the other groups.

Table 4. Pairwise Comparisons by HR Function Status and Recruitment Frequency

Sample 1 - Sample 2	Test Statistic	Std. Error	Std. Test Statistic	Sig.	Adj. Sig. ^a
Yes-Partly	-7,689	11,667	-,659	,510	1,000
Yes-No	-25,279	8,996	-2,810	,005	,015
Partly-No	17,589	14,225	1,237	,216	,649

Each row tests the null hypothesis that the Sample 1 and Sample 2 distributions are the same.

Asymptotic significances (2-sided tests) are displayed. The significance level is ,050.

a. Significance values have been adjusted by the Bonferroni correction for multiple tests.

Table 5 indicates clear differences in the frequency of recruiting HR professionals depending on whether organizations have an established HR function.

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Table 5. Mean Rank Values of HR Recruitment Frequency by HR Function Status (Last 5 Years)

Established HR function	N	Mean Rank
Yes	70	38,44
No	7	63,71
Partly	4	46,13
Total	81	

Organizations without an HR function show the highest mean rank (63.71), indicating the most frequent recruitment of HR specialists. In contrast, organizations with a fully established HR function have the lowest mean rank (38.44), suggesting a lower need to seek external HR professionals due to internally managed HR activities. Organizations with a partially established HR function occupy an intermediate position (46.13), supporting the pattern that less formalized HR structures rely more on external HR support. These findings are consistent with the results of the Kruskal–Wallis test, confirming statistically significant differences between groups.

Table 6. Kruskal–Wallis Test Results for HR Function Status and Recruitment Frequency

Test Statistics ^{a,b}	Frequency of HR Specialist Recruitment (Last 5 Years)
Kruskal-Wallis H	8,110
df	2
Asymp. Sig.	,017

a. Kruskal Wallis Test

b. Grouping Variable: Presence of an established HR function

The Kruskal–Wallis test results ($H = 8.110$; $p = 0.017$) indicate a statistically significant difference in the frequency of recruiting HR professionals across organizations with different levels of HR function formalization. Since $p < 0.05$, the results confirm that recruitment behavior varies significantly depending on whether an organization has an established HR function. Based on these findings, the Hypothesis 2 is confirmed.

Testing Hypothesis 3: Importance of National HR System according to HR Function Presence

To examine whether perceptions of the importance of developing a national HR management system differ according to the presence of an established HR function, a chi-square test of independence was conducted. Table 7 presents the distribution of responses across organizations with fully established, partially established, and no HR function.

Table 7. Relationship between HR Function Status and Perceived Importance of Developing a National HR Management System in Slovenia

HR Function Status		Importance of Developing a National HR Management System in Slovenia			Total
		Very Important	Important	Neutral	
Yes	Count	49	19	0	68
	Expected Count	47,3	18,9	1,7	68,0
	% within HR Function Status	72,1%	27,9%	0,0%	100,0%
No	Count	2	3	2	7
	Expected Count	4,9	1,9	,2	7,0
	% within HR Function Status	28,6%	42,9%	28,6%	100,0%
Partly	Count	4	0	0	4
	Expected Count	2,8	1,1	,1	4,0
	% within HR Function Status	100,0%	0,0%	0,0%	100,0%
Total	Count	55	22	2	79
	Expected Count	55,0	22,0	2,0	79,0
	% within HR Function Status	69,6%	27,8%	2,5%	100,0%

The results indicate clear differences between groups. Respondents from organizations with a fully established HR function predominantly rated the development of a national HR management system as very important (72.1%), whereas organizations without an HR function showed more varied responses, including neutral positions (28,6%). Organizations with a partially established HR function rated this issue as very important.

The chi-square test results presented in Table 8 confirm that these differences are statistically significant.

Table 8. Chi-Square Test Results for HR Function Status and Perceived Importance of a National HR Management System

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	24,534 ^a	4	<,001
Likelihood Ratio	15,116	4	,004
Linear-by-Linear Association	,768	1	,381
N of Valid Cases	79		

a. 7 cells (77,8%) have expected count less than 5. The minimum expected count is ,10.

Since $p < 0.05$, the results indicate a statistically significant association between the presence of an HR function and perceptions of the importance of developing a national HR management system. Based on these findings, the Hypothesis 3 is confirmed, demonstrating that respondents from organizations with an established HR function attribute greater importance to systematic HR development at the national level.

Testing Hypothesis 4: Recruitment Difficulties and Frequency of Hiring HR Specialists

To examine whether organizations that more frequently recruit HR professionals experience greater difficulties in finding suitable candidates, an independent samples t-test was conducted. Table 9 presents descriptive statistics comparing perceived recruitment difficulty between organizations that recruited HR professionals more frequently and those that recruited them rarely or not at all in the past five years.

Table 9. Mean Difficulty of Recruiting HR Professionals by Recruitment Frequency

Frequency of HR Specialist Recruitment in the Past 5 Years	N	Mean	Std. Deviation	Std. Error Mean
Recruited more frequently	40	2,17	,931	,147
Recruited rarely or never	41	3,12	1,435	,224

The results show clear differences in perceived recruitment difficulty between the two groups. Organizations that recruited HR professionals more frequently rated the difficulty of finding suitable candidates lower on average ($M = 2,17$; $SD = 0,93$) than organizations that recruited HR professionals rarely or not at all ($M = 3,12$; $SD = 1,44$).

The statistical significance of this difference is confirmed by the independent samples t-test results presented in Table 10.

Table 10. Independent Samples t-Test Results for Recruitment Difficulty by Recruitment Frequency

	Levene's Test for Equality of Variances		t-test for Equality of Means							
	F	Sig.	t	df	Significance		Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
					One-Sided p	Two-Sided p			Lower	Upper
Equal variances assumed	12,346	<,001	-3,514	79	<,001	<,001	-,947	,269	-1,483	-,411
Equal variances not assumed			-3,532	68,800	<,001	<,001	-,947	,268	-1,482	-,412

Levene's test indicated unequal variances ($F = 12.346$; $p < 0.001$); therefore, the adjusted t-test results were considered. Since $p < 0.05$, the findings demonstrate a statistically significant difference in perceived recruitment difficulty based on recruitment frequency. Organizations that more frequently seek HR professionals report greater challenges in identifying suitable candidates. Based on these results, the Hypothesis 4 is confirmed.

5 Discussion

The findings of this study offer valuable insights into how Slovenian organizations are responding to the challenges of digital transformation within human resource management. Consistent with international research (Adeosun & Adegbite, 2022; Coetzee & Veldsman, 2025), the results demonstrate that the modernization of HR functions is strongly influenced by organizational size, structural maturity, and sustained investment in human capital development.

The confirmation of the first hypothesis indicates that larger organizations are statistically more likely to have formally established HR functions than smaller enterprises. This finding is in line with previous studies by Folarin (2021) and Timane and Wandhe (2023), which emphasize that strategic HR roles are more prevalent in larger firms due to greater resource availability, operational complexity, and the need for systematic workforce planning. In contrast, smaller organizations tend to rely on more informal HR practices, often prioritizing administrative and compliance-related activities over strategic HR development.

These differences highlight the critical role of organizational scalability in digital transformation readiness. Larger organizations are better positioned to invest in HR analytics, digital learning systems, and structured competency development initiatives, whereas smaller firms frequently depend on ad hoc training and experiential learning. The findings therefore reinforce the view that successful digital HR transformation requires not only technological adoption but also adequate structural and cultural readiness—an aspect that is particularly salient in transitional and smaller-scale economies.

Furthermore, the analyses related to the second and fourth hypotheses reveal a significant association between HR function maturity and recruitment behavior, as well as between frequent HR recruitment and increased difficulty in sourcing qualified candidates. Organizations with more professionalized HR functions tend to recruit HR specialists more actively, yet simultaneously report greater challenges in attracting suitable talent. This paradox underscores the existence of a growing skills gap in the Slovenian HR labor market, particularly in areas such as HR analytics, strategic HRM, and employee development, which were identified as critical shortage domains by a substantial proportion of respondents.

These findings align with international research emphasizing the growing importance of digital and analytical competencies as prerequisites for effective HRM in the digital era (McCartney et al., 2021; Karwehl & Kauffeld, 2021). The observed gap between labor market demand and available HR expertise suggests that higher education institutions and professional bodies need to place greater emphasis on data literacy, digital agility, and strategic thinking within HR curricula. Moreover, the results underscore the critical role of lifelong learning and continuous upskilling in maintaining both individual employability and organizational competitiveness within the HR profession.

The results related to the third hypothesis indicate that respondents from organizations with established HR functions attribute significantly greater importance to the development of a national HR management system. This finding reflects an increasing recognition of HRM as a strategic infrastructure, essential not only for organizational performance but also for broader national competitiveness and workforce development.

These perceptions are consistent with the arguments of Ren et al. (2023), who emphasize that sustainable HRM extends beyond firm-level outcomes to support societal resilience, ethical governance, and long-term development. In this context, Slovenian organizations appear to

acknowledge the need for stronger institutional support mechanisms—such as coherent policy frameworks, professional HR standards, and digital infrastructure—to facilitate the transition toward a more data-driven and sustainable national HR ecosystem.

Integrating the empirical results with the proposed theoretical framework highlights digital agility as a key mediating capability between technological adoption and strategic HR performance. Organizations characterized by flexibility, a willingness to experiment, and a strong learning orientation are better positioned to translate digital technologies into effective HR practices, particularly in talent management, recruitment, and HR analytics.

However, organizational agility must be carefully balanced with ethical and sustainable HR practices. The findings suggest that many organizations remain in the early stages of developing HR analytics and digital systems, which increases the risk of prioritizing efficiency gains at the expense of employee well-being. This observation reinforces the argument of Ren et al. (2023) that digital transformation in HRM should be guided by principles of sustainable HRM, including fairness, transparency, and inclusivity, in order to avoid the dehumanization of work.

Within this context, the Slovenian experience reflects broader European challenges of advancing digitalization while safeguarding human-centered values. The results indicate that organizations best positioned for the future are those that successfully integrate technological innovation with human empathy, thereby positioning HR as a strategic driver of both organizational innovation and employee trust.

The study makes several important contributions. From a theoretical perspective, it extends existing models of HR competencies by empirically validating the relationships between organizational structure, digital readiness, and competency development within a post-transition economy. It supports the proposed conceptual model linking digital transformation → digital agility → HR analytics & CBHRM → sustainable HRM outcomes, offering an integrative framework for future research.

From a practical standpoint, the findings provide actionable insights for managers and policymakers. Organizations should:

- Strengthen HR analytics capabilities through targeted training;
- Promote digital agility and continuous learning among HR professionals;
- Develop national standards for HR competency certification; and
- Integrate sustainability and ethics into digital HR initiatives.

Such actions would help bridge the gap between technological potential and human capability, ensuring that digital transformation contributes to long-term organizational performance and broader societal resilience. The rapid digitalization of business environments has fundamentally reshaped the competency requirements for HR professionals, shifting the focus from administrative efficiency toward strategic adaptability, digital literacy, and ethical responsibility. The findings of this study confirm that organizational size and the maturity of the HR function significantly affect organizations' capacity to respond effectively to these evolving demands. Empirical evidence from 82 Slovenian organizations indicates that, although most companies have established HR departments, many continue to face difficulties in recruiting professionals with the analytical and strategic competencies required in the digital era. This pattern reflects a wider structural challenge: while HR digital transformation is advancing, the development of corresponding competencies is progressing at a slower pace than technological adoption.

The conceptual model developed in this study integrates four interrelated dimensions—digital transformation, digital agility, HR analytics and competency-based HRM, and sustainable HRM—into a coherent analytical framework. The model demonstrates that successful HR digitalization depends not only on technological infrastructure but also on human adaptability, learning orientation, and ethical governance. Thus, from a practical perspective, the findings underscore the importance of sustained investment in HR capability development, the promotion of data-informed decision-making, and the establishment of ethical oversight mechanisms in AI-enabled HR processes. From a research

perspective, the study offers a transferable and replicable framework that can be applied in other small open economies undergoing similar digital transitions.

In conclusion, the future of HRM does not lie in choosing between technological advancement and human-centered values, but in their effective integration. Organizations that develop digitally agile, analytically proficient, and ethically grounded HR professionals will be best positioned to navigate uncertainty and succeed in an increasingly technology-driven business environment.

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WHAT MATTERS MOST TO YOUNG FESTIVALGOERS? INSIGHTS FROM A CROSS-GENERATIONAL ANALYSIS CONDUCTED IN GERMANY

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Abstract: *Festivals are a unique cultural space where diverse audiences converge, each with varying expectations and priorities. By focusing on young people, this study explores which aspects festivalgoers across different age groups consider most important, using data from a comprehensive survey conducted in Germany (secondary data analysis of a 2023 survey; N = 3503). Through cross-tabulations, the analysis examines preferences such as cleanliness, hygiene facilities, transport options, and entertainment. While initial findings show that sustainability consistently ranks as a low priority for festival attendees regardless of age, this study aims to uncover potential generational differences in other key areas. The results provide valuable insights for festival organizers seeking to align their offerings with the diverse needs of their audiences while addressing broader cultural and societal expectations.*

Keywords: *festivals, audience, generational differences, experience economy, festival management*

1 Introduction

Festivals are unique cultural spaces where audiences comprise diverse social groups, each with its own expectations and priorities. They offer immersive, multisensory experiences that temporarily suspend everyday routines and social roles. Particularly for young people, festivals represent not only sites of entertainment but also spaces of identity formation, social bonding, and self-expression.

The word *festival* is often used in a wider sense to describe event formats such as large trade fairs or events featuring other art forms. (Bauer and Naber 2024; Bauer et al. 2022) However, for the purposes of this paper, we define the term festival as follows: Festivals are generally open-air events, usually lasting several days, at which a number of artists perform their music live. A designated camping area is often located on the festival site and is used exclusively for the accommodation of visitors.

While festivals are often discussed in terms of their artistic, economic, or environmental impact, relatively little is known about what actually matters most to young audiences when attending such events. This paper explores the values, preferences, and priorities of young festivalgoers by drawing on a cross-generational secondary analysis of survey data collected in Germany.

2 Theoretical Framework: The Experience Economy and Music Festivals

2.1 The Four Es of the Experience Economy

The conceptual foundation of this study draws on Pine and Gilmore's seminal work *The Experience Economy* (1999), which outlines the evolution of economic value from commodities to goods, services, and ultimately, staged experiences. According to their model, experiences represent a distinct economic offering—one that is intrinsically personal, emotionally resonant, and created

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through the intentional orchestration of goods and services in a memorable context. In this framework, companies do not merely deliver a product or a service, but rather engage customers in a time-bound, immersive, and emotionally impactful event.

Pine and Gilmore (1998) propose a classification of experiences along two dimensions: the level of customer participation (passive to active) and the degree of immersion (absorption to immersion). From this matrix emerge four realms of experience (the four Es in festival experience): education, entertainment, escapism, and esthetics. Rich, memorable experiences—such as those offered by successful festivals—typically integrate elements of all four realms. Entertainment includes passive enjoyment (e.g., watching a concert), while educational experiences involve active learning (e.g., workshops or lectures). Escapist experiences, by contrast, immerse participants fully in alternative realities or social dynamics, and esthetic experiences allow attendees to appreciate curated environments without direct interaction.

This typology is particularly well suited to the analysis of music festivals. Modern open-air festivals often blend these four realms: they entertain audiences with live performances, offer educational components such as artist talks or skill-based workshops, create escapist spaces through temporary architecture and theming, and appeal to the senses through immersive design and aesthetic ambiance. Festivals such as Burning Man or Glastonbury exemplify this integration, combining performance, interaction, community, and landscape into a holistic and transformative experience. (Pine and Gilmore 1998)

Pine and Gilmore (1998) also emphasize that businesses fundamentally operating within the experience economy charge for the experience itself—not merely for goods or services. Festivals meet this criterion explicitly: the purchase of a ticket grants access to a curated, multi-sensory environment whose value is primarily experiential. The economic logic of festivals thus mirrors the shift from service to staged experience.

Furthermore, Pine and Gilmore (1998) identify several principles for designing memorable experiences: theming the event, eliminating negative cues, harmonizing positive impressions, offering memorabilia, and engaging multiple senses. These principles can be observed in the branding strategies, stage designs, and immersive scenographies of many contemporary music festivals.

Ultimately, viewing music festivals through the lens of the experience economy offers a useful analytical frame for understanding the complexity of visitor motivations and the strategic design of festival environments. It situates festivals not simply as leisure events, but as orchestrated cultural productions within an evolving economic paradigm.

2.2. The five Es of the Experience Economy

Rivera et al. (2015) expand Pine and Gilmore's (1998) original model of the four Es of experience economics by adding a fifth E: economic value. In their study, this additional element is particularly relevant in the context of Generation Y—and, as we will see later in the present paper, even more so for Generation Z—as this group is often price-conscious.

In this expanded model, economic value is considered an integral component of the overall experience rather than merely a mediating variable. This means that the economic aspect—the cost factor, the willingness to invest in the experience, and the perceived value—directly influences the perception of the overall experience and thus influences future behavioral intentions (such as revisiting or recommending). (Rivera et al. 2015)

In short, the model now encompasses the five Es: education, entertainment, escapism, esthetics, and economic value. This fifth E highlights that economic considerations play a central role in the perception and evaluation of a festival experience for Generation Y, especially in a tourism context where investments in travel, accommodation, and tickets play a significant role in the perception of the overall experience. (Rivera et al. 2015)

Building on this theoretical framework, the present study investigates how festivalgoers across generational groups evaluate specific aspects of their festival experience—ranging from musical programming and atmosphere to hygiene facilities, sustainability, and social motives.

3. Quantitative Survey

3.1. Survey Procedure

For this study, data were subjected to a secondary analysis. The data were collected in 2023 as part of a study on the determinants of festival loyalty, which involved a quantitative investigation of visitor satisfaction and loyalty, as well as the development of recommendations for action for rock and pop festivals in Germany. (Michel 2024; Bauer et al. 2025) The survey was conducted using an online questionnaire. The data collection took place from January 2, 2023, to February 24, 2023. The quantitative data analysis was carried out using SPSS. (Michel 2024)

A total of 6,411 people took part in the survey for this study. Of these, 2,514 people (39.21%) dropped out of the survey; therefore, their responses could not be included in the data analysis. Of the remaining 3,897 participants, 394 people (10.11%) answered "never" to the introductory question "How often have you been to music festivals of the pop or rock genre in Germany?" These 394 individuals fell outside the defined population and were therefore excluded from the data analysis. After adjustment, the evaluable sample size was $N = 3,503$. (Michel 2024)

35.5 % of respondents were male, 63.3 % female, 0.8 % identified as non-binary (divers in the survey question) and 0.4 % did not specify their gender. (Michel 2024)

3.2. Survey Instrument

The questionnaire which was created for the original study was in German only and consisted of a total of 58 items in a largely closed format. For the secondary analysis carried out here, item 4 ("For what reasons do you visit a festival?", with up to six answers out of 21 predefined aspects and one free field), item 5 ("Which aspects are particularly important to you at a festival?", with up to six answers out of 26 predefined aspects and one free field) and the demographic questions of items 6 to 9 (gender, age, relationship status, and highest level of education) were of particular interest. (Michel 2024)

3.3. Method of Secondary Analysis of the Survey Data

For this secondary analysis, solely descriptive statistical methods were used to describe the data in terms of its frequency distributions in order to gain a comprehensive understanding of the relevant characteristics examined. The methods used included, in particular, the calculation of mean values and the presentation of cross-tabulations. As this was a secondary analysis, inferential statistical methods were deliberately avoided. (Gisske 2021)

The aim of the analysis was to identify potential generational differences in how various aspects of festival experiences are perceived. The data were analyzed using cross-tabulations based on years of birth. For this paper, we based our analysis on the following age cohorts and generational classifications (including count and percentage) (please note: All results and statements, especially those about the Baby Boomers, should be viewed against the background of their small number of cases. This also applies to the statements about Generation X, even though their case numbers are much higher).

- Baby Boomers (1946 to 1964): $n = 18$ (0.5 %)
- Gen X (1965 to 1979): $n = 211$ (6.0 %)
- Gen Y (1980 to 1995): $n = 1430$ (40.8 %)
- Gen Z (1996 to 2012): $n = 1844$ (52.6 %)

It should be noted that the generations are not homogeneous or isolated, but rather heterogeneous cohorts that live and operate within overlapping cultural and social contexts. People's

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socialization, behavior, and mindset depend on numerous characteristics other than their year of birth. Generation is primarily a statistical device in this study. (Jureit 2006)

All differences reported are descriptive; while statistical significance was checked for the sake of completeness, the low number of cases, especially among the Baby Boomer generation, made all significance tests inconclusive. Thus, all results are presented thematically to highlight broader trends and patterns. However, the results provide valuable insights for festival organizers who want to tailor the experiences they offer to the diverse needs of their attendees.

4. Results

4.1. “Which aspects are particularly important to you at a festival?”

The following results address the key aspects of how respondents answered the question: “Which aspects are particularly important to you at a festival?” It should be noted that respondents were able to indicate six of the 26 predefined aspects and one free field for this question. However, an analysis of the free text field was not within the scope of this study.

Importance of Music Acts (Table 1): The importance of music acts on the festival program differs notably across generations. While more than 91% of respondents from Gen X, Y, and Z rate music acts as a key component of the festival experience, only 77.78% of Baby Boomers consider them important. This indicates that younger generations assign greater significance to the musical lineup, whereas Baby Boomers diverge from this tendency, suggesting different expectations of the festival format.

Importance of Side Acts (Table 2): Side acts are generally considered unimportant across all generations. A full 100% of Baby Boomers regard them as irrelevant, and more than 93% of Gen X, Y, and Z respondents share this assessment. This broad consensus illustrates that secondary performances play only a marginal role in shaping the overall festival experience.

Importance of Atmosphere and Vibe (Table 3): The general atmosphere and vibe of a festival are highly valued across generations, though to varying degrees. While 85.78% of Gen X rate atmosphere as important, Baby Boomers follow closely with 77.78%. Although Gen Y and Z show similarly high ratings (82.31% and 82.97%), their assessments are slightly less consistent, pointing to a shared but more nuanced perception of festival ambience.

Importance of Cleanliness (Table 4): Cleanliness of the festival grounds is a point of generational divergence. Among Baby Boomers, 44.44% consider this aspect important, whereas over 70% of Gen X, Y, and Z respondents view it as unimportant. Only around 26–27% of younger respondents emphasize cleanliness, highlighting a generational divide in expectations related to physical infrastructure and order.

Importance of Hygiene Facilities (Table 5): Hygiene facilities are broadly recognized as important, though with subtle generational differences. Baby Boomers (55.56%) and Gen Z (54.18%) rate this aspect slightly more highly than Gen X and Y, who show slightly lower values (around 52–53%). While the differences are not dramatic, they suggest that older and the youngest respondents assign a little more weight to sanitary conditions.

Importance of Sustainability (Table 6): Sustainability is not a top priority for any generation. Although Baby Boomers assign the highest relative importance (16.67%), the majority in all age groups consider this aspect unimportant. Gen Y (7.76%) and Gen Z (10.57%) rank it particularly low, indicating that ecological awareness plays a minimal role in festival decision-making.

Importance of Safety (Table 7): Respondents' emphasis on safety differs across age groups. Gen Z places the most importance on safety (29.07%), followed by Baby Boomers (27.77%) and Gen Y (26.36%), while Gen X places the lowest value on it (21.8%). These findings suggest a strong awareness of safety issues among younger attendees, possibly driven by social and physical security concerns.

Importance of Festival Recognition (Table 8): The reputation or name recognition of a festival is regarded as unimportant by almost all respondents. Over 98% of respondents across all generations disregard this factor, and no meaningful variation between age groups is observed.

Importance of Price-Performance Ratio (Table 9): The perceived value for money offered by the festival is most important to Gen Z (43.55%), followed by Gen Y (40.10%) and Gen X (33.18%). Baby Boomers assign this aspect comparatively lower relevance (38.89%). This indicates that younger audiences are more cost-sensitive and more likely to evaluate festivals in terms of economic efficiency.

4.2. *“For what reasons do you visit a festival?”*

The following results address the key aspects of how respondents answered the question: “For what reasons do you visit a festival?” It should be noted that respondents were able to indicate six of the 26 predefined aspects and one free field for this question. However, an analysis of the free text field was not within the scope of this study.

Specific Artists as Reason for Attendance (Table 10): The presence of specific artists or bands on the festival program is a dominant reason for selecting and attending festivals among younger generations. While 91.16% of Gen Z, 89.02% of Gen Y, and 87.68% of Gen X respondents cite this as a reason for attendance, only 55.56% of Baby Boomers do so. This generational gradient suggests that the opportunity to see particular performers is significantly more important to younger attendees, underscoring a stronger artist-centered motivation.

Discovering New Music as Reason for Attendance (Table 11): Discovering new music appears to be more relevant for Gen X, with 43.60% indicating this as a motivation. In contrast, Gen Y and Gen Z show lower levels of interest in this aspect (32.94% and 31.34%), suggesting a more established preference structure or a less exploratory approach to festival attendance among younger groups. However, Baby Boomers show the lowest interest in discovering new music (27.78%).

Dancing as Reason for Attendance (Table 12): Dancing is of similar importance to Gen Z (22.83%) and Baby Boomers (22.22%), whereas Gen X and Gen Y assign it slightly lower relevance (17.54% and 18.39%). This results in a bimodal distribution in which both the youngest and oldest groups attribute greater value to physical expression and active participation.

Listening to Live Music as Reason for Attendance (Table 13): Live music remains a central component of the festival experience for all generations, with approximately 80% of respondents across all age groups identifying that aspect as a key reason for attending. This underscores the enduring appeal of live performance as the core attraction of music festivals.

Meeting New People as Reason for Attendance (Table 14): The desire to meet new people is most pronounced among Gen Z (27.93%), while Baby Boomers show the least interest in this aspect (22.22%). The generational difference suggests that social exploration and expanding one's network are more central to younger participants.

Socializing as Reason for Attendance (Table 15): Socializing with others is a moderately relevant motivation for Gen Z (28.25%) and Gen Y (27.06%). In comparison, only 16.67% of Baby Boomers identify this as a priority. This supports the notion that festivals serve as social platforms, especially for younger demographics.

Connecting with Like-Minded People as Reason for Attendance (Table 16): The opportunity to connect with like-minded individuals is important to 38.29% of Gen Z and 39.09% of Gen Y respondents, whereas only 27.78% of Baby Boomers express this interest. This pattern supports the idea that younger generations seek a sense of belonging and identity alignment in festival environments.

Escaping Daily Life as Reason for Attendance (Table 17): The opportunity to escape daily routines plays a stronger role for Baby Boomers (55.56%) than for Gen Z respondents (43.17%). This generational difference may reflect variations in lifestyle and work-related pressures, or differing conceptions of what festivals represent at different stages in life.

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Relaxation as Reason for Attendance (Table 18): Relaxation is another motivation with generational variance. It is a key value for 22.22% of Baby Boomers, compared to just 11.28% of Gen Z respondents. This supports the interpretation that younger generations tend to experience festivals more actively and less as a space for recovery.

Cultural Interest as Reason for Attendance (Table 19): Cultural interest plays a marginal role for all generations, with only around 4 to 7% citing it as a reason for attendance. This indicates that festivals are primarily perceived as entertainment-oriented rather than culturally educational events.

Partying as Reason for Attendance (Table 20): Partying is more prominent among Gen Y (41.05%) and Gen Z respondents (40.40%), while Baby Boomers are less inclined to prioritize this aspect (33.33%). This suggests that the festive and celebratory dimensions of festivals are particularly attractive to younger audiences.

Drinking Alcohol as Reason for Attendance (Table 21): Drinking alcohol is a more common motivation among younger generations, rising from 5.56% in Baby Boomers to 25.05% in Gen Z respondents. This may reflect a stronger association between alcohol and social enjoyment in younger festival cultures.

Drugs and Sex as Reasons for Attendance (Table 22 and 23): Drugs and sex are consistently ranked as low-relevance motivations across all age groups, with only about 0.5–5% identifying them as reasons for attendance. While festivals may retain a hedonistic image, such aspects do not play a prominent role in participants' explicit motivations.

Escapism as Reason for Attendance (Table 24): Escapism is cited more frequently by Baby Boomers (11.11%) than by Gen Y (9.44%) or Gen Z respondents (7.16%). This suggests that older attendees may be a little more inclined to view festivals as a form of withdrawal from everyday demands. In contrast, Pine and Gilmore (1998) and Rivera et al. (2015), report escapism as one of the four or five key factors of a festival experience.

Curiosity as Reason for Attendance (Table 25): Curiosity is a minor factor for all age groups, with only about 2–5% indicating it as a reason for attendance. Festivals thus appear to be approached with clear expectations rather than as exploratory ventures.

4.3. Discussion of Key Generational Differences

A number of generational differences stand out in the dataset. It is clear that music acts are less important to Baby Boomers than to younger cohorts. The same applies to the importance of sustainability and cleanliness, which Baby Boomers consistently rank higher than respondents in the Gen X, Y, or Z groups. Meanwhile, Gen Z places a greater emphasis on cost-related factors and perceived value for money, signaling a higher degree of economic pragmatism.

Entertainment and Atmosphere: Younger generations appear to view the festival experience primarily through the lens of entertainment and immersive atmosphere. Their preferences are strongly aligned with music acts, social engagement and vibrant ambiance. In contrast, Baby Boomers focus less on entertainment and may attend festivals for different, less experience-driven reasons. This aligns with a study by Bowen and Daniels (2005) which used a US case study to show that music acts are not the only reason for attending a festival.

Practical Considerations: Practical elements such as hygiene facilities and cleanliness are more valued by Baby Boomers, who associate festivals with certain infrastructural expectations. Among younger generations, these concerns are noticeably lower in importance, pointing to a higher tolerance for flexible or improvised conditions.

Sustainability Perceptions: Sustainability does not constitute a key priority for any age group. (Bauer et al. 2024) Surprisingly, younger generations—contrary to common assumptions—rate it lower than Baby Boomers. This could suggest that sustainability is perceived as disconnected from the escapist and hedonistic character of the festival experience, especially among younger participants.

Safety Perceptions: Safety receives greater attention from Gen Z than any other age group (29.07%), indicating a heightened awareness of vulnerability. While Baby Boomers show a comparable level of concern (27.77%), the underlying motivations may differ, ranging from personal well-being to concerns about infrastructural security. Gen X, meanwhile, places the least emphasis on safety (21.8%).

Price-Performance Considerations: Cost-efficiency is a major factor for Gen Z, with 43.55% rating value for money as important. This contrasts with Baby Boomers, of whom only 38.89% share this view. This suggests that younger festivalgoers approach the event more consciously in terms of financial return on investment, reflecting and supporting the extension of Pine and Gilmore's (1998) four Es to incorporate Economic Value, as proposed by Rivera et al. (2015)

Side Acts and Festival Recognition: Secondary elements such as side acts and brand awareness of the festival play only a minor role across all age groups. This reinforces the notion that the audience is primarily drawn by core elements such as main acts and atmosphere, rather than by marketing or auxiliary programming.

Atmospheric Factors: Atmosphere and vibe are among the most universally valued dimensions of the festival experience. More than 80% of respondents from Gen X, Y, and Z rate this as important, with Baby Boomers close behind at 77.78%. The data confirm atmosphere as a cross-generational point of convergence.

Differentiation and Homogeneity: While younger generations tend to exhibit more consistent preferences, Baby Boomers display greater variability in their responses. This internal heterogeneity may reflect differing life experiences or expectations within the older demographic, in contrast to the more homogeneous outlook among Gen Z and Gen Y cohorts.

Summary of Trends: The analysis shows that younger generations prioritize entertainment, ambiance, and value for money, while placing less emphasis on practicalities and normative concerns such as sustainability. Older generations, particularly Baby Boomers, are more attuned to hygienic and infrastructural standards and exhibit a wider range of expectations. Notably, side acts and festival branding remain insignificant across all groups, whereas atmosphere functions as a unifying factor.

4.4. *Limitations and Interpretive Considerations*

The findings of this study offer valuable insights into generational preferences and festival motivations, yet several limitations should be considered when interpreting the results.

Self-Report Bias and Social Desirability: All data in the study are based on self-reported responses collected via structured questionnaires. This method is prone to social desirability bias, which may cause respondents to underreport stigmatized behaviors or overstate socially accepted motivations. For example, topics such as drug use, sexual motives, and escapism may be intentionally or unconsciously underrepresented due to normative pressures or discomfort with disclosure.

Thus, it should be noted that the data analyzed here were collected in 2023, i.e., after the COVID-19 pandemic and before the partial legalization of cannabis in Germany. (Beck and Prinz 2024; Schranz et al. 2024) With the enforcement of the Cannabis Act on April 1, 2024, Germany adopted one of the most liberal legal approaches to cannabis on the continent. (Manthey et al. 2024) Studies have shown that cannabis consumption increased during the pandemic. (Kleine et al. 2024) Recent international studies on cannabis consumption in the festival context also show significantly higher consumption than the data presented here suggest. (Chaaban et al. 2024; Piercey et al. 2024; Hesse et al. 2010)

So even if the figures in this study may suggest otherwise, alcohol and drug consumption at festivals is demonstrably present and problematic (Dumbili 2024; Douglass et al. 2022; Jenkinson et al. 2014; Lim et al. 2010; Jaensch et al. 2018); studies from the 1980s and 1990s onwards have even examined the possibility of diagnosing adolescent drug use based on music preferences. (King 1988; Dent et al. 1992; Lim et al. 2008) And when it comes to sex at festivals, other studies tell a different

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story from this one: A recent, commercially conducted study by the sex toy retailer Lovehoney, which surveyed over 2,000 adults in 2023, shows that many festivalgoers are up for an adventure in a tent. In fact, more than a third (39%) of those surveyed have already had sex at a festival. But there are also obstacles and turn-offs: cramped spaces, flimsy air mattresses, and friends next door. However, not everyone is equally enthusiastic about festival sex. Almost half (47%) of the men surveyed admitted to having become intimate at a festival, compared to only 17% of women. Younger generations are also more willing to give in to their sexual impulses at festivals. Over half (55%) of 18- to 34-year-olds have already done so. But that doesn't mean that festival sex is only for young people: After all, around 13% of those over 55 said they are still sexually active at festivals. (<https://www.lovehoney.co.uk/blog/festival-season-101.html>, 05/12/2025) From a scientific perspective, the risks associated with sex at festivals and festivalgoers' awareness of them have been the main focus of research because educational work at festivals (as one of the Es of the experience economy) reaches a broad audience: Lim et al. (2007) showed that in a survey of 939 participants aged 16 to 29 who attended a music festival (Big Day Out, Australia), 43% of all sexually experienced participants did not use a condom because they reported being drunk or high at the time. Thus, heavy patterns of alcohol and other drug use were some of the strongest correlates of young people's engagement in risky sexual behaviour. (Jenkinson et al. 2014)

Lack of Access to Implicit Motives: An indication of latent brand orientation can be observed in real-world festival behavior: many high-profile festivals in Europe and beyond are regularly sold out before a single act is announced, e.g. Glastonbury Festival (UK), Wacken Open Air (Germany), Tomorrowland (Belgium), and Green Man Festival (Wales). This phenomenon suggests that attendees are indeed often driven by brand loyalty, trust in programming quality, or the symbolic value of attending the event itself—factors that may not be consciously articulated when responding to surveys. Consequently, the survey's finding that over 98% of respondents consider brand recognition unimportant must be interpreted with caution. The discrepancy between reported attitudes and actual booking behavior highlights the potential disconnect between stated preferences and underlying drivers of decision-making. Certain motivational dimensions—such as escapism or brand orientation—may not be fully captured through direct questioning. Although only 7.16% of Gen Z and 9.44% of Gen Y respondents indicated escapism as a reason for festival attendance, it is plausible that this motive operates on a more implicit level; as already mentioned above, Pine and Gilmore (1998) and Rivera et al. (2015), report escapism as one of the four or five key factors of a festival experience. Many respondents may not consciously interpret their desire to "get away" as escapism, but rather as a normalized aspect of their leisure culture. Similarly, festival brand recognition is almost unanimously deemed unimportant (over 98%), which could suggest that strong brand attachment is not consciously articulated by participants, even if it influences decision-making behavior. After all, what distinguishes a festival from a concert with multiple acts? One key difference is that festivals usually operate as independent brands with their own merchandise and identity. (Bauer and Naber 2025) Such implicit factors may require qualitative or indirect methods (e.g., projective techniques, interviews) for adequate identification.

Limitations of Closed Question Formats: The use of exclusively closed-ended questions restricts respondents' ability to elaborate on nuanced or hybrid motivations. Terms such as "relaxation", "atmosphere", or meeting "like-minded people" may be interpreted differently across individuals and contexts. This limitation underscores the importance of complementing quantitative research with qualitative insights to uncover hidden meanings and subjective interpretations. (Porst 2014)

Contextual Variability Across Festival Types: It should be noted that the survey specifically targeted individuals who had experience of attending pop or rock music festivals in Germany. This was established through the initial screening question: "How often have you been to music festivals of the pop or rock genre in Germany?" Consequently, the sample reflects the attitudes and priorities of

people who are already familiar with mainstream or large-scale music festivals, rather than niche formats or genre-specific subcultures. The survey did not differentiate between types of festivals, such as genre-specific, size-based, or location-based distinctions. Since expectations and experiences may differ significantly between, for instance, a small jazz festival and a large electronic music festival, the lack of contextual framing may dilute the interpretability of certain results. Dimensions such as hygiene facilities, safety, and sustainability may be perceived differently depending on festival infrastructure and programming.

Sample Distribution and Representativeness: Although the study was based on a large and diverse sample ($N = 3,503$), it was not designed as a representative cross-generational population survey. Notably, the number of Baby Boomer respondents was very low ($n = 18$), which limits the statistical robustness of comparisons involving this group—significance and robustness could therefore not be tested. Moreover, some demographic segments (e.g., underage participants) may be underrepresented, thereby affecting generalizability.

Genre-Specific and Format-Specific Expectations: The study did not control for musical genre preferences or festival formats, which may affect priorities such as music acts, cultural interest, or social engagement. A metal festival and a folk festival may attract audiences with vastly different value systems, which the aggregated data cannot fully reflect.

Despite these limitations, the findings offer a substantial contribution to understanding generational trends in festival participation. Future research could benefit from mixed-method approaches and more nuanced segmentation to deepen the interpretation of cross-generational visitor expectations and motivations.

4.5. Conclusion

This study offers concrete insights into the varying expectations of festivalgoers across generations, providing a valuable knowledge base for the management of open-air music events. Younger audiences—particularly those from Gen Z and Gen Y—tend to prioritize immersive entertainment, social connectivity, and economic value, with music acts and atmosphere serving as central anchors of the festival experience. In contrast, Baby Boomers display greater sensitivity to infrastructural factors such as hygiene facilities and cleanliness, as well as a more heterogeneous set of motivations that include escapism and relaxation.

These findings underscore the importance of differentiated audience strategies. Festival organizers seeking to attract and retain multigenerational audiences should align core programming and spatial planning with the diverse value systems of their attendees. For younger groups, maintaining a strong musical lineup and fostering vibrant, socially oriented environments will remain key. For older audiences, the provision of comfort, clarity of logistics, and accessible infrastructure may increase satisfaction and loyalty.

The study also highlights the limitations of normative communication strategies in areas such as sustainability. Despite public discourse framing younger generations as particularly environmentally conscious, survey responses indicate that sustainability is not a decisive factor in the context of festivals. This suggests a need for more behaviorally informed approaches—such as nudging and design-based interventions—rather than relying on appeals to ecological responsibility. (Bauer et al. 2024; Aßmann 2022; Bär et al. 2022; Bär and Korrman 2020; Sunstein 2014) Nudging refers to subtle incentives that aim to steer people's behavior in a certain direction without explicitly forcing them to change their behavior. By gently nudging visitors toward more sustainable choices, it could be possible to promote pro-ecological behaviors without visitors feeling coerced. (Aßmann 2022)

Ultimately, the results support a more data-driven and audience-centered approach to festival management. By integrating generational profiles into planning and communication strategies, organizers can design more inclusive, relevant, and resilient events.

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Appendices: Cross-Tabulations by Age Cohorts

1. “Which aspects are particularly important to you at a festival?”—Percentage agreement by generation (n = Gen Z: 1844, Gen Y: 1430, Gen X: 211, Baby Boomers: 18).

Tab 1. Cross-tabulation year of birth – importance of music acts

	Baby Boomer	Gen X	Gen Y	Gen Z	Total
-1	22.22%	9.00%	7.20%	8.19%	7.91%
music acts	77.78%	91.00%	92.80%	91.81%	92.09%

Tab 2. Cross-tabulation year of birth – importance of side acts

	Baby Boomer	Gen X	Gen Y	Gen Z	Total
-1	100.00%	95.26%	94.89%	93.33%	94.12%
side acts	0.00%	4.74%	5.11%	6.67%	5.88%

Tab 3. Cross-tabulation year of birth – importance of atmosphere and vibe

	Baby Boomer	Gen X	Gen Y	Gen Z	Total
-1	22.22%	14.22%	17.69%	17.03%	19.69%
mood	77.78%	85.78%	82.31%	82.97%	80.31%

Tab 4. Cross-tabulation year of birth – importance of cleanliness of the premises

	Baby Boomer	Gen X	Gen Y	Gen Z	Total
-1	55.56%	70.14%	72.38%	73.16%	72.59%
cleanliness	44.44%	29.86%	27.62%	26.84%	27.41%

Tab 5. Cross-tabulation year of birth – importance of hygiene facilities

	Baby Boomer	Gen X	Gen Y	Gen Z	Total
-1	44.44%	46.92%	47.41%	45.82%	46.53%
hygiene	55.56%	53.08%	52.59%	54.18%	53.47%

Tab 6. Cross-tabulation year of birth – importance of sustainability

	Baby Boomer	Gen X	Gen Y	Gen Z	Total
-1	83.33%	86.26%	92.24%	89.43%	90.53%
sustainability	16.67%	13.74%	7.76%	10.57%	9.65%

Tab 7. Cross-tabulation year of birth – importance of safety

	Baby Boomer	Gen X	Gen Y	Gen Z	Total
-1	72.22%	78.20%	73.64%	70.93%	72.48%
security	27.77%	21.80%	26.36%	29.07%	27.52%

Tab 8. Cross-tabulation year of birth – importance of festival recognition

	Baby Boomer	Gen X	Gen Y	Gen Z	Total
-1	100%	98.58%	98.60%	98.81%	98.72%
awareness	0%	1.42%	1.40%	1.19%	1.28%

Tab 9. Cross-tabulation year of birth – importance of price-performance ratio

	Baby Boomer	Gen X	Gen Y	Gen Z	Total
-1	61.11%	66.82%	59.93%	56.45%	58.52%
price-performance	38.89%	33.18%	40.07%	43.55%	41.48%

2. “For what reasons do you visit a festival?” —Percentage agreement by generation (n = Gen Z: 1844, Gen Y: 1430, Gen X: 211, Baby Boomers: 18).

Tab 10. Cross-tabulation year of birth – seeing specific bands

	Baby Boomer	Gen X	Gen Y	Gen Z	Total
-1	44.44%	12.32%	10.95%	8.84%	10.11%
specific bands	55.56%	87.68%	89.02%	91.16%	89.89%

Tab 11. Cross-tabulation year of birth – discovering new music

	Baby Boomer	Gen X	Gen Y	Gen Z	Total
-1	72.22%	56.40%	67.06%	68.66%	67.29%
new music	27.78%	43.60%	32.94%	31.34%	32.71%

Tab 12. Cross-tabulation year of birth – dancing

	Baby Boomer	Gen X	Gen Y	Gen Z	Total
-1	77.78%	82.46%	81.61%	77.17%	79.30%
dance	22.22%	17.54%	18.39%	22.83%	20.70%

Tab 13. Cross-tabulation year of birth – listening to live music

	Baby Boomer	Gen X	Gen Y	Gen Z	Total
-1	22.22%	18.96%	20.07%	19.96%	19.95%
live music	77.78%	81.04%	79.93%	80.04%	80.05%

Tab 14. Cross-tabulation year of birth – meeting new people

	Baby Boomer	Gen X	Gen Y	Gen Z	Total
-1	77.78%	75.83%	76.50%	72.07%	74.14%
new people	22.22%	24.17%	23.50%	27.93%	25.86%

Tab 15. Cross-tabulation year of birth – socializing with family and friends

	Baby Boomer	Gen X	Gen Y	Gen Z	Total
-1	83.33%	76.78%	72.94%	71.75%	72.59%
socialization	16.67%	23.22%	27.06%	28.25%	27.41%

Tab 16. Cross-tabulation year of birth – being together with similar people with similar interests

	Baby Boomer	Gen X	Gen Y	Gen Z	Total
-1	72.22%	62.56%	60.91%	61.71%	61.49%

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similar interests	27.78%	37.44%	39.09%	38.29%	38.51%
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Tab 17. Cross-tabulation year of birth – looking for a break from everyday life

	Baby Boomer	Gen X	Gen Y	Gen Z	Total
-1	44.44%	47.39%	44.41%	56.83%	51.13%
balance	55.56%	52.61%	55.59%	43.17%	48.87%

Tab 18. Cross-tabulation year of birth – relaxation

	Baby Boomer	Gen X	Gen Y	Gen Z	Total
-1	77.78%	80.57%	85.03%	88.72%	86.67%
relaxation	22.22%	19.43%	14.97%	11.28%	13.33%

Tab 19. Cross-tabulation year of birth – cultural interest

	Baby Boomer	Gen X	Gen Y	Gen Z	Total
-1	100.00%	92.89%	95.38%	95.44%	95.29%
culture	0.00%	7.11%	4.62%	4.56%	4.71%

Tab 20. Cross-tabulation year of birth – partying

	Baby Boomer	Gen X	Gen Y	Gen Z	Total
-1	66.67%	69.19%	58.95%	59.60%	59.95%
party	33.33%	30.81%	41.05%	40.40%	40.05%

Tab 21. Cross-tabulation year of birth – drinking alcohol

	Baby Boomer	Gen X	Gen Y	Gen Z	Total
-1	94.44%	87.20%	78.32%	74.95%	77.16%
drinking	5.56%	12.80%	21.68%	25.05%	22.84%

Tab 22. Cross-tabulation year of birth – taking drugs

	Baby Boomer	Gen X	Gen Y	Gen Z	Total
-1	94.44%	99.05%	99.37%	99.19%	99.40%
drugs	5.56%	0.95%	0.63%	0.81%	0.77%

Tab 23. Cross-tabulation year of birth – having sex

	Baby Boomer	Gen X	Gen Y	Gen Z	Total
-1	94.44%	100.00%	99.30%	98.97%	99.14%
sex	5.56%	0.00%	0.70%	1.03%	0.86%

Tab 24. Cross-tabulation year of birth – escapism

	Baby Boomer	Gen X	Gen Y	Gen Z	Total
-1	88.89%	97.16%	90.56%	92.84%	92.15%
escapism	11.11%	2.84%	9.44%	7.16%	7.85%

Tab 25. Cross-tabulation year of birth – curiosity

	Baby Boomer	Gen X	Gen Y	Gen Z	Total
-1	94.44%	97.63%	97.27%	95.50%	96.35%
curiosity	5.56%	2.37%	2.73%	4.50%	3.65%

ORGANIZATIONAL ADAPTABILITY AND RESILIENCE FOR SUCCESSFUL MANAGEMENT

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Abstract: *This study examines the critical role of organizational adaptability and resilience in ensuring effective managerial performance within an increasingly volatile and uncertain business environment. Building on contemporary management theory, the study clarifies the conceptual foundations of adaptability and resilience, emphasizing their complementary functions in supporting organizational transformation. The analysis investigates how adaptability fosters strategic flexibility, rapid resource reconfiguration, and innovation capacity, while resilience enables organizations to absorb shocks, maintain operational continuity, and recover efficiently from disruptions. To illustrate the practical relevance of these concepts, the article integrates case studies from diverse industries, highlighting specific mechanisms through which organizations respond to environmental turbulence. The findings underscore the importance of leadership behavior, organizational culture, and digital maturity as key determinants shaping both adaptive and resilient capacities. Furthermore, several research directions are proposed, including the need for standardized measurement instruments, deeper investigation of the psychological underpinnings of resilient leadership, and expanded cross-cultural comparative studies to better understand contextual influences. Overall, the study concludes that the integrated development of adaptability and resilience constitutes a strategic foundation for long-term organizational sustainability. By cultivating these capabilities, managers can enhance decision-making effectiveness, strengthen organizational robustness, and foster sustained competitive advantage. The greatest danger in times of turbulence is not the turbulence; it is to act with yesterday's logic. (Peter F. Drucker)*

Keywords: *organizational adaptability, organizational resilience, strategic management, resilient leadership, organizational sustainability.*

1 Introduction

In an economic environment characterized by volatility, uncertainty, and accelerated technological transformations, organizational adaptability and resilience are becoming essential strategic competencies for successful management. Contemporary organizations are exposed to multiple pressures — from rapid shifts in consumer preferences and intensifying global competition to economic, social, or health crises that challenge traditional governance structures and operational processes. In this context, the ability of managers to anticipate risks, respond effectively to disruptions, and transform challenges into opportunities represents a crucial indicator of long-term performance. Adaptability reflects an organization's ability to rapidly adjust its strategies, resources, and work models in response to external changes, while resilience denotes its capacity to absorb shocks, recover, and maintain functionality under stress. (Lengnick-Hall et al., 2011)

Together, these two dimensions support the development of a flexible and innovative organizational culture grounded in continuous learning, transformative leadership, and agile decision-making processes. Thus, addressing adaptability and resilience is not merely a theoretical concern, but a practical necessity for strengthening the sustainability and competitiveness of modern organizations.

2 Adaptability and Resilience Concepts in the Management Theory

To deepen the discussion of the topic, it is necessary to present the conceptual foundations by defining the key terms. Organizational adaptability represents an organization's capacity to respond quickly and effectively to changes in the external environment by adjusting its strategies, processes, and internal structures. In the specialized literature, the concept is associated both with strategic flexibility and with the ability to implement operational transformations in a timely manner (Tushman et al., 1996). Adaptability does not refer solely to reacting to change; it also includes proactivity, namely the anticipation of trends and the preparation of the organization for emerging scenarios.

An adaptable organization benefits from environmental scanning mechanisms, rapid decision-making processes, and a culture oriented toward experimentation and continuous learning. Moreover, adaptability involves the integration of innovative technologies and the ability to reconfigure resource portfolios in an agile manner, without compromising operational stability. Thus, adaptability becomes a central element of modern strategic management, promoting long-term competitiveness and sustainability. Organizational resilience is defined as an organization's ability to absorb shocks, recover from disruptions, and maintain functionality under conditions of significant stress (Sutcliffe et al., 2003). Unlike simple crisis-response mechanisms, resilience involves a structured capacity for anticipation, adaptation, and transformation, enabling the organization to become more robust following adverse events (Hamel et al., 2003).

Recent literature emphasizes that resilience is not merely a static attribute, but a dynamic process built over time through deliberate managerial practices, investment in human capital, and the development of strong organizational relationships. Key elements of resilience include resource redundancy, competency diversity, internal cohesion, and the existence of efficient communication systems. Therefore, resilience enables an organization not only to withstand disruptions but also to capitalize on the opportunities they generate. Thus, adaptability and resilience are strongly interconnected concepts that jointly contribute to an organization's ability to maintain performance in contexts of uncertainty. Adaptability facilitates the rapid modification of strategies and processes, while resilience ensures the continuity and stability necessary to navigate major disruptions. From this perspective, adaptability represents the change-oriented component, whereas resilience embodies the component focused on maintaining functionality under stress.

The relationship between the two dimensions is synergistic: resilient organizations tend to be more adaptable because they possess flexible structures and a culture that tolerates uncertainty, while adaptable organizations can strengthen their resilience through continuous learning and innovation processes. In contemporary management, the integration of these two capabilities is considered essential for sustainable success, particularly in environments characterized by volatility, uncertainty, and high complexity.

The factors that influence adaptability are the following: leadership and strategic vision, organizational culture, innovation and organizational learning, and the integration of emerging technologies. (Tushman et al., 1996). Leadership is a fundamental element of adaptability, as the way leaders interpret change shapes the direction and pace of organizational transformation. Leaders with a flexible strategic orientation are able to identify emerging opportunities, promote experimentation, and create a psychological climate in which employees perceive change as an opportunity rather than a threat. A clear vision and the ability to communicate the organization's direction coherently determine the degree of internal alignment during periods of transition.

Organizational culture either promotes or inhibits adaptability through the norms, values, and attitudes it cultivates. A culture oriented toward continuous learning, collaboration, and innovation encourages moderate risk-taking and decision-making flexibility. In contrast, rigid, procedure-driven cultures tend to discourage change, which can negatively affect the speed of adaptation. Thus, cultural transformation becomes an essential instrument for facilitating adaptive processes.

Innovation represents one of the central pillars of adaptability, enabling organizations to create new solutions and differentiate their operating models. Organizational learning—both formal and informal—contributes to the updating of competencies and the development of a growth-oriented

mindset. In this regard, processes of data collection, analysis, and interpretation play a crucial role in informing strategic and operational decisions.

Emerging technologies—artificial intelligence, digitalization, automation, and collaborative platforms—profoundly reshape organizational functioning. The ability to integrate new technologies rapidly not only optimizes internal processes but also facilitates the creation of competitive advantages. At the same time, technological adoption requires advanced digital skills, operational flexibility, and a well-structured change management approach.

Strategic agility involves an organization's ability to detect opportunities, rapidly reallocate resources, and implement decisions iteratively. This model is grounded in flexibility, transparency, and continuous feedback, enabling managers to adjust strategies in accordance with the evolving context. Agility is frequently associated with flat organizational structures, decentralized decision-making processes, and the use of agile methodologies inspired by software engineering.

Organizational transformation represents a complex approach that entails simultaneous changes in strategy, structure, culture, and technology. Established frameworks—such as Kotter's model for managing change or theories on ambidextrous organizations—provide conceptual foundations for implementing deep and systemic change. (Kotter, 2012) These models emphasize employee engagement, effective communication, and the reinforcement of new behaviors through appropriate reward mechanisms. The specialized literature offers numerous examples of organizations that have succeeded in maintaining their competitiveness due to their adaptability. Companies in sectors such as technology, financial services, or manufacturing have demonstrated that strategic flexibility, digitalization, and an innovation-oriented culture play a decisive role in their success. Case studies highlight that organizations that consistently invest in skill development, predictive analytics, and cross-functional collaboration are better prepared to respond to emerging challenges.

Regarding organizational resilience, which has become a central topic in management literature—particularly in the context of proliferating economic, health, technological, and geopolitical crises—we propose the following perspective. In an environment characterized by volatility and interconnectivity, organizations are exposed to unpredictable disruptions that can affect normal functioning, critical resources, and overall performance. From this perspective, resilience is not merely an ability to return to an initial state, but a multidimensional capacity to absorb shocks, adapt, and evolve in the face of adversity. (Sutcliffe et al., 2003)

This domain examines the main sources of vulnerability, the mechanisms through which resilience is developed, and the essential role of leadership in managing disruptions. Sources of vulnerability and risk arise from two areas: both the external environment and the internal one. Organizations operate within an ecosystem marked by complex interdependencies. Macroeconomic shifts, political instability, legislative developments, technological dynamics, and fluctuating consumer behaviors can generate significant risks. Health crises or supply chain disruptions highlight the fragility of global systems and the need for robust continuity strategies. External risk is often characterized by the lack of direct control and therefore requires sophisticated mechanisms for anticipation and assessment.

In addition to external pressures, resilience is influenced by an organization's internal vulnerabilities: rigid processes, excessive dependence on certain resources, lack of critical competencies, poor communication, or a culture oriented toward conformity and risk aversion. In many cases, internal vulnerability can amplify the effects of external disruptions, turning a localized issue into a systemic crisis. Therefore, process mapping and the identification of weak points represent preliminary conditions for building resilience.

In this context, the mechanisms for developing resilience are diverse and must follow several key stages: risk anticipation and scenario planning, response capacity and operational continuity, and post-crisis recovery and learning. Resilient organizations adopt a proactive approach to uncertainty by conducting continuous risk analyses and developing alternative scenarios for potential disruptions. Scenario planning allows for the evaluation of probabilities, potential impacts, and response options,

thereby reducing strategic surprise. This capability relies on efficient monitoring systems, environmental data collection, and advanced analytical tools.

Rapid response to disruptions is essential for limiting negative effects. Resilient organizations implement operational continuity plans, emergency response protocols, and resource-flexibilization mechanisms. Supplier diversification, technological redundancy, the ability to relocate teams, and procedures for operating in digital environments all contribute to maintaining functionality. These mechanisms reduce downtime and ensure the continuity of essential services.

One of the distinctive components of resilience is learning from disruptions. (Hamel, G., & Välikangas, L., 2003) Effective organizations document crisis experiences, assess the performance of their responses, and identify opportunities for improvement. This process transforms crisis into a source of innovation and development. Post-crisis learning strengthens organizational culture, contributing to a higher level of preparedness for future situations.

The previous approaches direct our attention toward the dimension of resilient leadership, which represents an important factor in managing disruptions, as leaders influence both the perception of risks and the direction of the organizational response. Resilient leaders are distinguished by calmness, clarity of thought, the ability to make decisions under pressure, and the capacity to maintain team cohesion. They adopt a long-term perspective, and their leadership style facilitates both internal stability and strategic flexibility. In disruptive situations, leaders are confronted with incomplete information, tight deadlines, and high levels of risk. The ability to balance rational analysis with intuition, to prioritize critical actions, and to communicate transparently becomes essential. Resilient leaders are oriented toward iterative and adaptable solutions, avoiding decision paralysis and enabling the continuation of activities in a controlled manner.

Another fundamental element of resilient leadership is managing the psychological dimension of the crisis by building trust and internal cohesion. Trust in leadership, the perception of safety, and clear communication influence employees' stress levels and their capacity to cooperate. Effective leaders strengthen cohesion through transparency, empathy, and the active involvement of organizational members in the decision-making process. (Vogus et al., 2007) Thus, resilience becomes a collective effort, not merely a managerial task. The interdependence between adaptability and resilience generates a conceptual framework essential for assessing managerial performance in contemporary organizations. (Burnard et al., 2011). In an environment marked by rapid change, managers are increasingly required to develop competencies that go beyond traditional operational management and encompass strategic flexibility, foresight, empathy, and the ability to lead adaptive processes. This perspective examines the ways in which adaptability and resilience influence decision-making processes, organizational culture, and the long-term sustainability of organizations.

All these elements have a major impact on decision-making processes. In this regard, a success-oriented manager must necessarily focus on the following aspects: decision flexibility and speed, data orientation and contextual analysis, as well as the management of ambiguity and uncertainty.

Managers operating in a dynamic context need the ability to make rapid decisions without compromising their quality. Adaptability enhances flexibility in evaluating alternatives and accelerates the decision-making process by accepting uncertainty as an integral part of organizational reality. Decisions become iterative, based on successive adjustments rather than on a fixed and rigid plan. This approach offers the organization increased mobility in the face of emerging opportunities. (Hollnagel, E. 2014) Modern organizations are increasingly dependent on analytical data, which profoundly influences managerial performance. Adaptability encourages managers to develop a data-driven approach, integrating predictive tools and continuous risk assessments. Resilience, on the other hand, provides the necessary framework for establishing robust analytical procedures, allowing decisions to be adjusted even under pressure. The interaction between the two dimensions ensures a solid informational basis for effective strategic decisions.

High-performing managers are capable of operating in grey areas where information is incomplete and rapid changes may invalidate existing plans. Adaptability fosters the acceptance of

ambiguity, while resilience reduces emotional and organizational vulnerability in the face of decision-making pressure. In this way, managers succeed in maintaining strategic direction, avoiding both decision paralysis and impulsiveness. (Weick, K. E., & Sutcliffe, K. M., 2007)

The impact on organizational culture is reflected in several areas: the promotion of a growth mindset, collective versus individual resilience, and the creation of a psychologically safe climate. Organizational culture directly influences the effectiveness of managerial strategies. A culture oriented toward learning, experimentation, and innovation supports the development of adaptive competencies. Managers play a crucial role in shaping this culture through their behaviors, communication, and recognition mechanisms. The growth mindset encourages employees to perceive change as an opportunity for development rather than a source of stress. While individual resilience refers to the emotional and cognitive capacities of managers and employees, collective resilience represents the organization's ability to function coherently in the face of adversity. Effective managers cultivate collective resilience through support mechanisms, transparent communication, balanced distribution of responsibilities, and the strengthening of team trust. The interaction between individual and collective resilience leads to a culture capable of managing disruptions effectively.

A psychologically safe climate fosters experimentation, the expression of opinions, and moderate risk-taking. Adaptable and resilient managers build an environment in which errors are treated as learning opportunities rather than personal failures. In this way, a culture that supports innovation and flexibility is developed—essential pillars of organizational performance in dynamic contexts. The application of these approaches leads to significant contributions in ensuring organizational sustainability. The specific vectors of the organizational sustainability construct are reflected in the following dimensions: operational continuity and recovery capacity, long-term innovation capability, and sustainable competitive advantages.

Organizational sustainability depends on the ability to maintain long-term performance, even under conditions of stress. Resilience enables organizations to absorb shocks and return to functional levels, while adaptability ensures the rapid reconfiguration of resources and strategies when market conditions change. Managers who master these competencies contribute directly to the stability and continuity of operations. Continuous innovation is a key indicator of sustainability in today's economy. Adaptability stimulates openness to new ideas, while resilience provides the necessary framework for testing and implementing them in a controlled manner. Managers who are able to leverage the complementarity between these two dimensions facilitate the creation of an organization capable of continuously regenerating its business models. By integrating adaptability and resilience into managerial strategies, organizations develop sustainable competitive advantages that are difficult for competitors to replicate. Strategic flexibility, a robust organizational culture, and effective risk-management mechanisms enable the maintenance of performance in an ever-changing external environment. Thus, sustainability becomes not merely a managerial objective, but the outcome of a coherent and well-prepared organizational system.

Case studies represent a fundamental tool in management research, as they allow for a detailed analysis of the ways in which theoretical principles manifest in practice. Organizational adaptability and resilience become visible when organizations face major disruptions, and their response highlights both their internal capabilities and the limitations of their management systems. The following section presents several significant examples from different sectors, emphasizing the mechanisms through which organizations have succeeded in managing change and uncertainty.

Case Study 1: Digital Transformation in a Technology Company

A global technology company was compelled to accelerate its digitalization process due to rapid market shifts and the emergence of new competitors. Organizational adaptability manifested through the implementation of agile processes, the reconfiguration of development teams and the introduction of iterative innovation mechanisms.

Key elements of adaptability identified:

- Strategic agility: the rapid adoption of a business model based on digital services.
- Continuous learning: internal upskilling programs focused on artificial intelligence and cloud computing.
- Structural flexibility: the creation of cross-functional teams with autonomy in decision-making.

In parallel, organizational resilience was strengthened through technological redundancy, the use of hybrid infrastructures, and the development of robust operational continuity protocols. As a result, the organization not only absorbed market pressures but also succeeded in expanding its client portfolio within a short period of time.

Case Study 2: Supply Chain Management in the Manufacturing Industry

In the manufacturing sector, a mid-sized company faced significant supply chain disruptions caused by logistical restrictions. In the absence of a rigid structure, the organization demonstrated adaptability by diversifying its suppliers, renegotiating contracts, and developing regional partnerships.

Key elements of resilience observed:

- Resource redundancy: identifying alternative suppliers for critical components.
- Scenario planning: conducting risk simulations to anticipate logistical bottlenecks.
- Response capacity: reorganizing production flows to optimize delivery times.

This approach reduced internal vulnerability and enabled the company to maintain production continuity even under conditions of high volatility. The effectiveness of the response was closely linked to the managerial capacity for coordination and communication during stressful situations.

Case Study 3: Organizational Resilience in a Public Service Institution

A public institution responsible for managing critical services faced an operational crisis triggered by system overload and limited human resources. In this context, organizational resilience was tested through the institution's ability to maintain service functionality.

Mechanisms observed:

- Interdepartmental coordination: establishment of operational units for rapid response.
- Human capacity enhancement: intensive training programs and personnel redistribution.
- Procedural innovation: digitalization of administrative workflows and simplification of public interactions.

These measures led to reduced response times and strengthened public trust in the institution. The case illustrates the importance of resilient leadership and a collaborative culture within public sector structures.

We will now conduct a comparative analysis of the three case studies in order to identify the common elements observed. These are:

- Interdependence between adaptability and resilience

All organizations demonstrated that adaptability without resilience can lead to inconsistent efforts, while resilience without adaptability can generate rigidity. Success emerges from the complementarity of these two dimensions.

- The central role of leadership

In each case, leaders facilitated transformation processes through effective communication, stress management, and the mobilization of resources.

- The importance of organizational culture

Cultures oriented toward collaboration, learning, and flexibility accelerated adaptive processes and enabled organizations to navigate disruptions with reduced impact.

- The use of technology as a facilitator

Digitalization and analytical tools were present across all case studies, demonstrating their essential role in managing complexity.

In summary, the case studies analyzed indicate that high-performing organizations in contexts of uncertainty are those that coherently integrate adaptability and resilience. The ability to respond effectively to disruptions depends not only on structure and processes, but also on leadership, culture, and technological infrastructure. In this regard, resilience and adaptability are not merely theoretical concepts, but strategic instruments indispensable to contemporary management.

Organizational adaptability and resilience represent two essential competencies for managerial success in the contemporary context, which is characterized by uncertainty, complexity, and accelerated change. The analysis carried out in the previous chapters highlights the fact that these two dimensions cannot be treated in isolation, but must be understood as interdependent elements of a dynamic organizational system capable of responding effectively to disruptions and capitalizing on emerging opportunities.

First, adaptability is manifested through strategic flexibility, innovation capacity, and the ability of organizations to reconfigure their resources and processes in response to developments in the external environment. This flexibility enables not only rapid reactions but also the anticipation of trends, thereby contributing to the strengthening of competitive advantage. In parallel, resilience provides the structural and cultural support necessary for organizations to absorb shocks, maintain functionality in difficult situations, and recover quickly after destabilizing events.

Second, the presented case studies demonstrate in practical terms that high-performing organizations are those that integrate adaptability and resilience in a coherent manner. Whether through accelerated digitalization, supply chain management, or the functioning of public services, success stems from the management's ability to mobilize resources, coordinate actions, and maintain team cohesion. Leadership proves to be a decisive factor, as it shapes both the perception of risks and the direction of transformation processes.

Third, organizational culture plays a crucial role in supporting these two competencies. A culture oriented toward continuous learning, collaboration, transparency, and accountability facilitates both adaptive processes and the development of collective resilience. When employees feel supported and involved, the organization's capacity to manage uncertainty increases significantly.

The analysis conducted in this article highlights multiple theoretical and practical challenges related to organizational adaptability and resilience, which may serve as the foundation for relevant future research directions. The complexity of these concepts, their multidimensional nature, and their interaction with diverse contextual variables call for in-depth investigations capable of providing a more nuanced understanding of contemporary organizational phenomena.

In this regard, several research directions are identified that may contribute to the development of scientific knowledge in the field:

- ***The relationship between digital maturity and organizational resilience capacity***

Although digital technologies are recognized as resilience enablers, the literature still offers limited empirical analyses demonstrating the direct relationship between digital maturity and the effectiveness of response mechanisms to disruptions. Future research could develop predictive models to identify technological variables with significant impact on operational continuity, recovery speed, and shock-absorption capacity.

- ***Psychological mechanisms of managerial resilience in crisis situations***

A promising direction involves examining resilience at the managerial level, exploring the emotional, cognitive, and behavioral mechanisms that determine leader effectiveness under pressure. Qualitative studies, longitudinal research, or mixed-method approaches may identify psychological profiles associated with resilient leadership and clarify how these influence decision-making processes and organizational climate.

- ***The role of organizational culture as a mediator between adaptability and performance***

Organizational culture may moderate or mediate the relationship between adaptability, resilience, and performance. Future research could identify cultural typologies that facilitate adaptive processes, with emphasis on innovation-oriented, collaborative, and learning-focused cultures.

Comparative studies across industries could offer a comprehensive perspective on how norms and values shape organizational capacity to manage change.

- ***The impact of artificial intelligence on adaptive processes***

The integration of AI-based technologies into organizational activities opens new research opportunities. Future studies could examine how AI supports risk anticipation, decision optimization, and operational flexibility, as well as the ethical implications of using such technologies in adaptive management.

- ***The interaction between adaptability, resilience, and sustainability***

Longitudinal studies are needed to reveal how the combination of adaptability and resilience contributes to organizational sustainability. In this context, theoretical models could be developed to identify optimal levels of these capacities, enabling organizations to maximize performance without generating excessive costs or unnecessary rigidity.

- ***Development of standardized measurement instruments***

One of the main methodological challenges identified is the lack of validated tools for measuring adaptability and resilience. Future research could contribute to the development of psychometric scales, operational indicators, and organizational audit methods that allow for comparable evaluations at the individual, team, and organizational levels.

- ***Adaptability in the public and nonprofit sectors***

Most existing studies focus on the private sector, which justifies expanding research to public and nonprofit organizations. Investigations may examine how bureaucratic constraints, political pressures, and resource limitations affect the capacity of these institutions to develop and implement adaptive and resilient mechanisms.

- ***The intercultural dimension of adaptability and resilience***

Globalization intensifies the need for an intercultural perspective on adaptability. Future studies can explore how cultural differences influence perceptions of change, decision-making flexibility, and risk management, providing a comparative framework useful for multinational organizations.

- ***Evaluating the costs of adaptability and resilience***

While the advantages of these two capacities are well recognized, their associated costs remain less explored. Future research could analyze the cost–benefit balance of implementing adaptability and resilience strategies, identifying conditions under which investments yield optimal results.

The proposed directions reflect the need for a multidisciplinary approach, integrating perspectives from management, psychology, technology, sociology, and organizational studies. In this regard, we consider that future research can contribute to developing a consolidated conceptual framework and practical instruments capable of supporting organizations in managing the challenges of a continuously evolving environment. Integrating adaptability and resilience into managerial strategies remains an emerging field with significant potential for advancing organizational theories and practices.

3 Conclusions

In conclusion, the central idea is that adaptability and resilience are not objectives in themselves, but prerequisites for the long-term sustainability of organizations. In a fragile environment, managerial performance cannot rely solely on operational efficiency; it must also encompass innovation capacity, the integration of emerging technologies, and the consolidation of response mechanisms in risk situations.

Thus, our thesis underscores the importance of developing a management approach simultaneously oriented toward flexibility, stability, and continuous learning. Such an approach enables organizations to transform disruptions into opportunities and remain competitive in a constantly evolving economic landscape.

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NON-PERFORMING LOANS AND ECONOMIC GROWTH IN SOUTHEAST EUROPE

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Abstract: *The main purpose of this research is to analyze the impact of non-performing loans on the economic growth of Southeast European countries for the period 2012-2022. This research has a sample of 10 countries, part of South-Eastern Europe, which includes countries such as Kosovo, Albania, Montenegro, Macedonia, Romania, Slovenia, Bulgaria, Greece, Croatia, and Bosnia and Herzegovina. The scientific methodology that has been applied in this study is the quantitative method. The data used in the research are secondary data and were generated from official data published by the World Bank and the Kosovo Statistics Agency. Based on the results of this research, we can conclude that the increase in the level of non-performing loans has a negative impact on the economic growth of the countries of Southeast Europe for the period 2012-2022. While there is a positive relationship between the rate of unemployment and GDP, it should be noted that the rate of unemployment, as an independent variable of this research, has turned out to be statistically insignificant. However, there is a positive relationship between inflation and GDP.*

Keywords: *Non-performing loans, GDP, economic growth, lending interest rate.*

1. INTRODUCTION

This study analyzes how non-performing loans influence the economic growth of Southeast European countries during the period 2012–2022. The analysis is based on several key macroeconomic variables, including Gross Domestic Product (GDP), Non-Performing Loans (NPL), the Unemployment Rate (UN), Inflation (INFL), and the Loan Interest Rate (IR). Non-performing loans, also known as bad loans, are loans that indicate the borrowers' inability to repay their debts. In a perfect banking system, each borrower would pay their debts, but this banking system does not exist in reality. Also, during various financial crises, the situation with non-performing loans becomes even more difficult. The level of non-performing loans affects the banking system, and as such, the banking system affects the financial system. Also, the increase in the level of NPLs reduces the profitability of banks because the cost of NPLs is higher than that of ordinary loans, which affects banks' ability to offer loans to businesses and individuals. The countries included in this research are: Kosovo, Albania, Montenegro, Macedonia, Romania, Slovenia, Bulgaria, Greece, Croatia, and Bosnia and Herzegovina.

Research conducted by Ristevska (2020) explores the problem of non-performing loans in the banking sectors of Southeast European countries following the 2008–2009 financial crisis. The study identifies the main determinants of non-performing loans and evaluates their impact on the broader financial environment. The results indicate that higher profitability is associated with lower levels of non-performing loans, whereas loan growth and the capitalization rate have a positive and statistically significant influence on the NPL portfolio. Whereas the study by Klein (2013) investigates non-performing loans (NPLs) in Central, Eastern, and Southeastern Europe (CEE) over the period 1998–2011. The study concludes that elevated levels of NPLs, which many CEE countries currently face, hinder the pace of economic recovery. Furthermore, NPLs were found to be responsive to macroeconomic indicators, including GDP growth, unemployment, and inflation. The findings of the researchers Tanasković and Jandrić (2015) show a negative correlation between GDP growth and the growth of the NPL ratio. The ratio of foreign currency loans, GDP, and the level of the exchange rate are positively related to the increase in the ratio of non-performing loans (NPL).

2. LITERATURE REVIEW

A research conducted by Gashi, Tafa, and Bajrami (2022) found that annual GDP growth, final government consumption, the real interest rate, gross domestic savings, and the unemployment rate all observed to affect the level of non-performing loans. In the Western Balkans, NPLs have shown a rising trend following the global financial crisis, with the highest levels observed in Serbia and Albania, followed by Montenegro, Bosnia and Herzegovina, and Macedonia, while Kosovo recorded the lowest levels. These patterns highlight the varying credit risk across the region and the need for country-specific banking policies to effectively manage non-performing loans (Tmava, Avdullahi, & Sadikaj, 2018). The findings of the empirical analysis conducted in Turkey show a causal relationship between the volume of domestic credit provided by Turkish banks and non-performing loans. Granger causality tests demonstrate the dual nature of these interactions. According to Erdoğan (2016), the most important components of economic growth are non-performing loans, GDP at constant prices, public and private sector expenditures at constant prices (PS and PSE), the volume of domestic credit (CV), and total income from interest on loans. Another expectation is that the sub-items of economic growth, NPL, GDP, PE, PSE, CV, and I, are causally related to each other.

A research conducted by Morakinyo and Sibanda (2016) shows that the joint determination of long-term economic growth by non-performing loans (NPL) and other factors, such as bank credit to the economy, gross enrollment in secondary school, the growth rate of government expenditure and the rate of inflation in Nigeria using the bank-based approach, is estimated in this paper using the endogenous growth model. The quarterly data sample covers the years 1998 to 2014. The results of the restricted test imply that these factors and economic growth have long-run co-movements. In the long run, every variable in the model has statistical significance. Economic growth was directly affected by the amount of non-performing loans (NPL) and negatively by bank credit to the economy.

In the case of exchange rates, the direction of the effect depends on the extent of foreign currency lending to vulnerable borrowers, which is particularly high in countries with pegged or managed exchange rates. In the case of stock prices, the impact turns out to be greater in countries that have a large stock market relative to GDP. According to Beck, Jakubik, and Piloju (2013), these results are robust to alternative econometric specifications. However, according to Balgova, Nies, and Plekhanov (2016), the economy benefits in the medium term from the reduction of non-performing loans (NPLs). Moreover, economies that are actively working to resolve non-performing loans (NPLs) perform equally well, although countries that see an inflow of new credit expand faster. Neglecting the issue of NPLs has a negative impact on the performance of the economy.

The purpose of the research by Zhang, Zhang, Zhou, and Zaidi (2020) was to identify the links between economic growth, non-performing loans (NPLs), and financial inclusion. Large panel data from 21 Organization for Economic Co-operation and Development (OECD) countries were used for dynamic panel estimation using Driscoll-Kraay fixed-effect standard errors. Their findings showed a long-term correlation between financial inclusion, non-performing loans, and economic growth. Financial inclusion reduces non-performing loans (NPLs), which boosts economic growth. NPLs also have a negative effect on economic growth and financial inclusion. The increase in the level of non-performing loans may have negatively impacted the economy by reducing banks' ability to disburse loans or making them reluctant to extend loans to the productive sector. This study supports established findings that money supply and economic growth are positively related. It also showed that government spending and economic growth in Nigeria are positively related (Osunnaiye & Alymkulova, 2022). The results of research conducted in 2014 suggest that the main cause of high levels of NPLs is the economic slowdown, which is evident from statistically significant and economically large coefficients on GDP, unemployment, and the inflation rate (Škarica, 2014).

NPLs are an essential barometer of the health and fragility of the banking system, and as recent events have shown, they can affect the stability of the economy as a whole (Kastrati, 2011). Both lenders and borrowers bear the cost of non-performing loans (NPLs), which reduce the availability of

credit, skew credit distribution, erode consumer confidence, and hamper economic expansion. According to Balgova, Nies, and Plekhanov (2016), the economy benefits in the medium term from the reduction of NPLs, and economies that actively resolve NPLs perform well, although countries that see an inflow of new credit expand faster. Neglecting the issue of NPLs harms economic performance. Finally, Algara, Pascual, Polido, and Villareal III (2017) found that credit growth and NPLs move inversely, indicating countercyclical behavior, though the effect is not statistically significant. Their results also show strong persistence of NPLs, a positive effect of the real interest rate on NPLs, and a negative effect of the banks' funding structure (non-BSP borrowings to total assets). No structural break was detected in the model's coefficients.

3. META-ANALYSIS

Table 1 presents an overview of the studies examined in this research through a meta-analytic approach. It outlines the essential elements of each study, such as the time frame analyzed, the variables applied, the methodological frameworks, and the main empirical outcomes. By bringing these components together, the table helps illustrate the areas of alignment and divergence among previous studies, as well as the methodological trends within the existing body of literature.

Table 1. Meta-analysis of the paper

Author	Years	Variables	Methods	Findings
(Osunnaiye, A. V., & Alymkulova, N., 2022)	2011-2020	Non-performing loans, economic growth, bank credit to the private sector, money supply, and government spending	Autoregressive Distributed Cointegrated Model (ARDL)	The findings revealed a negative long-term relationship between NPLs and economic growth. This suggests that higher levels of NPLs can constrain economic performance by limiting banks' lending capacity or making them more cautious in extending credit to productive sectors.
(Szarowska, 2018)	1999-2015	NPL, GDP, Unemployment rate, nominal effective exchange rate, general government debt in % of GDP, interest rate on lending Inflation,	Panel Regression with Fixed Effects Analysis, Granger Causality Test	Panel regression with fixed effects identifies unemployment as the most influential macroeconomic determinant of non-performing loans (NPLs), showing a direct and proportional relationship between the two. The results also confirm that inflation, economic growth, and exchange rate movements exert negative effects on NPL levels. In contrast, the loan interest rate demonstrates a positive and expected impact. Additionally, the study highlights a clear and significant influence of the financial crisis on the increase in problem loans.
(Louzis, D. P., Vouldis, A. T., & Metaxas, V. L., 2012)	2003Q1-2009Q3	GDP, NPL, unemployment, interest rates, and managerial caliber	Dynamic date panel	The findings of this research done in Greece show that macroeconomic factors such as GDP, unemployment, interest rates, public debt and managerial caliber account for the majority of non-performing loans (NPL) in the Greek banking system in all loan categories.
(Radivojević, N., Cvijanović, D., Sekulic, D., Pavlovic, D., Jovic, S., & Maksimović, G., 2019)	2000-2015	GDP, final consumption expenditure unemployment, inflation rate, bank capital for active, interest rate on loans	GMM Model, Ordinary Least Square (OLS), via Dynamic Fixed Effect (DFE) and Random Effect (RE),	The paper aims to highlight the theoretical benefits of GMM over other (often used) panel data estimators for the analysis of non-performing loans (NPLs) and to illustrate these benefits in the context of emerging markets in Latin American countries. To show how important macro and microeconomic factors affect bad loans, the study requires an appropriate econometric model. The significance of the relationship

				between the inflation rate and the microeconomic variables under consideration in this paper was not supported by any data.
(Zhang, P., Zhang, M., Zhou, Q., & Zaidi, S. A. H., 2020)	2008-2018	Financial inclusion, non-performing loans (NPL), inflation, unemployment, trade, infrastructure	Driscoll-Kraay fixed-effect standard errors.	The findings showed the long-term correlation between financial inclusion, non-performing loans and economic growth. Financial inclusion reduces non-performing loans (NPLs), which boosts economic growth. NPLs also have a negative effect on economic growth and financial inclusion.
(Ghosh, 2017)	1984Q1-2016Q2	Real GDP growth, Employment rate	Vector autoregression (VAR)	An increase in overall non-performing loans (NPLs) dampens real GDP growth in the United States, with the effect being especially pronounced in the construction sector. Likewise, higher levels of NPLs substantially reduce employment growth in the banking and construction industries, as well as overall and non-agricultural employment, with the latter showing greater sensitivity.
(Beck, R., Jakubik, P., & Piloiu, A., 2013)	2000-2011	Real GDP growth, Employment rate, GDP, Non-Performing Loans NPL, Nominal Effective Exchange Rates, Loan Interest Rates, Stock Prices and Total Bank Credit	Dynamic panel estimation	Dynamic panel analysis indicates that real GDP growth, stock prices, exchange rates, and credit interest rates all significantly influence the level of non-performing loans (NPLs). The impact of the exchange rate depends on the extent of foreign currency lending to vulnerable borrowers, which tends to be higher in countries with fixed or pegged exchange rates. Regarding stock prices, their effect on NPLs is more pronounced in countries where the stock market constitutes a substantial share of GDP.

Source: Data processed by the author (2025)

4. METHODOLOGY

The main purpose of this research is to analyze the Impact of non-performing loans on the economic growth of the countries of Southeast Europe for the period 2012-2022. So this research shows what impact non-performing loans have on the economic growth of Southeastern European countries. The main variables of this research are: Gross Domestic Product (GDP), Non-Performing Loans (NPL), Unemployment Rate (UN), Inflation (INFL), and Lending Interest Rate (IR).

The data that will be used in the research are secondary data and have been generated from official data published by the World Bank and the Kosovo Statistics Agency. These data are mainly annual data presented also in the form of a time series expressed in percentage. The results of this study will be analyzed through the Stata program.

The research questions of this study are:

1. How does the change in the level of non-performing loans affect the growth of the GDP of the Southeast European countries for the period 2012-2022?
2. How does the change in the lending interest rate affect the GDP of South-East European countries for the period 2012-2022?
3. What is the relationship between inflation, unemployment rate, and GDP for the countries of the European Union for the period 2010-2020?

The main hypotheses of this research are:

H0 - *the increase in the level of non-performing loans has a negative impact on the GDP of Southeast European countries.*

H1 - *The increase in the level of non-performing loans does not negatively affect the GDP of the countries of South-Eastern Europe.*

Table 2. Description of the variables included in the econometric models

Variables	Variable description	Source
Dependent Variable (Y)	Gross Domestic Product (GDP)	Annual reports of the World Bank, time series (2012- 2022) https://data.worldbank.org/
Independent variable (X1)	Non-performing loans (NPL)	Annual reports of the World Bank, time series (2012- 2022) https://data.worldbank.org/
Independent variable (X2)	Unemployment rate (UN)	Annual reports of the World Bank, time series (2012- 2022) https://data.worldbank.org Kosovo Statistics Agency https://ask.rks-gov.net/
Independent variable (X3)	Inflation (INFL)	Annual reports of the World Bank, time series (2012- 2022) https://data.worldbank.org/
Independent variable (X4)	Lending interest rate (IR).	Annual reports of the World Bank, time series (2012- 2022) https://data.worldbank.org/

Source: Data processing by author (2025)

To test the hypotheses of this study, the econometric model must be built to prove these hypotheses. This econometric model will look like the following:

$$GDP_{it} = \beta_0 + \beta_1 NPL_{it} + \beta_2 UN_{it} + \beta_3 INFL_{it} + \beta_4 IR_{it} + \gamma_{it}$$

Where:

GDP - Gross Domestic Product

NPL – Non-performing loans

UN - Unemployment rate

INFL – Inflation

IR - Lending interest rate

stochastic variables (other factors not considered in the model)

i – code and t – time period.

5. RESULTS OF ECONOMETRIC MODEL

During this chapter, the results of descriptive analysis, correlation analysis will be analyzed, and the hypotheses of this study will be tested to test the research questions. The data used in this study are secondary data processed in the STATA program and are presented within the panel data. These data were obtained from the database of the World Bank and the Statistics Agency of Kosovo. The time period along which this study extends is the period 2012-2022. The countries included in this study are: Kosovo, Albania, North Macedonia, Bosnia and Herzegovina, Romania, Bulgaria, Slovenia, Greece, Montenegro, and Croatia. Here, the results of descriptive statistics, correlation analysis, and hypothesis testing will be analyzed. This testing will be done using standard multiple regression analysis, fixed effect model, random effect model, Hausman Taylor Estimation, GMM Model, Arellano Bond Estimation, GEE model.

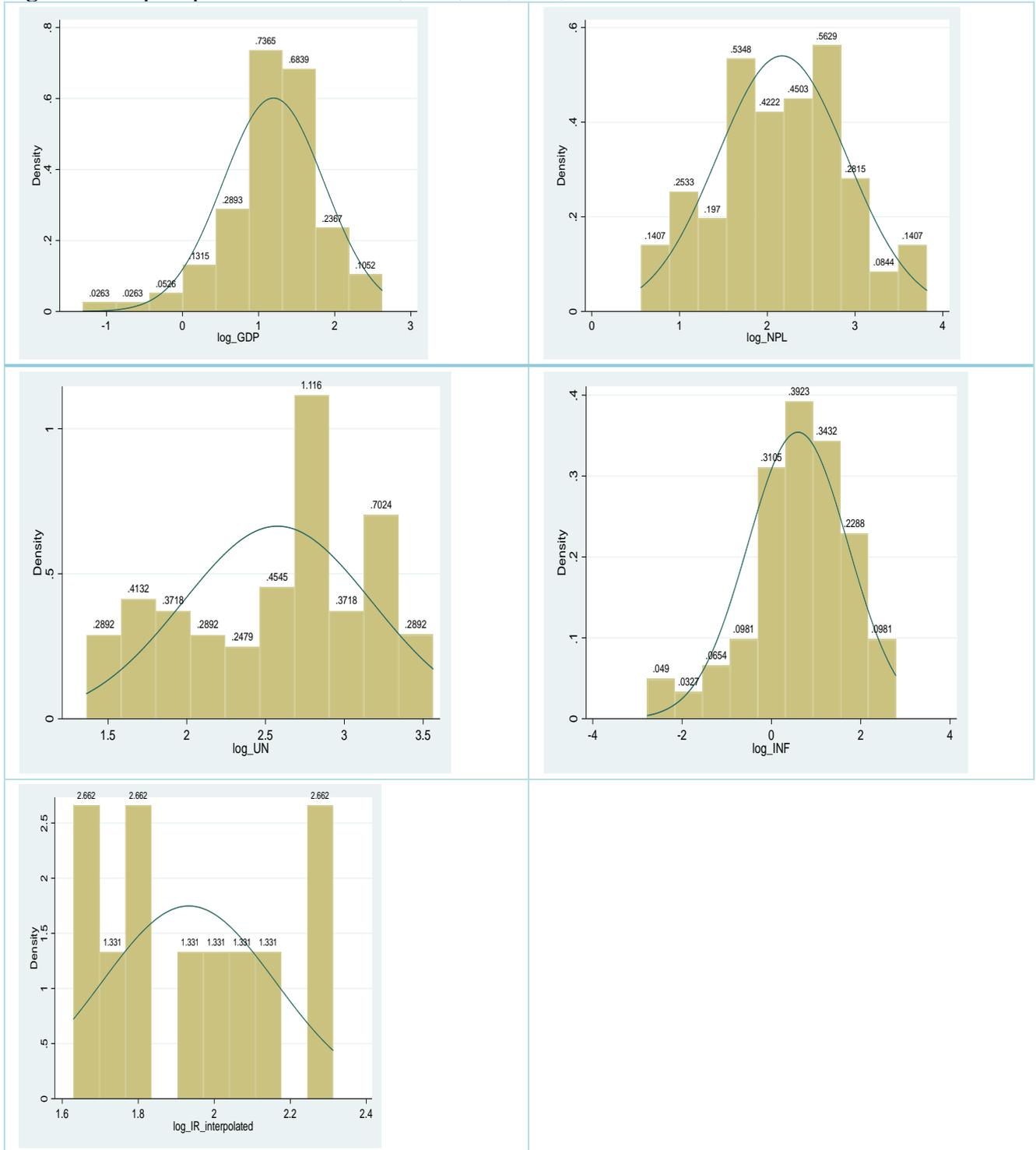
Table 3. presents the descriptive statistics for the variables of this econometric model.

Variable	Obs	Mean	Std. Dev.	Min	Max
GDP	87	1.195569	.6634592	-1.309467	2.623577
NPL	109	2.168643	.7386305	.5597465	3.8193
UN	110	2.575716	.6007112	1.363537	3.563883
INF	99	.5945533	1.126233	-2.778324	2.783897
IR	110	1.93297	.2282555	1.629694	2.312825

Source: Author's calculations in Stata (2025)

From the descriptive statistics, we can see that the GDP variable has an average of 1.19, a minimum value of -1.3, and a maximum value of 2.62. The UN variable has an average of 2.57, a minimum value of 1.3, and a maximum value of 3.5. Whereas INFL has an average of 1.12, a minimum value of -2.77, and a maximum value of 2.7. The IR variable has 110 observations, an average of 1.93, a minimum value of 1.6, and a maximum value of 2.3. Whereas NPL has an average value of 2.1, a minimum value of 0.5, and a maximum value of 3.8.

Figure 4. Graphic presentation of GDP, NPL, UN, INF, IR



Source: Author's calculations in Stata (2025)

From the graphical presentation of the histogram, we can see that between GDP as a dependent variable and NPL, UN, INF, and IR as independent variables, a normal distribution exists.

5.1 CORRELATION ANALYSIS

Table 4 shows the general correlations between the dependent variable and the independent variables of this study.

Table 4. Correlation analysis results

	GDP	NPL	UN	INF	IR
GDP	1.0000				
NPL	-0.5644	1.0000			
UN	-0.0903	0.1694	1.0000		
INF	0.3543	-0.4722	-0.3850	1.0000	
IR	-0.5700	0.5025	0.2608	-0.2182	1.0000

Source: Author's calculations in Stata (2025)

From the results of the correlation analysis, we can see that there is a negative correlation between GDP, NPL, IR, and UN. While an average correlation exists between GDP and INF.

6. EMPIRICAL SUMMARY OF ECONOMETRIC MODEL RESULTS

This section presents a summary of the key empirical findings obtained from the estimated econometric model.

Table 5. Summarizes the empirical results from the econometric model.

Variables	Linear Regression	Random Effects Generalized Least Squares (GLS) Regression	Fixed Effects Regression	Hausman Taylor Regression	GEE Model	GMM Model
GDP	-	-	-	-	-	-
NPL	-.2740041 (0.009) **	-.2664591 (0.020) **	-.2931447 (0.176)	-.2240009 (0.161)	-.2738477 (0.006) **	-.1520023 (0.580)
UN	.1440274 (0.150)	.1518951 (0.191)	.4692666 (0.230)	.2196543 (0.262)	.1441543 (0.135)	.3917149 (0.772)
INFL	.1163411 (0.090) *	.1281902 (0.074) *	.2004789 (0.053) *	.1587362 (0.094) *	.1166029 (0.076) *	.0162989 (0.514)
IR	-1.31567 (0.000) ***	-1.317227 (0.000) ***	-1.388863 (0.001) ***	-1.408226 (0.000) ***	-1.315672 (0.000) ***	-1.366691 (0.369)
R Square	0.4263					
Adj. R ²	0.48879					

Source: Author's calculations in Stata (2025)

* significance level 10%

** significance level 5%

*** 1% significance level

These results will be commented on through Standard Multiple Regression Analysis. Based on the results of the standard multiple regression analysis and the regression equation, we see that all the variables of this study are significant at a confidence level of 10%, except for the variable of the Unemployment Rate (UN), which exceeds the allowed significance. The correlation coefficient between dependent and independent variables is 45.5%. So there is an average correlation or connection between the variables of this study. Whereas the coefficient of determination between the independent and dependent variables is moderately high at 42.6%, so for 42.63% the independent variables explain the dependent variable. These results prove that this model is statistically stable.

β_0 - if all factors are constant, then the GDP value is 3.85.

β_1 NPL – if non-performing loans (NPL) increase by one unit, holding other factors constant, then GDP will decrease by 0.27 units. This statement is true because the significance level is $0.009 < 0.05$.

β_2 UN- if the unemployment rate (UN) increases by one unit, keeping other factors constant, then GDP will increase by 0.14 units. This statement is not true because the significance level exceeds the 10% significance level, i.e., $0.15 > 0.10$

β_3 INFL- if inflation increases by one unit, keeping other factors constant, then GDP will increase by 0.11 units. This statement is true at a significance level of 10%, i.e., $0.09 < 0.10$.

β_4 IR - if the lending interest rate (IR) increases by one unit, keeping other factors constant, then GDP will decrease by 1.13%. This statement is true because the significance level is $0.000 < 0.05$.

We can conclude that all independent variables are significant, statistically significant and prove the validity of the hypotheses of this study, with the exception of the variable of the Unemployment Rate (UN), which is not significant at the 10% confidence level.

In this section, the research questions and hypotheses of the study are addressed based on the empirical results. The analysis indicates that the increase in the level of non-performing loans has a negative impact on the GDP of Southeast European countries during the period 2012–2022, confirming the acceptance of the null hypothesis (H0) and the rejection of the alternative hypothesis (H1). Similarly, the results show that rising lending interest rates exert a negative effect on GDP across the region. Regarding the relationship between inflation, unemployment, and GDP, the findings suggest a positive relationship between inflation and GDP, while the unemployment rate, although positively associated with GDP, was not statistically significant. Economically, moderate inflation in some Southeast European countries during 2012–2022 may have stimulated export growth and tourism, increased actual consumption due to expectations of rising prices, and alleviated the burden of indexed debt, thereby supporting economic activity. These results, derived from multiple regression analysis, provide a clear empirical basis for understanding the macroeconomic determinants of GDP growth in the region.

6. CONCLUSIONS/ RECOMMENDATIONS

From this research, we conclude that the increase in non-performing loans has negatively affected the economic growth of South-Eastern European countries during the period 2012–2022. Similarly, rising lending interest rates exert a negative impact on GDP across the region. The findings also indicate a positive relationship between the unemployment rate and GDP; however, it should be emphasized that unemployment was not statistically significant as an independent variable in this study. In addition, the results show a positive relationship between inflation and GDP.

Since this research concludes that rising levels of non-performing loans negatively affect the GDP of Southeast European countries, it is essential that policymakers in the region prioritize measures aimed at reducing these loans. This can be achieved through closer supervision of financial institutions and by promoting sound financial policies that strengthen risk assessment practices. Additionally, tightening lending criteria would help prevent the accumulation of high-risk loans in the future. Creating new jobs and stimulating economic activity are also crucial, as improved income stability enables businesses and individuals to better manage their financial obligations.

Furthermore, enhanced regional and international cooperation among Southeast European countries is necessary to address shared financial challenges and develop joint strategies for reducing non-performing loans. Finally, the development of programs that support banks and borrowers in managing non-performing loans - including assistance with repayment negotiations and debt restructuring - would contribute significantly to mitigating the issue.

7. DISCUSSION

The relationship between non-performing loans (NPLs) and economic growth in Southeast Europe carries important implications for policymakers, financial institutions, and investors. Elevated NPL levels can undermine bank balance sheets, reducing their capacity to provide credit to households and businesses. This limitation in credit supply can, in turn, restrict investment and slow down overall economic growth. The findings of this study are largely consistent with the results of previous research, which generally indicate that non-performing loans have a negative impact on the economic growth of countries in the Western Balkans. High levels of non-performing loans are shown to constrain the credit supply, limit investment opportunities, and reduce overall economic activity, thereby slowing down the growth process in the region. Previous studies, including Nkusu (2011), Klein (2013), and Louzis et al. (2012), Annual GDP growth, final government consumption, the real interest rate, gross domestic savings, and the unemployment rate all affect the level of non-performing loans (Gashi, Tafa, & Bajrami, 2022). In the Western Balkans, NPLs have shown a rising trend following the global financial crisis, with the highest levels observed in Serbia and Albania, followed by Montenegro, Bosnia and Herzegovina, and Macedonia, while Kosovo recorded the lowest levels. These patterns highlight the varying credit risk across the region and the need for country-specific banking policies to effectively manage non-performing loans (Tmava, Avdullahi, & Sadikaj, 2018).

Several studies report that increases in unemployment negatively affect economic growth. Quantitatively, a one-percentage-point increase in the unemployment rate corresponds to a 0.5-percentage-point decrease in GDP (Kukaj, 2018). In the context of the six Western Balkan countries examined, the findings suggest that GDP growth does not exert a significant effect on the unemployment rate. Nevertheless, from a policy standpoint, these results provide important guidance for regional policymakers, emphasizing that fostering sustainable economic growth remains a key consideration in the development of strategies aimed at mitigating unemployment. (Arifi, Xhixha, & Aliu, 2023). The analysis of inflation and economic growth in the Western Balkans highlights a nuanced relationship. Moderate inflation can have a positive or neutral effect on GDP, whereas higher levels of inflation, beyond certain thresholds, tend to reduce economic growth (Misiri & Fetaj, 2022). The impact of inflation is also influenced by complementary fiscal policies, such as government spending, which can amplify or mitigate its effects (Krasniqi Markaj & Haxhimustafa, 2024).

These findings underscore the importance of maintaining price stability through well-calibrated monetary and fiscal policies. Policymakers in the region need to balance efforts to control excessive inflation with measures that support sustainable growth, as both elements are crucial for long-term economic development in the Western Balkans (Malenković, 2023)

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PUBLIC FINANCE MANAGEMENT SYSTEMS IN ALBANIA: GAPS, REGIONAL COMPARISONS, AND REFORM PATHWAYS

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***Abstract:** This paper evaluates Albania's public finance management (PFM) systems by examining governance frameworks, macroeconomic performance, and regional comparisons within the Western Balkans. The author has used the qualitative analysis of international governance standards, regulatory reports, and national economic data. The study highlights how principles of openness, integrity, and accountability—originally articulated in the Cadbury Report—have been adapted to the public sector through the CIPFA framework. Through the economic analysis the author has identified the key strengths, including improved fiscal balances, declining public debt ratios, and resilience to external shocks, while also revealing persistent gaps in budget execution, transparency, and public investment management. Comparative insights from neighboring countries underscore both shared regional challenges and Albania's relative progress. The paper concludes with strategic directions for strengthening PFM in Albania, emphasizing enhanced accountability mechanisms, more effective use of audits, and better alignment of fiscal policy with long-term development goals.*

***Keywords:** Public sector governance, Accountability; Transparency; Integrity; Governance principles; CIPFA framework.*

1. INTRODUCTION

As more nations develop democratic, market-based economies, adopting standards based on generally accepted accounting principles (GAAP) is becoming increasingly important to the soundness of their financial systems. Sound accounting standards support efficient financial management and reporting systems that provide vital information to creditors and equity investors so that they can make profitable investments. Investors provide much need risk capital and are concerned with the risk inherent in, and return provided by, their investments. Investors and information that will help them determine if they should buy, hold, or sell an investment. Lenders, on other hand, are interested in information that permits them to determine whether their loans, and the interest attaching to them, will be paid when due. Corporate Governance Principles about the Cadbury Report set 3 foundational principles that companies listed in the stock exchange have to observe: openness, integrity and accountability. Openness of the companies, within the limits set by their competitive position, is the foundational element for the level of trust which needs to exist between the business and all those who have an interest in its success. Integrity – it means both direct practice and completeness. What is required of financial reporting is that it should be honest and that it should present a balanced picture of the state of the company's affairs. The integrity of reports depends on the integrity of those who prepare and present them. Accountability – The Boards of directors are accountable to their shareholders and both have to play their part in making that accountability effective. Boards of directors need to do so through the quality of the information which they provide to shareholders, and shareholders through their willingness to exercise their responsibilities as owners.

2. LITERATURE REVIEW

2.1. Matters of public and corporate governance

Governance is a broad term with different meanings and perceptions and is generally used in different disciplines such as political science, public administration, economics, and management (Almqvist *et al*, 2013). Corporate governance refers to the exercise of power over corporate entities (Tricker, 2012; Shleifer and Vishny, 1997), "mechanisms of steering and controlling" (Colley *et al.*, 2005), or "ways in which suppliers of finance assure themselves of getting a return on investment" (Shleifer and Vishny, 1997). Corporate governance refers to systems by which companies are directed and controlled (Tricker, 2012; European Commission, 2011, p. 2; International Federation of Accountants, 2001) and is therefore relevant for all organizational forms, such as SOEs, family business, cooperatives, and not-for-profit firms. In the public sector a debate around "governance" is related to new models and principles of steering that appear in the form of networks and hybrid organizations. Governance is not just about corporate management and marketization but also about the changing nature of government and seeks to understand such transformations (Kettl, 1993, 2000; Tricker, 1994; Rhodes, 2000). Thus, governance refers to all processes whether undertaken by a government, market, or network (Bevir, 2013), and deals with the steering and coordination of various actors, often in network-type patterns of collaboration (Rhodes, 1997).

2.2. Characteristics of the Corporate Governance of public entities in the UK

Considering the particularities of the public sector, respectively public entities not being listed in the stock exchange and not being owned by investors / shareholders, as well as the fact that they are not exclusively oriented towards profits, the characteristics of private companies' corporate governance do not entirely reflect within the corporate governance of public entities.

In the context of the critique brought to the Cadbury Code (which was criticized in the specialized literature because it referred solely to the private sector, and not to the public sector), starting from the three fundamental principles of corporate governance identified by the Cadbury Report, in July 1995, the Chartered Institute for Public Finance and Accounting (CIPFA) developed the first corporate governance framework for the public sector, containing a common set of principles and standards for management and control of public organizations. The corporate governance framework for the public sector, developed by the CIPFA approaches 3 key areas:

The first key area – *organizational processes and structures* – refers several aspects regarding: (i) Responsibility towards the law; (ii) Responsibility for public money; (iii) Communication with stakeholders;

The second area of the corporate governance framework – *controls and financial reporting* – consists of the following components:

(i) Annual reporting; (ii) Internal controls; (iii) Audit committees; (iv) External audits.

The last area of the corporate governance framework – *behavioral standards of directors* – refers to: (i) Leadership / management; (ii) Behavioral codes.

2.3. Recent developments and macroeconomic perspectives

The pace of economic growth over the last few years, until the earthquake strikes in November 2019 and the Covid-19 pandemic, has shown a positive development trend that has been reflected in a number of macroeconomic parameters in the country. So far, the country's main economic and financial fundamentals and overall macroeconomic stability have withstood these shocks relatively well. Even through the most recent external shock resulting from the war in Ukraine, it appears that so far our economy has adapted and performed relatively well.

During the first half of 2023, the Albanian economy continued to grow, showing a stabilization of economic activity. The Gross Domestic Product (GDP) for the first half of 2023 has increased by about 3.05% compared to the first half of 2022 according to the latest estimate available from INSTAT. This recovery relies on a wide range of factors and is present in almost all sectors of the economy. The increase in business confidence, especially in the services and construction sectors, as well as fiscal and monetary support policies, have brought an increase in household consumption, public and private

investments. Both the manufacturing and service sectors have benefited from these developments, providing recovery for business and employment. (INSTAT, Q1, 2023). According to the perspective of aggregate demand, in the first half of 2023, it is estimated that almost all components of aggregate demand have increased. Growth through the first half of 2023 was mainly generated by domestic demand, both private consumption and investment. Meanwhile, foreign demand is estimated to have had a negative contribution, as the high positive contribution from the increase in imports of goods and services was counterbalanced by the lower contribution from the increase in exports. In this context, total final consumption, which constitutes the largest share in the economy, for the first half of 2023 experienced an increase of 4.15%, while private consumption recorded an increase of 3.73% compared to the same period of the previous year. (Bank of Albania, 2023/II).

Total investments for the first half of 2023 recorded a stronger growth of 9.23%, compared to 6.53 percent in 2022. *Foreign trade* data suggest that exports and nominal imports of goods have contracted in annual terms. The decline is more pronounced in the case of exports and more moderate for imports. The drop in international prices remains the main factor behind the negative performance in both cases. While *exports* of goods suffered a decline in the second and third quarters, exports of services, especially those related to tourism, have registered growth rates for the same period, and will compensate for the decrease in exports of goods, making a contribution net positive in total exports in GDP growth. More specifically, exports of goods for the nine-month period 2023 recorded a decrease of -9.0% compared to the previous year. While the imports of goods for the nine-month period 2023 marked a decrease of -6.5% compared to the previous year. The trade deficit for the period January - September 2023 has improved by 3.6% compared to the same period a year ago. The coverage rate of exports to imports for this period is 51.3%.

On the aggregate supply side, positive contribution in the first half of 2023 was made by several branches, specifically: "Construction" with +0.93 percentage points, "Real estate activities" with +0.74 percentage points, "Public Administration, Education and Health " with +0.56 percentage points, "Arts, entertainment and recreation and other service activities" with 0.40 percentage points, "Trade, Transport, Accommodation and Food Service" with +0.31 percentage points", "Information and Communication" with +0.21 points percentage, "Financial and Insurance Activities" with +0.08 percentage points. The group: "Professional activities and administrative services" contributed negatively with -0.17 percentage points. (Instat, 2023) Also, the developments in the *labor market* so far have been positive. The latest data from INSTAT according to the Quarterly Labor Force Survey (LFS) in the second quarter of 2023, show that the official unemployment rate for the 15-64 age group is 11.1%, compared to 11.5% that was for the same quarter of a year ago. As for the working age group of 15 years and older, the official unemployment rate in the second quarter of 2023 was 10.7%. The number of unemployed persons of working age (15-64 years) in the second quarter of 2023 was 157,202 persons. In the second quarter of 2023, the number of employees of working age (15-64 years) was 1,255,840 people. Compared to the same quarter of the previous year (Q2-2022), the number of employed persons increased by 33,106 persons or +2.7%. (INSTAT , 2023).

The external position of the economy, another very important and typically vulnerable foundation in the face of such shocks, remained relatively solid, beyond the initial expectations for the impact that this foundation of the economy could have from the impact of the pandemic and the negative chain implications it could cause in other foundations. In 2022, the *balance of payments* closed with a slightly negative deficit, being calculated at around -0.4% of GDP. (Bank of Albania). Meanwhile, in the first half of 2023, the current account deficit stands at 324 million euros, narrowed in annual terms by about 121 million euros or 27% compared to the same period a year ago. Also, only for the second quarter of 2023, the current account deficit is 195 million euros, narrowed in annual terms by about 4 million euros (or 2%) against the background of the expansion of the trade surplus in services. The trade balance in services expanded significantly in the categories: travel services, transport services, construction, as well as in net income from services for the processing of physical inputs. (IMF, 2024).

In the first half of 2023, *revenues* from services generally related to Tourism increased by +37.4%, compared to the first half of 2022. Also for this period, Remittances also increased by +17.8%. These developments, together with the expansion of secondary income, positively influenced the performance of the current deficit, compensating for the deepening of the trade deficit in goods and the expansion of the negative balance of (primary) income from investments. (Bank of Albania). In the first half of 2023, *Foreign Direct Investments* recorded a value of +686 million euros or +7.2%, compared to +640 million euros in the first half of 2022. Also, only for the second quarter of 2023, FDI recorded a value of +379 million euros or +12.3%, compared to +337 million euros in the second quarter of 2022. This quarter, foreign exchange inflows in the form of foreign direct investments were mainly concentrated in real estate (to the extent of 20%), the sector of hydrocarbons (to the extent of 17%), financial intermediation (to the extent of 15%), and energy (to the extent of 9%).

The stock of *foreign exchange* reserves, at the end of June 2023, marked 5,548 million euros, enough to cover 7.3 months of average annual imports of goods and services. (Ministry of Finance and Economy, 2025). These developments in the external position of the economy and the relatively good performance of the economy as a whole have also been reflected in the other very important foundation of the exchange rate. Having a free exchange rate regime, the local currency (Leku) has remained quite stable against the main currencies (Euro, etc.) around the level of 120 Lek/Euro during the years 2019-2021, a period which coincides with the pandemic, and has significantly intensified this appreciation during the last two years with a faster strengthening trend, a period characterized by the rapid improvement of the current account deficit.

The sustainability of the financial sector, in terms of capitalization, liquidity and profitability, continues to remain another strong foundation of the economy. *Non-performing loans* (NPL) have continued to decrease, marking at the end of July the level of about 5.28% from the 8% they marked about two years ago. The total stock of bank loans in August 2023 had an increase of 1.9% compared to the same month of 2022. The stock of loans in Lek registered an increase of 8.4%, while that in foreign currency decreased by 5.0%, compared to one year before. Lending of the private sector of the economy has suffered a decrease for loans to businesses where at the end of August 2023, a decrease of 2% was recorded compared to a year ago, while loans to consumers continue to grow, where for the same period they recorded the increase of 9.0%.

Regarding *Deposits*, referring to the data so far, during the month of August 2023 the total stock of bank deposits increased by 1.7% compared to the same month of 2021. The total stock of deposits in Lek increased by 0.3%, while that in foreign currency increased by 2.8%. In August 2023, it turns out that about 42.1% of the total stock of deposits consists of deposits in Lek, while the rest of 57.9% consists of deposits in foreign currency. The total stock of deposits for the month of August 2023 only increased by 55 billion Lek compared to the previous month (July 2023). The total stock of business deposits in August 2023 increased by 17.2% compared to August 2022, while the total stock of individuals' deposits decreased by 2.6% compared to the same month a year ago. (BoA, 2023)

Inflation has reflected the recent external supply shock due to the war in Ukraine, becoming one of the main macroeconomic issues for our economy, as in many other countries around the world. However, the fact that inflation in our country has been significantly lower than in the countries of the region (at the 6.7% average annual rate for 2022), or than the average of the countries, is important and in favor of the developments and prospects of the economy. Of the European Union. Inflation in Albania recorded the highest value in October 2022, of 8.3%, mainly caused by food and transport costs. As for the latest data available, in September 2023 the annual change in the consumer price index is 4.1%, while a year ago this change was 8.1%. The average inflation for the nine months of 2023 is 5.1%. (IMF, 2024).

3. Countries of region

Based on reports and analyzes of international institutions, the performance of economic growth in the Western Balkans region was different among countries in the second quarter of 2023.

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In Serbia, Albania and Montenegro, higher rates of expansion were recorded than in the quarter the previous one, while in Kosovo, Bosnia-Herzegovina and North Macedonia, GDP growth slowed down. On average, the region's real GDP growth accelerated marginally to 2% on an annual basis from 1.9% in the first quarter. The unemployment rate fell compared to the previous quarter in some countries and in most of them it was the same or lower than in the same period a year ago.

The four-quarter moving average current account deficit in the region fell to 4% of GDP in June, the lowest level since the third quarter of 2021. This improvement was mainly driven by strong growth in services exports, higher remittance inflows and narrowing merchandise trade deficits helped by softening import prices.

Driven by the slowdown in energy and food prices, average annual consumer price inflation in the Western Balkan countries slowed further to 10.2% in the second quarter of 2023. The rate of inflation continued to decline through August in most economies, at levels ranging from 3.2% in Kosovo and 11.5% in Serbia. In countries with monetary autonomy, the pace of tightening slowed: in Albania, the base rate of monetary policy has remained unchanged since March and in Serbia since July. Continued economic expansion and high inflation supported the growth of budget revenues and fiscal balances have improved in almost all Western Balkan economies in the first eight months of 2023, with the exception of North Macedonia.

Economic growth was generally driven by private consumption and in some countries by the recovery of investments. However, consumer spending showed a mixed performance across the region; where they turned positive in Bosnia-Herzegovina and even accelerated in Kosovo and Albania, while they slowed down in North Macedonia and Montenegro and continued to fall in Serbia.

Table 1: Gross Domestic Product (annual growth in %, in real terms)

	2018	2019	2020	2021	2022	2023*
	<i>Real economic growth, in %</i>					
Albania	4.0	2.1	-3.3	8.9	4.9	3.7
Bosnia and Herzegovina	4.6	2.3	-2.9	7.3	3.8	1.5
Chuang	3.4	4.8	-5.3	10.7	5.2	us
Macedonia	2.8	3.9	-4.7	4.5	0.9	2.0
Black Mountain	5.1	4.1	-15.3	13.0	6.4	3.0
Serbia	4.5	4.3	-0.9	7.5	2.3	1.9
The average of the region	4.1	3.6	-5.4	8.7	3.9	2.4

Source: European Commission (DG-ECFIN), MFE

The reduction in the current account deficit was particularly pronounced in North Macedonia and Serbia, which saw the biggest deterioration in its external balance when the energy crisis hit in 2022. Foreign direct investment inflows remained broadly stable in the four quarters to June and covered most or all of the current account deficit in some countries.

Table 2: Current Balance (% of GDP)

	2018	2019	2020	2021	2022	2023*
	<i>Current account balance, (in % of GDP)</i>					
Albania	-6.8	-7.9	-8.7	-7.7	-6.0	-4.7
Bosnia and Herzegovina	-3.3	-2.6	-2.8	-1.8	-4.3	-3.8
Chuang	-7.6	-5.7	-7.0	-8.7	-10.5	us

Macedonia	0.2	-3.0	-2.9	-2.8	-6.2	-4.1
Black Mountain	-17.0	-14.3	-26.1	-9.2	-13.2	-10.3
Serbia	-4.8	-6.9	-4.1	-4.2	-6.9	-5.5
The average of the region	-6.6	-6.7	-8.6	-5.7	-7.9	us

Source: European Commission (DG-ECFIN), MFE

Trade dynamics were generally dampened by weak and often contracting exports of goods, which were however offset by a steady increase in services exports, particularly in countries dependent on tourism. Import growth was slow overall.

Table 3: Trade balance of goods (% of GDP)

	2018	2019	2020	2021	2022	2023*
<i>Trade balance (in % of GDP)</i>						
Albania	-22.4	-22.9	-22.4	-25.3	-23.8	-22.4
Bosnia and Herzegovina	-22.5	-22.3	-18.0	-18.3	-22.4	us
Chuang	-41.0	-40.3	-38.0	-44.8	-48.0	us
Macedonia	-16.2	-17.3	-16.6	-19.7	-27.0	-25.5
Black Mountain	-43.9	-41.7	-39.2	-38.7	-46.1	-45.3
Serbia	-11.9	-12.2	-11.1	-11.3	-15.5	-13.9
The average of the region	-26.3	-26.1	-24.2	-26.4	-30.5	us

Source: European Commission (DG-ECFIN), MFE

Average employment growth slowed to 0.9% on an annual basis in the Western Balkans in the second quarter of 2023, while labor force participation increased in some countries, notably in Albania where it climbed to a record high of 75.8%. Overall, unemployment rates in the region remained high compared to the EU, ranging from 9.6% in Serbia to 13.5% in Montenegro.

Table 4: Unemployment rate (in %)

	2018	2019	2020	2021	2022	2023*
Albania	12.8	12.0	12.2	12.0	11.3	10.7
Bosnia and Herzegovina	18.4	15.7	15.9	17.4	15.4	14.5
Chuang	29.6	25.7	25.9	20.7	12.6	us
North Macedonia	21.0	17.5	16.6	15.6	14.5	14.2
Black Mountain	15.5	15.4	18.4	16.9	15.1	14.1
Serbia	13.7	11.2	9.7	11.0	9.4	9.3
The average of the region	18.5	16.3	16.5	15.6	us	us

Source: European Commission (DG-ECFIN), MFE

The January-August budget balance recorded surpluses in Albania, Montenegro, Kosovo and Serbia, which however was often partly due to under-executed capital expenditure, sometimes by a significant margin.

Table 5: General government balance (Fiscal deficit in % of GDP)

	2018	2019	2020	2021	2022	2023*
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Fiscal balance, (in % of GDP)

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Albania	-1.6	-1.9	-6.7	-4.6	-3.7	-2.4
Bosnia and Herzegovina	2.2	1.9	-5.2	-0.3	-0.4	-0.3
Chuang	-2.9	-2.9	-7.6	-1.2	-0.5	us
Macedonia	-1.8	-2.0	-8.0	-5.3	-4.5	-3.9
Black Mountain	-3.9	-2.0	-11.1	-1.9	5.2	-4.7
Serbia	0.6	-0.2	-8.0	-4.1	-3.1	-2.8
The average of the region	-1.2	-1.2	-7.8	-2.9	us	us

Source: European Commission (DG-ECFIN), MFE

The ratio of public debt to GDP decreased in most countries in the second quarter of 2023 compared to the end of 2022, partly due to strong nominal GDP growth. The public debt ratio remained the highest in Albania and Montenegro, with 64.8% and 62.4% of GDP, respectively.

Table 6: Total public debt (% of GDP)

	2018	2019	2020	2021	2022	2023*
	<i>Public and guaranteed debt (in % of GDP)</i>					
Albania	67.7	65.8	74.3	74.5	64.5	61.5
Bosnia and Herzegovina	34.1	32.3	36.1	33.9	29.4	29.5
Chuang	17.0	17.6	22.4	21.5	19.9	us
Macedonia	40.4	40.5	50.8	52.0	51.0	51.5
Black Mountain	70.1	76.5	105.3	82.5	69.5	71.0
Serbia	53.7	52.0	57.0	56.5	55.2	52.1
The average of the region	47.2	47.5	57.7	53.5	48.3	us

Source: European Commission (DG-ECFIN), MFE

The economic performance of the Western Balkans in 2023 reflects a region navigating post-pandemic recovery while adjusting to global price shocks and domestic structural constraints. Although growth remained positive, it was uneven across countries, with Albania, Serbia, and Montenegro experiencing accelerated expansion, while North Macedonia, Kosovo, and Bosnia and Herzegovina recorded slower momentum. On average, regional GDP growth improved marginally to 2%, supported primarily by private consumption and, in several cases, by recovering investments.

External sector indicators showed notable improvement. The regional current account deficit fell to its lowest level since 2021, driven by strong services exports—particularly tourism—higher remittances, and easing import prices. Countries such as North Macedonia and Serbia experienced the most significant adjustment, reversing part of the deterioration caused by the 2022 energy crisis. Despite weak goods exports, the resilience of services exports and moderate import growth helped strengthen overall trade balances. Inflationary pressures eased considerably in response to declining global energy and food prices, with average inflation dropping to 10.2%. Monetary tightening slowed across economies with independent monetary policy frameworks, most notably in Albania and Serbia, where policy rates remained unchanged for several months. The moderation in inflation, combined with continued—though modest—economic expansion, contributed to higher budget revenues and improved fiscal balances in most countries.

Labor market conditions continued to strengthen gradually. Employment growth remained positive, labor force participation increased in several economies, and unemployment rates either declined or stabilized. Nevertheless, unemployment remains significantly higher than in EU member states, reflecting persistent structural challenges in regional labor markets. Public finances showed overall improvement, with budget surpluses recorded in Albania, Montenegro, Kosovo, and Serbia for the January–August period. However, these surpluses were often influenced by under-execution of

capital spending, highlighting ongoing weaknesses in public investment management. Public debt ratios also declined in most countries, supported by strong nominal GDP growth, though levels remain comparatively high in Albania and Montenegro.

4. Conclusion

The analysis of Albania's public finance management (PFM) system shows that substantial progress has been made in strengthening macroeconomic stability, modernizing fiscal governance, and improving institutional performance. Albania has demonstrated resilience in the face of major shocks—including the 2019 earthquake, the COVID-19 pandemic, and recent external price shocks—supported by prudent fiscal policies, sustained reforms, and a gradual alignment with European governance standards. Key macroeconomic indicators, such as GDP growth, employment, the current account balance, and public debt, have generally moved toward more sustainable trajectories, despite persistent structural vulnerabilities. At the core of these developments lies the increasing importance of sound governance frameworks. The evolution of public-sector corporate governance, inspired by international standards such as CIPFA and the Cadbury principles, has contributed to greater transparency, accountability, and integrity in public financial decision-making. Nonetheless, gaps remain in areas such as internal control systems, the effectiveness of audit institutions, fiscal risk management, and the integration of performance-based budgeting.

Comparative analysis with Western Balkan economies shows that Albania performs relatively well in terms of economic resilience, labor force participation, tourism-related service exports, and foreign direct investment inflows. However, the country continues to face challenges related to external sector vulnerabilities, fluctuating trade balances, and public debt levels that remain among the highest in the region. Overall, the findings underscore that continued modernization of PFM systems is essential for ensuring fiscal sustainability, strengthening public trust, and supporting long-term economic development. Effective governance will remain a decisive factor in Albania's ability to maintain macroeconomic stability and progress toward EU integration.

5. Recommendations

Strengthening public financial management should begin with reinforcing internal control and audit mechanisms across government institutions. This requires enhancing the capacity, independence, and accountability of internal audit units, while improving coordination with external audit bodies to ensure coherent and effective oversight. Expanding fiscal transparency is also essential, including broader and timelier publication of fiscal reports, better-quality data, and improvements in performance-based budgeting that link resource allocation to measurable outputs and outcomes.

A more resilient fiscal framework further depends on improved management of fiscal risks and public assets. Governments should implement systematic monitoring of contingent liabilities, state-owned enterprises (SOEs), and public-private partnerships, supported by medium-term risk assessments integrated into the annual budget cycle. Strengthening SOE governance in line with OECD standards—through transparent oversight, professional and depoliticized boards, standardized reporting, and regular external audits—is critical. In parallel, sustainable public debt management should be promoted through prudent borrowing, diversified financing sources, and growth-enhancing reforms. Finally, enhancing the efficiency of public expenditures requires substantial improvements in public investment management, digital transformation, and institutional capacity. Better project appraisal systems, cost-benefit analysis, and procurement planning are essential to reduce persistent under-execution of capital expenditures. Expanding digital tools for budgeting, accounting, tax administration, and financial reporting—alongside improved interoperability of government information systems—will support more efficient service delivery. These efforts must be complemented by continuous professional training, knowledge exchange with EU institutions, and alignment with the EU's *acquis communautaire*, particularly in procurement, financial control, and anti-corruption, to advance Albania's broader integration and governance reform agenda.

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CORPORATE GOVERNANCE COMPLIANCE AND FINANCIAL PERFORMANCE IN ROMANIAN FINANCIAL INSTITUTIONS

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Abstract: *This paper examines the effect of compliance with the Corporate Governance Code (CGC) on the profitability and leverage of Romanian financial institutions listed in the Premium category. The study uses panel data from 2018–2023, applying descriptive and regression analyses processed in Microsoft Excel to evaluate the impact of governance compliance, foreign ownership, and managerial ownership on ROA, ROE, and LEV. The findings show that CGC compliance significantly improves profitability but does not affect leverage. Managerial ownership enhances both ROE and leverage, while foreign ownership increases leverage without improving performance. The results contribute to corporate governance research in emerging markets and offer practical insights for regulators and investors regarding the importance of effective governance mechanisms.*

Keywords: *corporate governance, financial performance, compliance, emerging markets, Bucharest Stock Exchange*

1. Introduction

Corporate governance (CG) provides the framework through which companies ensure transparency, accountability, and investor protection, while striking a balance between ethical conduct and regulatory compliance. In Romania, compliance with the Corporate Governance Code (CGC) of the Bucharest Stock Exchange (BVB) has become mandatory for listed companies, reflecting European efforts to harmonize governance practices and enhance market integrity.

Internationally, three dominant governance models can be identified: the Anglo-American model, centered on shareholder value maximization; the European model, which integrates employee participation; and the Asian model, which broadens stakeholder inclusion to customers, suppliers, and financial institutions. Despite these variations, all models converge on the idea that governance mechanisms are designed to align managerial decisions with stakeholder interests and foster long-term value creation.

However, most empirical studies on the link between corporate governance and firm performance focus on developed markets such as the United States, the United Kingdom, or Western Europe (Bhagat & Bolton, 2008; Gompers et al., 2003; Klapper & Love, 2004). Evidence from emerging economies remains scarce and often inconclusive. Romania, in particular, is underrepresented in comparative research, despite the existence of mandatory governance codes.

Despite the increasing attention to corporate governance in developed markets, empirical evidence from emerging European economies, particularly Romania, remains limited and often inconsistent. Previous studies have primarily focused on developed countries with mature regulatory environments, leaving a research gap regarding how governance compliance and ownership structures influence firm performance and capital structure in transitional contexts. Therefore, this study aims to examine the impact of compliance with the Corporate Governance Code (CGC), foreign ownership,

and managerial ownership on the financial performance and leverage of Romanian financial institutions listed in the Premium category of the BVB. By doing so, it aims to provide empirical evidence from an emerging market and contribute to a broader understanding of how governance mechanisms influence profitability and financing decisions in evolving institutional environments.

2. Literature Review and Hypothesis Development

2.1 Ideas about the concept of corporate governance

Corporate governance (CG) has been conceptualized in multiple ways, yet all highlight its role in ensuring transparency, accountability, and balanced decision-making. Feleagă et al. (2011) view CG as a fundamental component of corporate economies, shaping both decision-making processes and the image presented to investors. Telembeci (2014) and Shleifer and Vishny (1997) emphasize its connection to managerial control and investor protection.

Other scholars, such as Boghean (2019), adopt a broader view, portraying governance as a blend of vision, risk management, and compliance. According to the OECD (1999), governance defines the distribution of rights and responsibilities among shareholders, managers, boards, and other stakeholders, ensuring corporate efficiency and integrity.

The evolution of governance is closely tied to the historical development of corporate models. Feleagă et al. (2011) distinguish between the shareholder model, typical of Anglo-American economies, and the stakeholder model, prevalent in Europe. Nistor and Popa (2014) expand this perspective, identifying three main categories: the Anglo-American, European, and Asian models. Jula (2017) notes that the Anglo-American model focuses on shareholder returns, while the European and Asian models incorporate employees and broader stakeholder interests.

Although these models differ, they converge on the principle that effective governance aligns managerial decisions with stakeholder interests and strengthens financial sustainability. This diversity reflects how governance adapts to institutional, social, and economic contexts, while retaining its central role in supporting corporate credibility and performance.

While numerous studies in developed economies (Bhagat & Bolton, 2008; Gompers et al., 2003; Klapper & Love, 2004) demonstrate a consistent positive link between corporate governance and firm performance, empirical findings in emerging markets remain less conclusive. Romania is underrepresented in comparative analyses despite being subject to mandatory corporate governance codes. Based on this theoretical background, the present study aims to investigate how governance mechanisms affect profitability and capital structure in the Romanian financial sector, thereby addressing a notable gap in empirical research.

2.2. Criteria for the assessment and quantification of financial performance in the context of corporate governance implementation

Beginning with the definition of the concept of financial performance, Avram (2017) contends that a company's economic results can only be assessed in relation to other values achieved through its activities, with consistent surpassing of target objectives serving as the primary indicator of financial success for entities. Several key elements that define financial performance and are also closely tied to the concept of corporate governance will be outlined below.

2.2.1. The relationship between corporate governance, financial performance and capital structure

Research has emphasized the close connection between corporate governance, financial performance, and capital structure. For instance, Dănescu and Popa (2019) found that, for Romanian banks, foreign ownership and managerial shareholding positively influence ROA and ROE, while overall compliance showed no significant effect. Avram (2017) argues that good governance enhances credibility and transparency, reducing the risk of inefficiency or fraud.

Similarly, Hațegan and Curea-Pitorac (2017), building on Carroll's CSR framework, highlight that ethical and legal responsibilities shape the governance–performance link. Earlier studies also connect governance to capital structure. Berle and Means (1932) suggested that concentrated ownership strengthens control over management, improving performance, while Novaes and Zingales (1999) linked debt structure to differing managerial and shareholder incentives.

Cărăușu and Onofrei (2017) and Wicaksono et al. (2019) confirm that governance rules improve capital management, information efficiency, and integration with global markets. Overall, studies demonstrate that governance and compliance with CG principles significantly affect both profitability and capital structure, though the magnitude and direction of these effects vary across contexts.

Based on the reviewed literature, it becomes essential to empirically test whether corporate governance characteristics significantly influence financial performance and capital structure among Romanian listed institutions.

H1: Corporate governance characteristics are significantly associated with financial performance and capital structure among Romanian listed institutions.

2.2.2. The relationship between corporate governance and economic profitability (ROA)

Return on Assets (ROA) reflects a firm's efficiency in using assets to generate profit (Brigham, Gapenski, & Daves, 1999) and is a key indicator of performance. Corporate governance is expected to enhance ROA by promoting transparency, reducing conflicts of interest, and improving resource allocation (Bhagat & Bolton, 2008).

Empirical studies support this link: Hossain et al. (2024) reported that board size and specialized committees improve ROA, though board independence had an adverse effect; Dey and Sharma (2021) found governance characteristics such as committees and CEO duality significantly influenced ROA in India.

By contrast, Mardiana and As'ari (2023) observed that independent commissioners and institutional or managerial ownership showed no significant effect in Indonesian mining firms.

Mititean (2022) highlighted the positive effects of board size, gender diversity, and meeting frequency on both ROA and ROE in Romania. Considering these theoretical perspectives and mixed empirical findings, the study assumes that compliance with the Corporate Governance Code, foreign ownership, and managerial ownership may have a measurable impact on firms' economic profitability, as reflected by ROA.

H2.1: A higher degree of compliance with the CGC exerts a positive effect on ROA.

H2.2: Foreign ownership of share capital exerts a positive effect on ROA.

H2.3: Managerial ownership of share capital exerts a positive effect on ROA.

2.2.3. The relationship between corporate governance and financial profitability (ROE)

Return on Equity (ROE) measures a firm's ability to generate profit from shareholders' equity (Ross, Westerfield, & Jaffe, 2016). Good governance practices are expected to strengthen ROE by aligning managerial decisions with shareholder interests (Baysinger & Butler, 2019).

Empirical evidence remains mixed. Anggraini (2024) found that shareholder rights and audit committees significantly increased ROE in Indonesian firms, while Affes et al. (2023) and Alkhazaleh et al. (2022) reported different effects across countries. Mansour et al. (2022) confirmed a positive impact but noted that capital structure moderates this relationship.

Drawing on these findings, the study explores whether CGC compliance, foreign ownership, and managerial ownership are associated with higher financial profitability (ROE) in Romanian listed institutions.

H3.1: A higher degree of compliance with the CGC exerts a positive effect on ROE.

H3.2: Foreign ownership of share capital exerts a positive effect on ROE.

H3.3: Managerial ownership of share capital exerts a positive effect on ROE.

2.2.4. The relationship between CG and debt ratio

The debt ratio (LEV) reflects the extent of debt financing in a firm's capital structure and the level of financial risk it assumes (Petty et al., 2015). From an agency perspective, effective governance should maintain sustainable leverage by improving internal controls and monitoring risks (Jensen, 1986).

Empirical studies provide mixed evidence. Chowdhury (2024) demonstrated that board size, independence, and gender diversity in Bangladesh have an impact on leverage, with more potent effects observed under high managerial ownership. Hung et al. (2024) found that independent directors in Taiwanese firms correlated with higher debt, suggesting their focus on maximizing shareholder wealth. Al-Gamrh (2024) highlighted that governance not only affects leverage levels but also borrowing conditions, especially under economic uncertainty.

In light of these theoretical assumptions and the inconsistent results observed in emerging markets, the study tests whether CGC compliance, foreign ownership, and managerial ownership significantly influence firms' leverage levels.

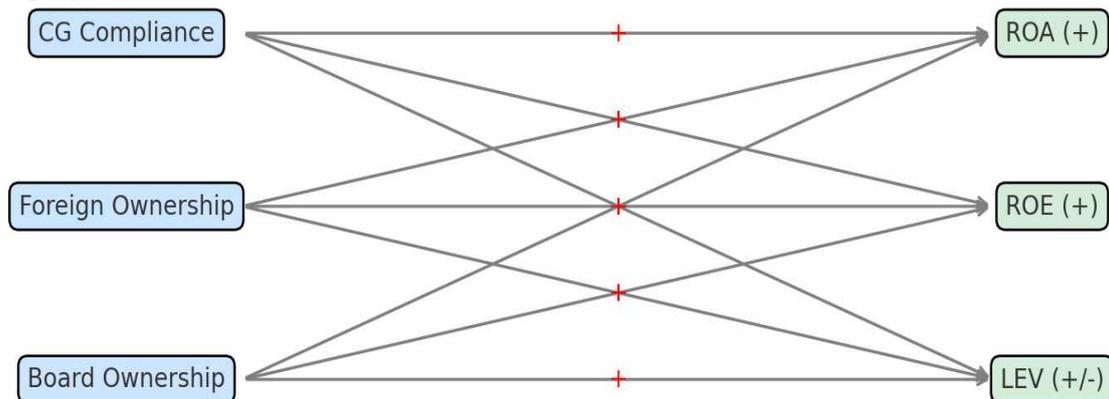
H4.1: A higher degree of compliance with the CGC exerts a negative effect on leverage.

H4.2: Foreign ownership of share capital exerts a positive effect on leverage.

H4.3: Managerial ownership of share capital exerts a positive effect on leverage.

As shown in Figure 1, the conceptual framework integrates corporate governance compliance, foreign ownership, and board ownership as key explanatory variables, with ROA, ROE, and leverage serving as the dependent performance indicators.

Figure 1. *Conceptual framework – links between governance compliance, ownership structure, and financial performance (ROA, ROE, LEV)*



Source: own conception

3. RESEARCH DESIGN

This section describes the methodological approach and empirical procedures used to analyze the relationship between corporate governance and firm performance. The research design adopts a quantitative explanatory method, combining descriptive and inferential analyses to examine how corporate governance compliance, ownership structure, and financial performance are related. This approach ensures both internal and external validity by utilizing panel data from 2018 to 2023. This design enables the identification of causal links between governance mechanisms and firm performance over time.

The analysis covers nine financial institutions listed in the Premium category of the BVB. These entities were selected because they are required to comply with the Corporate Governance Code (CGC), ensuring comparability in governance practices. Data were extracted from annual reports, financial statements, administrators' reports, and "Apply or Explain" statements, which indicate the degree of compliance with CGC requirements.

The data were processed and analyzed using Microsoft Excel, which facilitated the computation of descriptive statistics, correlation coefficients, and regression estimations applied in this study. The study focuses on three dependent variables: ROA (Return on Assets), ROE (Return on Equity), and LEV (Debt Ratio). The independent variables are the Corporate Governance Disclosure Index (CGDI), measuring compliance with CGC provisions; FOROWN, representing foreign ownership; and BOWN, representing managerial ownership. Table 1 displays the variables employed in the econometric study conducted.

Table 1. Variables used in the models of governance compliance, ownership, and financial performance

Variable	Description	Measuring	Studies that used similar variables
ROA	Return on assets rate (%)	Net profit/Total assets	Bunea and Țurlea (2016); Bojan and Lungu (2022); Dănescu and Popa (2019); Bhagat and Bolton (2008); Gompers et al. (2003)
ROE	Rate of return on capital (%)	Net profit/Equity	Bunea and Țurlea (2016); Bojan and Lungu (2022); Dănescu and Popa (2019); Kim et al. (2006); Klapper și Love (2004)
LEV	Debt ratio (%)	Total liabilities/Equity	Dănescu and Popa (2019); Berger et al. (1997); Jensen (1986)
CGDI	Compliance with the CGC (%)	Weighted average of fulfilled provisions (1 = full, 0.5 = partial, 0 = not fulfilled)	Dănescu and Popa (2019); Haniffa and Hudaib (2006); Brown and Caylor (2006)
FOROWN	Foreign ownership (dummy)	1 if >50% capital foreign, else 0	Dănescu and Popa (2019); Douma et al. (2006); Choi et al. (2007)
BOWN	Managerial ownership (%)	Shares held by BoD / Total shares	Dănescu and Popa (2019); Morck et al. (1988); McConnell and Servaes (1990)

Source: Own processing based on indicators used in other similar studies

The study design relies on mathematical expressions that develop predictive models to identify factors influencing CGC compliance, capital structure, and financial performance, potentially influencing future governance practices.

To operationalize the Corporate Governance Disclosure Index (CGDI), the following equation was applied:

$$CG = \frac{\sum_{i=1}^n v_i * p_i}{\sum_{i=1}^n p_i} \quad (1)$$

where: CG = The assessed degree of conformity; $v_i \in \{0, 0.5, 1\}$ = the value of the degree of fulfillment of requirement I; p_i = the degree of importance (weighting) given to requirement I; n = the total number of requirements assessed

According to the correlation matrix presented in Table 3, it was concluded that the most representative models that can be built, considering the sample and the number of variables included in the research, are the unifactorial regression models listed below. The analyses will be carried out from 2018 to 2023, based on the comprehensive construction of company-year models.

$$ROA = \beta_0 + \beta_1 * X_i + \varepsilon \quad (2)$$

$$ROE = \beta_0 + \beta_1 * X_i + \varepsilon \quad (3)$$

$$LEV = \beta_0 + \beta_1 * X_i + \varepsilon \quad (4)$$

where: β = coefficient of the variable; X_i = value of the independent variable, representing the degree of compliance with the requirements of the Corporate Governance Code, the share capital held by foreign investors, and the share capital held by management of financial institutions; ε = model error (indicating the risk that the dependent variables are influenced by other factors not included in the econometric model).

The results obtained from these models are presented and interpreted in the following section.

4. EMPIRICAL RESULTS

4.1. Baseline results

Table 2 presents the descriptive statistics of the research variables during the analyzed period.

Table 2. *Descriptive statistics summary (2018–2023)*

Variable	Range (Min–Max)	Mean trend	Standard Deviation	Variation (CV)
CGDI	85.29% – 100%	from 95.9% to 97.2%	~4%	4–5%
BOWN	0% – 46.99%	from 0.7% to 5.4%	1.5% → 15.6%	>200%
ROA	–6.68% – 35.29%	Fluctuating (avg ~4–9%)	4–11%	114–196%
ROE	–24.96% – 36.44%	Peak in 2022 (14.5%), drop in 2023	5–15%	72–238%
LEV	0.34% – 1583.3%	Highly volatile	340–615%	139–168%

Source: Data processing using the Microsoft Excel application

The Corporate Governance Disclosure Index (CGDI) consistently demonstrates a high level of compliance, ranging from a minimum of 85.29% (SSIF BRK Financial Group, 2020) to 100% across all years. The average increased from 95.92% (2018) to 97.22% (2022–2023), reflecting steady improvement, with low variability and relative homogeneity among firms (Annex 1, col. 7).

Managerial ownership (BOWN) rose from 0.72% in 2018 to 5.36% in 2023, though with strong asymmetry and high variability, mainly due to extreme values recorded by Transilvania Bank (up to 46.99%). This suggests uneven but increasing involvement of management in shareholding (Annex 1, col. 8).

Foreign ownership (FOROWN) is a binary variable; more than 50% of capital was foreign-held only in BRD and Patria Bank (Annex 1, col. 9).

For profitability, the ROA ranged between –6.68% (SSIF BRK, 2023) and 35.29% (Fondul Proprietatea, 2022), confirming that non-compliance can negatively impact performance (Ionescu et al., 2015). Values were highly dispersed, with most firms recording modest profitability (Annex 1, col. 4). ROE followed a similar pattern, from –24.96% (SSIF BRK, 2023) to 36.44% (Fondul Proprietatea, 2022), showing substantial variation and evidence that CG compliance supports higher returns (Annex 1, col. 5).

Leverage (LEV) also varied widely, with averages ranging from 203.83% (2021) to 441.97% (2023). Although some firms (e.g., Fondul Proprietatea) maintained sustainable debt levels, the overall heterogeneity highlights different approaches to financing structures in relation to governance (Annex 1, col. 6).

4.2. Analysis of Potential Relationships Between Economic and Financial Performance and Corporate Governance Variables

To test H1, a correlation matrix was developed to explore the relationships between financial performance indicators (ROA, ROE, and LEV) and corporate governance variables (CGDI, BOWN, and FOROWN) for the period 2018–2023.

Table 3. *Matrix of correlations between variables*

	ROA	ROE	LEV	CGDI	BOWN	FOROWN
ROA	1					
ROE	0.62	1				
LEV	-0.36	0.14	1			
CGDI	0.29	0.39	0.19	1		
BOWN	-0.09	0.28	0.48	0.178	1	
FOROWN	-0.22	0.02	0.57	0.06	-0.10	1

Source: Data processing using the Microsoft Excel application

The results highlight several important patterns:

ROA and ROE are strongly correlated (0.62), confirming that firms with higher economic profitability also deliver higher returns on equity.

LEV is negatively correlated with ROA (-0.36), suggesting that higher indebtedness reduces efficiency in asset use, but shows a weak positive link with ROE (0.14), indicating potential short-term gains for shareholders.

CGDI correlates positively with both ROA (0.29) and ROE (0.39), supporting the view that stronger compliance with the Corporate Governance Code enhances profitability. Its weak positive link with leverage (0.19) indicates that compliance alone does not constrain debt levels.

BOWN shows a weak negative relationship with ROA (-0.09) but a positive correlation with ROE (0.28) and especially with leverage (0.48), suggesting that managerial ownership may incentivize higher risk-taking.

FOROWN has a negative association with ROA (-0.22), no relevant link with ROE (0.02), and a moderate positive correlation with leverage (0.57). This implies that foreign ownership tends to increase reliance on debt financing without consistently improving profitability.

Overall, the results partially support H1, indicating that governance characteristics are associated with performance and capital structure; however, the effects are heterogeneous and context-dependent.

4.3. The impact of compliance with CGC requirements, foreign investor share capital, and BoD share capital on ROA.

This study examines the impact of CGC compliance, foreign ownership, and managerial ownership on economic profitability (ROA) by applying three unifactorial econometric models covering the period from 2018 to 2023. The models were built using data from Annex 1, ensuring both methodological rigor and relevance to the current economic context. In all regression models, statistical significance was assessed at conventional thresholds (1%, 5%, and 10%), with p-values reported accordingly.

The first econometric model determines the influence of the degree of compliance with the requirements of the CGC on economic profitability and has the following formulation: *The degree of compliance with the requirements of the CGDI exerts a significant influence on ROA.*

An analysis of the impact of compliance with the CGC provisions on the rate of return on assets reveals that the proposed model is statistically significant at the 5% level ($p < 0.05$).

Table 4. Regression analysis of the ROA-CGDI model

	<i>Coefficients</i>	<i>t Stat</i>	<i>P-value</i>
Intercept	-0.45	-1.954	0.05
CGDI	0.47	2.189	0.03
R ²	0.08		
F Significance	4.79		

Source: Data processing using the Microsoft Excel application

Table 4 shows that the model for H2.1 is statistically significant ($F = 4.79$, $p < 0.05$), confirming that CGC compliance has a positive influence on ROA for BVB-listed institutions during 2018–2023. The explanatory power is modest ($R^2 = 0.08$), but the positive coefficient ($\beta = 0.47$, $p < 0.05$) indicates a direct relationship: $ROA = -0.40 + 0.47 \cdot CGDI + \varepsilon$.

The second econometric model examines the impact of share capital owned by foreign investors on economic profitability, as articulated in the following hypothesis: *The share capital held by foreign investors (FOROWN) has a significant influence on economic profitability (ROA).*

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The second model tests the effect of foreign ownership on ROA. The correlation matrix (Table 3) indicated a weak negative link ($r = -0.22$). The regression results are presented in Table 5. The results obtained from data processing in Excel are highlighted in Table 5. It is of significant importance to note that the model is valid ($F = 2.76, p < .01$), confirming the hypothesis that the independent variable, represented by the share capital held by foreign investors, indeed influences economic profitability.

Table 5. *Regression analysis of the ROA-FOROWN model*

	<i>Coefficients</i>	<i>t Stat</i>	<i>P-value</i>
Intercept	0.05	5.35	0.00
FOROWN	-0.03	-1.66	0.10
F Sig	2.76		
R ²	0.05		
Multiple R	0.22		

Source: Data processing using the Microsoft Excel application

The model is statistically significant ($F = 2.76, p < 0.01$), confirming that the independent variable has a significant influence on economic profitability. The model indicates a weak negative relationship between foreign ownership and ROA ($\beta = -0.03, p = 0.10$), with limited explanatory power ($R^2 = 0.05$). Thus, firms with majority foreign capital show slightly lower profitability, consistent with mixed findings in emerging markets. The model is expressed as: $ROA = 0.05 - 0.03*FOROWN + \epsilon$.

The third econometric model tested is formulated as follows: *Management ownership of equity (BOWN) has a significant influence on economic profitability (ROA)*. The regression model created for sub-hypothesis H2.3 is outlined as follows: $ROA = \beta_0 + \beta_1 * BOWN + \epsilon$. The developed third unifactorial regression model is invalid based on the data in Table 6.

Table 6. *ANOVA test for the analysis of the ROA-BOWN model*

	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Sig F</i>
Regression	1	0.002	0.002	0.4993	0.48
Residual	52	0.256	0.004		
Total	53	0.259			

Source: Data processing using the Microsoft Excel application

The ANOVA results ($F = 0.49, p > 0.1$) do not support the tested hypothesis, confirming that the third econometric model is rejected.

4.4. The impact of compliance with CGC requirements, share capital held by foreign investors, and share capital held by the BoD on ROE

To test H3, three unifactorial regression models were estimated for the period 2018–2023, assessing the effects of compliance with the CGC (CGDI), foreign ownership (FOROWN), and managerial ownership (BOWN) on financial profitability, measured by ROE. In all regression models, statistical significance was assessed at conventional thresholds (1%, 5%, and 10%), with p-values reported accordingly. The first econometric model tests the following statement: *A higher degree of compliance with the CGC exerts a positive effect on ROE*. The regression model created for sub-hypothesis H3.1 during the analyzed period is outlined as follows: $ROE = \beta_0 + \beta_1 * CGDI + \epsilon$. The regression results in Table 7 confirm that CGC compliance has a significant and positive effect on ROE ($F = 9.33, p < 0.05$), accounting for 15.22% of its variation. This indicates that firms with higher compliance levels consistently achieve superior shareholder returns.

Table 7. Regression analysis of the ROE-CGDI model

	<i>Coefficients</i>	<i>t Stat</i>	<i>P-value</i>
Intercept	-0.84	-2.77	0.08
CGDI	0.95	3.05	0.00
R ²	0.15		
F Sig	9.33		

Source: Data processing using the Microsoft Excel application

The second model tests the following statement: *Foreign ownership of share capital exerts a positive effect on ROE*. Despite the correlation matrix indicating a very weak positive association ($r = 0.02$), the regression results (Table 8) show no significant effect ($F = 0.02$, $p > 0.05$). Therefore, foreign ownership does not significantly influence ROE, and H3.2 is rejected. The results ($p = 0.88$) confirm the absence of a statistically significant relationship between foreign ownership and financial profitability.

Table 8. ANOVA – Analysis of the ROE-FOROWN model

	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	1	0.00	0.00	0.02	0.88
Residual	52	0.51	0.01		
Total	53	0.59			

Source: Data processing using the Microsoft Excel application

The third model tests the following statement: *Managerial ownership of share capital exerts a positive effect on ROE*. The regression results (Table 9) confirm a significant positive relationship ($F = 4.63$, $p < 0.05$), with managerial ownership explaining 8% of the variation in ROE ($R^2 = 0.08$). Although the correlation is weak ($\beta = 0.46$, $p < 0.05$; Multiple $R^2 = 0.28$), the model supports H3.3, indicating that management shareholding contributes to higher financial profitability.

Table 9. Regression analysis of the ROE-BOWN model

	<i>Coefficients</i>	<i>t Stat</i>	<i>P-value</i>
Intercept	0.07	5.41	1.5862E-06
BOWN	0.46	2.15	0.03
R ²	0.08		
F Significance	4.63		
Multiple R	0.28		

Source: Data processing using the Microsoft Excel application

4.5 The impact of compliance with CGC requirements, foreign investor share capital, and Board of Directors' share capital on LEV

Three unifactorial models were estimated for 2018–2023 to test the effects of CGC compliance, foreign ownership, and managerial ownership on leverage (LEV), based on the dataset in Annex 1. In all regression models, statistical significance was evaluated at standard thresholds (1%, 5%, and 10%), with p-values explicitly reported.

The first econometric model is based on the following statement: *A higher degree of compliance with the CGC exerts a negative effect on leverage*. An analysis was conducted to examine the impact of financial leverage based on the level of compliance with the provisions of the CGC. Table 10 presents the findings, which indicate that the hypothesis formulated is not supported ($F = 1.98$, $p > 0.05$).

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Table 10. ANOVA test for the analysis of the LEV-CGDI model

	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	1	40.68	40.68	1.98	0.16
Residual	52	1065.73	20.49		
Total	53	1106.41			

Source: Data processing using the Microsoft Excel application

The F-test value of 0.16 shows that the hypothesis linking CGC compliance to the debt ratio of BVB -listed financial institutions cannot be accepted. The model’s invalidity is reinforced by the wide variation in leverage percentages across the six years (Annex 1, col. 7).

The second econometric model is designed to assess the impact of the share capital held by foreign investors on financial leverage. It is based on the following hypothesis: *Foreign ownership of share capital exerts a positive effect on leverage*. The second sub-hypothesis examines the effect of foreign ownership on the debt ratio (LEV) of financial institutions during 2018–2023. The correlation matrix (Table 3) shows a moderate positive link ($r = 0.57$). Regression results (Table 11) confirm this relationship ($F = 25.20$, $p < 0.05$), with foreign ownership explaining 32% of the variation in leverage ($R^2 = 0.32$). The positive coefficient ($t = 6.22$, $p < 0.05$) indicates that higher foreign ownership is associated with increased leverage, supported by a Multiple R of 0.57.

Table 11. Regression analysis of the LEV-FOROWN model

	<i>Coefficients</i>	<i>t Stat</i>	<i>P-value</i>
Intercept	1.77	3.04	0.00
FOROWN	6.22	5.02	0.02
Multiple R	0.57		
R ²	0.32		
F Sig	25.20		

Source: Data processing using the Microsoft Excel application

The third econometric model examining the impact of management ownership on financial leverage is based on the following hypothesis: *Managerial ownership of share capital exerts a positive effect on leverage*. The third regression model (Table 12) is valid ($F = 15.77$, $p < 0.05$), confirming H4.3. Managerial ownership explains 23% of the variation in leverage ($R^2 = 0.23$), and the positive coefficient ($\beta = 34.13$, $t = 3.97$, $p < 0.01$) indicates a direct relationship, suggesting that higher management shareholding is associated with increased leverage.

Table 12. Regression analysis of the LEV-BOWN model

	<i>Coefficients</i>	<i>t Stat</i>	<i>P-value</i>
Intercept	2.66	4.72	1.791E-05
BOWN	34.13	3.97	0.00
R ²	0.23		
F Significance	15.77		

Source: Data processing using the Microsoft Excel application

To provide a clearer perspective, Table 13 summarizes the main results of this study. It contrasts them with prior empirical findings, highlighting whether the observed relationships were positive, negative, or non-significant across different contexts.

Table 13. Comparative evidence on the relationship between corporate governance and financial performance

Relationship	Finding (this study)	Evidence from prior literature
CG compliance → ROA	Positive and significant	Positive: Bhagat & Bolton (2008); Dănescu & Popa (2020). Non-significant: Dănescu & Popa (2019).
CG compliance → ROE	Positive and significant	Positive: Affes et al. (2023); Bojan & Lungu (2022). Mixed results in emerging markets (Anggraini, 2024; Alkhazaleh et al., 2022).
CG compliance → Leverage	Not significant	Negative or weak: Dănescu & Popa (2020); partial evidence in Chowdhury (2024).
Foreign ownership → ROA	Weak negative (not robust)	Positive: Douma et al. (2006); Choi et al. (2007). Negative/insignificant in some emerging contexts (Mansour et al., 2022).
Foreign ownership → ROE	Not significant	Positive: Anggraini (2024). Insignificant: Alkhazaleh et al. (2022).
Foreign ownership → Leverage	Positive and significant	Positive: Hung et al. (2024); Chowdhury (2024).
Managerial ownership → ROA	Not significant (heterogeneity bias)	Mixed: Berle & Means (1932) (positive); Mititean (2022) (positive).
Managerial ownership → ROE	Positive and significant	Positive: Baysinger & Butler (2019); Mititean (2022).
Managerial ownership → Leverage	Positive and significant	Positive: Bojan & Lungu (2022).

Source: Own processing based on empirical findings and previous studies

Building on these results, several practical implications emerge for regulators, managers, and investors in the Romanian financial sector. Consistent compliance with the Corporate Governance Code is associated with higher profitability (ROA, ROE), underlining the need for effective regulatory enforcement. The absence of a significant effect on leverage suggests that formal compliance alone cannot discipline capital structure decisions, indicating the importance of complementary prudential measures. Managerial ownership has a positive influence on ROE and leverage, indicating that aligning managers' incentives with those of shareholders promotes risk-taking and value creation. By contrast, foreign ownership tends to increase leverage but does not consistently improve profitability, suggesting that external investors may prioritize access to capital over operational efficiency. These findings are particularly relevant for both regulators (e.g., ASF, BVB) and institutional investors who use governance compliance as a criterion for screening investments.

5. DISCUSSION

The analysis began by examining the existing relationships between compliance with the provisions of the Corporate Governance Code, economic and financial performance, and capital structure. A series of unifactorial models was developed based on information collected from nine financial institutions listed in the Premium category on the BVB. The findings indicated both validated hypotheses and some models that could not be confirmed due to various factors, such as the lack of homogeneity in the values recorded by some entities during the reference period.

The results provide mixed support for the hypotheses tested.

H1 confirmed that corporate governance characteristics are significantly associated with financial performance and capital structure, though not uniformly across all indicators. This supports the view that governance mechanisms matter, but their impact depends on specific variables and institutional context.

H2 showed that CGC compliance and foreign ownership influence ROA, while managerial ownership was not a significant factor. This partly aligns with Bhagat & Bolton (2008) and Dănescu & Popa (2019), who also found positive but inconsistent effects of governance on economic profitability. The lack of impact from managerial ownership reflects heterogeneity in shareholding structures among Romanian firms.

H3 confirmed that both CGC compliance and managerial ownership have a positive effect on ROE, whereas foreign ownership has no significant effect. These findings are consistent with those of Affes et al. (2023) and Bojan & Lungu (2022), who reported positive links between governance mechanisms and shareholder returns. However, they contrast with studies in emerging markets (Anggraini, 2024; Alkhazaleh et al., 2022), which found mixed or insignificant results.

H4 indicated that compliance with CGC does not influence leverage, but foreign and managerial ownership significantly increase debt ratios. This contrasts with Dănescu & Popa (2020), who reported a negative relationship, but is consistent with Chowdhury (2024) and Hung et al. (2024), who highlighted the role of ownership in shaping capital structure decisions.

Taken together, the findings suggest that governance compliance strengthens profitability but does not constrain leverage, while ownership structures—particularly foreign and managerial—play a decisive role. These results underline the importance of considering both governance frameworks and ownership dynamics when analyzing corporate performance in emerging markets.

Overall, the evidence suggests that corporate governance compliance contributes to improving profitability, but has a limited influence on capital structure, where ownership factors remain the most decisive. These findings underscore the dual importance of governance frameworks and ownership configurations in shaping firm outcomes, particularly in emerging markets where institutional enforcement is less robust. Thus, the study bridges theoretical perspectives with empirical insights, setting the stage for drawing broader conclusions regarding the role of governance in Romania's financial sector.

6. CONCLUSION

This study assessed the impact of compliance with the (CGC on the financial performance and capital structure of Romanian financial institutions listed in the Premium category of the BVB. By combining panel data analysis with insights from corporate governance theories, the research provides evidence specific to an emerging European market.

Theoretical contribution. The findings extend the existing literature, which has been predominantly focused on developed markets, by showing how governance compliance, ownership structure, and financial outcomes interact in Romania's financial sector. In particular, the results confirm that CGC compliance significantly improves profitability (ROA and ROE), while managerial ownership has a dual role, strengthening both equity returns and leverage capacity. These results highlight that the governance–performance nexus must be interpreted through the lens of institutional context, ownership concentration, and regulatory enforcement—dimensions often overlooked in prior studies.

Practical contribution. From an applied perspective, the results emphasize that compliance with the CGC should not be viewed merely as a formal requirement but as a signal of institutional reliability. For investors, especially those considering allocations in emerging markets, governance compliance can serve as a trustworthy screening criterion in assessing firm quality and risk exposure. For regulators and policymakers, the evidence underlines the importance of promoting meaningful governance practices rather than focusing exclusively on formal adherence.

Future research. This study is limited by its focus on a small sample of financial institutions and a restricted set of governance variables. Future research could expand the analysis by incorporating environmental, social, and governance (ESG) indicators to examine whether sustainability-related governance factors reinforce or moderate financial outcomes. Additionally, cross-sectoral comparisons between financial and non-financial firms, or cross-country comparisons within Central

and Eastern Europe, would further enrich the understanding of how governance mechanisms operate in diverse institutional contexts.

In conclusion, corporate governance compliance plays a crucial role in enhancing financial performance in Romania's financial sector; however, its effectiveness depends on ownership structures and contextual factors. Strengthening governance practices and integrating sustainability considerations are essential for long-term resilience and value creation in emerging markets.

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Annex 1 Database related to the study conducted in the scientific paper

AN	Companie	ROA	ROE	LEV	CGDI	BOWN	FOROWN
2018	BRD - GROUPE SOCIETE GENERALE S.A.	2.58%	19.64%	661.07%	97.06%	0.04%	1
	SSIF BRK FINANCIAL GROUP SA	-4.70%	-7.85%	67.00%	92.65%	0.00%	0
	BURSA DE VALORI BUCURESTI SA	12.24%	11.40%	3.16%	100.00%	0.08%	0
	FONDUL PROPRIETATEA	11.91%	11.95%	0.34%	100.00%	0.00%	0
	LION CAPITAL S.A.	2.80%	3.04%	8.59%	97.06%	0.04%	0
	PATRIA BANK S.A.	-1.17%	-18.37%	1474.34%	95.59%	1.53%	1
	SIF MUNTENIA S.A.	3.93%	4.23%	7.86%	88.24%	0.00%	0

AN	Companie	ROA	ROE	LEV	CGDI	BOWN	FOROWN
	SIF OLTENIA S.A.	4.09%	4.63%	13.07%	92.65%	0.34%	0
	BANCA TRANSILVANIA S.A.	2.00%	17.02%	750.81%	100.00%	4.40%	0
2019	BRD - GROUPE SOCIETE GENERALE S.A.	2.86%	21.10%	637.56%	97.06%	0.04%	1
	SSIF BRK FINANCIAL GROUP SA	-2.63%	-4.99%	89.39%	88.24%	0.00%	0
	BURSA DE VALORI BUCURESTI SA	8.47%	7.88%	3.14%	100.00%	0.27%	0
	FONDUL PROPRIETATEA	9.48%	9.51%	0.36%	100.00%	0.03%	0
	LION CAPITAL S.A.	3.15%	3.32%	5.67%	100.00%	0.04%	0
	PATRIA BANK S.A.	-0.01%	-0.08%	986.43%	95.59%	0.80%	1
	SIF MUNTENIA S.A.	1.69%	1.82%	7.21%	88.24%	0.00%	0
	SIF OLTENIA S.A.	4.86%	5.47%	12.64%	92.65%	0.36%	0
	BANCA TRANSILVANIA S.A.	1.65%	16.45%	900.09%	100.00%	4.52%	0
2020	BRD - GROUPE SOCIETE GENERALE S.A.	2.85%	20.14%	607.42%	97.06%	0.04%	1
	SSIF BRK FINANCIAL GROUP SA	5.64%	12.66%	124.60%	85.29%	0.00%	0
	BURSA DE VALORI BUCURESTI SA	6.28%	6.54%	4.21%	100.00%	0.53%	0
	FONDUL PROPRIETATEA	26.26%	26.36%	0.42%	100.00%	0.00%	0
	LION CAPITAL S.A.	5.45%	5.80%	6.49%	100.00%	0.31%	0
	PATRIA BANK S.A.	0.17%	1.60%	857.58%	95.59%	0.00%	1
	SIF MUNTENIA S.A.	6.66%	7.11%	6.75%	91.94%	0.00%	0
SIF OLTENIA S.A.	5.19%	5.69%	9.56%	92.65%	0.40%	0	

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FINANCIAL INSTITUTIONS**

AN	Companie	ROA	ROE	LEV	CGDI	BOWN	FOROWN
	BANCA TRANSILVANIA S.A.	1.85%	19.07%	929.11%	100.00%	5.15%	0
2021	BRD - GROUPE SOCIETE GENERALE S.A.	1.54%	10.05%	550.69%	98.53%	0.04%	1
	SSIF BRK FINANCIAL GROUP SA	0.96%	2.74%	184.36%	88.24%	0.00%	0
	BURSA DE VALORI BUCURESTI SA	8.07%	8.39%	3.91%	100.00%	0.45%	0
	FONDUL PROPRIETATEA	-1.00%	-1.00%	0.54%	100.00%	0.00%	0
	LION CAPITAL S.A.	3.19%	3.37%	5.64%	100.00%	0.31%	0
	PATRIA BANK S.A.	10.02%	10.02%	89.98%	95.59%	0.00%	1
	SIF MUNTENIA S.A.	-1.60%	-1.66%	3.92%	91.18%	0.00%	0
	SIF OLTENIA S.A.	2.53%	2.79%	10.09%	95.59%	0.00%	0
	BANCA TRANSILVANIA S.A.	1.16%	12.57%	985.33%	100.00%	4.69%	0
2022	BRD - GROUPE SOCIETE GENERALE S.A.	1.91%	13.41%	602.51%	100.00%	0.00%	1
	SSIF BRK FINANCIAL GROUP SA	8.84%	24.60%	177.65%	91.18%	0.00%	0
	BURSA DE VALORI BUCURESTI SA	6.97%	7.55%	8.25%	100.00%	0.57%	0
	FONDUL PROPRIETATEA	35.29%	36.44%	3.26%	100.00%	0.00%	0
	LION CAPITAL S.A.	10.73%	11.33%	5.60%	100.00%	0.65%	0
	PATRIA BANK S.A.	0.25%	2.81%	1037.41%	95.59%	0.00%	1
	SIF MUNTENIA S.A.	12.89%	13.47%	4.47%	89.71%	0.00%	0
	SIF OLTENIA S.A.	1.55%	1.71%	10.24%	98.53%	0.00%	0

AN	Companie	ROA	ROE	LEV	CGDI	BOWN	FOROWN
	BANCA TRANSILVANIA S.A.	1.43%	19.06%	1237.11%	100.00%	4.82%	0
2023	BRD - GROUPE SOCIETE GENERALE S.A.	1.80%	19.61%	990.48%	100.00%	0.01%	1
	SSIF BRK FINANCIAL GROUP SA	-6.68%	- 24.96%	274.78%	91.18%	0.00%	0
	BURSA DE VALORI BUCURESTI SA	9.10%	9.86%	8.35%	100.00%	0.56%	0
	FONDUL PROPRIETATEA	18.86%	19.01%	0.78%	100.00%	0.00%	0
	LION CAPITAL S.A.	2.80%	2.94%	5.01%	100.00%	0.67%	0
	PATRIA BANK S.A.	0.49%	5.87%	1104.78%	95.59%	0.00%	1
	SIF MUNTENIA S.A.	-1.71%	-1.79%	4.37%	89.71%	0.00%	0
	SIF OLTENIA S.A.	7.39%	7.83%	5.93%	98.53%	0.00%	0
	BANCA TRANSILVANIA S.A.	1.63%	27.37%	1583.30%	100.00%	46.99%	0

BUILDING AN AI-ENABLED ECONOMY: GLOBAL POLICY MODELS AND STRATEGIC DIRECTIONS FOR AZERBAIJAN

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Abstract: *This paper examines how leading economies integrate artificial intelligence into national economic and business systems and evaluates the relevance of these experiences for Azerbaijan's emerging AI strategy. The study analyzes the strategic and legislative frameworks of the United States, China, and Spain, focusing on their approaches to innovation governance, sectoral prioritization, institutional design, and mechanisms that facilitate AI adoption by firms. The purpose of the research is to identify which elements of these international models can support Azerbaijan's transition toward a more diversified, knowledge-based economy. Using a comparative policy analysis, the paper reviews national AI strategies, regulatory acts, implementation tools, and public-private innovation infrastructures to assess their transferability to the South Caucasus context. The findings show that the United States demonstrates the strongest framework for commercialization and research-industry collaboration; China provides a structured sectoral planning model with measurable targets; and Spain offers a balanced, human-centric regulatory approach aligned with EU governance standards. When compared with these systems, Azerbaijan's strategy presents solid long-term ambitions but lacks detailed sectoral roadmaps, commercialization mechanisms, and trust-building governance tools. The paper concludes by proposing targeted recommendations for Azerbaijan, including AI commercialization hubs, sector-specific roadmaps, and an ethical governance package aligned with international best practices.*

Keywords: Artificial Intelligence (AI); digital economy; economic transformation; comparative analysis; Azerbaijan

Introduction

The accelerating global transition toward AI-enabled economic systems has pushed countries to redefine how they regulate innovation, support business competitiveness, and structure long-term development strategies. Understanding these differences is essential for countries such as Azerbaijan, where AI integration is not only a technological priority but also a core component of broader economic restructuring.

The purpose of this research is to analyze how the United States, China, and Spain incorporate artificial intelligence into their economic and business policies, and to determine which elements of their experience are most relevant for improving Azerbaijan's national AI agenda for 2025–2028. Rather than evaluating AI as an isolated technological field, the study examines its strategic, regulatory, and institutional dimensions to capture how countries translate AI capabilities into economic outcomes.

The research method is a comparative policy analysis that systematically reviews national AI strategies, legislative acts, institutional mechanisms, and economic programs in the selected countries. This method allows the paper to identify structural similarities, divergences, and transferable policy instruments that fit Azerbaijan's developmental context.

The novelty and originality of the study stem from its focus on AI as a tool for economic modernization and business transformation, rather than treating it solely as a digital innovation. Existing literature rarely evaluates how advanced AI economies can inform the strategic development of transitioning economies, particularly within the South Caucasus. By synthesizing global practices

and aligning them with Azerbaijan's structural priorities, this research offers a unique, evidence-based perspective on how the country can close policy gaps, strengthen institutional readiness, and accelerate the economic benefits of AI adoption.

Discussions

Artificial intelligence has rapidly evolved from a specialized technological domain into a foundational driver of economic modernization, business transformation, and institutional efficiency. Across leading economies, AI now shapes national development agendas, influences global competitiveness, and redefines how states, firms, and societies organize production and decision-making. As countries formulate long-term strategies to harness these capabilities, differences in governance models, policy tools, and implementation mechanisms become increasingly visible—offering valuable lessons for states working to integrate AI into broader economic and institutional reforms. The present study examines these international experiences to evaluate how AI can be systematically incorporated into national development frameworks and what this implies for countries pursuing structural transformation.

The United States has constructed one of the most extensive and economically oriented AI governance ecosystems, grounded in a long tradition of technology-led growth, competitive markets, and innovation-driven entrepreneurship. The U.S. approach relies on a layered system in which federal strategies set long-term priorities, while private-sector dynamism accelerates adoption across industries. This structure reflects the broader American economic philosophy: competition-led growth supported by strategic public investment.

At the center of this ecosystem, the National AI Initiative Act (2020) serves as the foundational legislative framework, establishing a whole-of-government mechanism to coordinate federal research, support commercialization, and strengthen national competitiveness. Its design was heavily shaped by the National Security Commission on Artificial Intelligence (NSCAI), whose 2021 Final Report emphasized that U.S. leadership in AI requires integrated action across national security, economic competitiveness, research capacity, and workforce development. The NSCAI's assessment—that AI is a strategic infrastructure comparable to electricity or semiconductors—directly informed federal priorities by highlighting the need for robust public-private collaboration, advanced computing resources, trusted data environments, and targeted industrial policy. [NSCAI Final report, 2021, p. 27] Thus, the Act institutionalizes many of the Commission's recommendations by strengthening interagency coordination, accelerating translational research, and linking innovation to national resilience.

Through research infrastructure, public-private consortia, and targeted AI institutes, the Act embeds AI as a strategic enabler of industry modernization and business innovation. This legislative core is continuously reinforced by a series of Executive Orders that broaden the state's engagement with AI adoption. These orders encourage federal agencies to adopt AI tools, upgrade digital infrastructures, and create trustworthy standards that shape business incentives. Their combined effect is to accelerate the diffusion of AI technologies into the economy by reducing regulatory ambiguity, facilitating experimentation, and strengthening data ecosystems. These actions reflect a recognition—underscored repeatedly by the NSCAI—that regulatory clarity is essential for enabling firms, especially SMEs, to invest confidently in AI-powered solutions.

The core of this architecture is articulated in the National AI Initiative Act of 2020, which established a permanent and institutionalized coordination mechanism across federal agencies, public research institutions, and private-sector stakeholders. By formalizing interagency collaboration, the Act seeks to reduce fragmentation in AI policymaking and ensure coherence between research priorities, regulatory frameworks, and commercialization pathways. It positions the federal government not merely as a regulator, but as a strategic orchestrator of the national AI ecosystem, aligning scientific advancement with long-term economic and security objectives.

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- First, the Act prioritizes advancing U.S. leadership in artificial intelligence research and development, recognizing innovation capacity as a cornerstone of global competitiveness. This objective is pursued through sustained federal funding allocations, the strengthening of national laboratories, and the development of coordinated, cross-agency AI research roadmaps. Emphasis is placed on foundational research, high-performance computing infrastructure, and mission-oriented AI applications in sectors such as healthcare, defense, energy, and transportation. By reducing duplication of efforts and encouraging interdisciplinary collaboration, the Act enhances the efficiency and strategic focus of public R&D investments.
- Second, the Initiative underscores the importance of developing trustworthy and ethical AI systems, reflecting growing societal and regulatory concerns over algorithmic bias, data privacy, cybersecurity, and accountability. The Act promotes transparency, robustness, and human-centered design as guiding principles for AI deployment, particularly in high-risk and socially sensitive domains. Through collaboration with standards-setting bodies and research institutions, it encourages the development of technical benchmarks and governance frameworks that balance innovation with public trust and democratic values.
- Third, a central pillar of the Act is supporting the training, recruitment, and retention of an AI-ready workforce. Recognizing human capital as a critical constraint in AI development, the Initiative supports new STEM education programmes, interdisciplinary curricula, federally funded research fellowships, and reskilling initiatives. Strong emphasis is placed on partnerships between universities, research centers, and industry to ensure that academic training aligns with real-world technological needs, thereby strengthening the talent pipeline across both public and private sectors.
- Finally, the Act highlights international cooperation and the protection of U.S. economic and national security interests, framing AI as both a strategic economic asset and a geopolitical instrument. While promoting collaboration with allied countries in research, standards development, and ethical governance, the Initiative also emphasizes safeguarding critical technologies from adversarial use. This dual approach reflects a broader strategy in which AI policy is integrated into foreign policy, trade, and national security planning, reinforcing the United States' position in an increasingly competitive global AI landscape [National AI Initiative Act of 2020, p. 24–25].

These priorities operate within an innovation ecosystem where the public and private sectors constantly interact. Many of the Act's underlying assumptions are consistent with empirical evidence on technological change. Sustained investment in general-purpose technologies generates durable productivity gains when research institutions and industry are jointly mobilized, for instance, aligns with findings that long-term R&D coordination is essential for national competitiveness. The U.S. framework embodies this logic by explicitly linking foundational research to commercialization pathways and high-skill employment.

A significant operational pillar of the American system is the NIST AI Risk Management Framework (2023), which—though voluntary—functions as a national standard for assessing security, robustness, fairness, and reliability. This flexible, use-case-neutral design allows organizations of different scales to implement risk controls without constraining experimentation. Such modular approaches echo broader insights in innovation economics showing that adaptive regulatory instruments often enable more rapid diffusion of new technologies than rigid statutory regimes [NIST AI Risk Management Framework (2023)]. The American model thus prioritizes scalability and experimentation, reflecting its dynamic innovation culture.

While federal policies shape strategic direction, the private sector remains the engine of applied development. U.S. firms allocate vast financial and computational resources to AI infrastructure, large-scale model training, and sectoral applications—from manufacturing optimization to logistics, predictive maintenance, cybersecurity, and financial analytics. This environment aligns with research

indicating that countries with deep capital markets and strong entrepreneurial ecosystems tend to achieve faster productivity gains from AI adoption due to higher absorptive. The NSCAI similarly stressed that private-sector innovation is indispensable for sustaining national leadership, calling for predictable federal investment and reduced barriers to deployment. The American experience illustrates this dynamic: policy sets the conditions, but firms drive the transformation.

Workforce development constitutes another central dimension. AI-related talent programmes, federal scholarships, and university–industry research networks aim to expand the expertise needed to support long-term competitiveness. The emphasis on human capital reflects a broader understanding that frontier technologies produce their highest economic returns when paired with specialized skills and institutional capacity—an observation widely supported in economic literature on skill-biased technological change. This focus directly responds to NSCAI’s identification of talent development as the single most important factor for sustained leadership. The U.S. strategy therefore treats education not merely as a supporting component but as an integral part of technological leadership.

Regulatory policy, meanwhile, remains intentionally decentralized. Instead of imposing a comprehensive federal AI law, the United States allows agencies, states, and industries to adopt differentiated standards tailored to context. This fragmented structure generates debates about consistency and accountability, yet it supports rapid scaling and continuous innovation. It also enables sector-specific experimentation, especially in areas such as healthcare data analytics, autonomous systems, and digital platforms. Where more stability is required, federal guidance and executive orders provide guardrails, particularly for public-sector AI procurement, cybersecurity, and ethical requirements. NSCAI argued that such flexible regulatory architectures are necessary to preserve innovation velocity while preventing strategic vulnerabilities.

The U.S. model stands apart for its combination of structural coordination—anchored by the National AI Initiative Act and shaped significantly by the NSCAI—with market-driven scale, flexible regulation, and deep research capacity. These features position AI as both an economic catalyst and a component of geopolitical advantage. Compared with Spain’s structured regulatory model and Azerbaijan’s transformation-oriented strategy, the American approach reflects a mature innovation ecosystem where scientific leadership, entrepreneurial competition, and security-driven strategic planning jointly drive national AI capabilities.

Building on the U.S. experience—where federal coordination, standardized risk management, and a market-led innovation ecosystem form the backbone of AI advancement—China represents a contrasting but equally influential model in the global landscape of AI-driven economic transformation. While the United States accelerates AI adoption through competition, entrepreneurship, and flexible governance, China relies on long-term planning, state-coordinated investment, and rapid industrial integration. [Khanal, S., Zhang, H., & Taeiagh, A, 2025, p. 24] This structural difference not only shapes the pace and direction of AI deployment but also determines how firms, industries, and regional ecosystems internalize the economic potential of artificial intelligence.

China’s AI governance framework is anchored in the New Generation Artificial Intelligence Development Plan (AIDP, 2017), a comprehensive and centrally coordinated national strategy that explicitly positions artificial intelligence as a “strategic technology for international competitiveness and national security.” Unlike more market-driven governance models, the AIDP reflects China’s state-led developmental approach, in which long-term technological priorities are defined at the national level and implemented through coordinated action across government ministries, state-owned enterprises, private technology firms, and research institutions. The plan integrates AI development into China’s broader industrial policy agenda, linking technological advancement with economic restructuring, social governance, and geopolitical influence.

The AIDP establishes a clear three-stage roadmap for achieving global AI leadership:

First, by 2020, the plan targeted foundational progress in AI standards, core algorithms, data infrastructure, and enabling technologies. This phase emphasized building a robust technological base through increased public investment in basic research, the expansion of national AI laboratories, and

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the development of regulatory and technical standards to guide early-stage adoption. These efforts aimed to reduce dependence on foreign technologies and strengthen domestic innovation capacity.

Second, by 2025, the strategy envisions world-leading breakthroughs in applied AI, particularly in strategically prioritized sectors such as advanced manufacturing, healthcare, smart cities, and agriculture. At this stage, AI is positioned as a key driver of industrial upgrading, productivity growth, and public service optimization. The plan promotes large-scale pilot projects, industry–academia collaboration, and the commercialization of AI technologies, enabling their diffusion across both traditional and emerging industries.

Finally, by 2030, the AIDP sets the ambitious goal of achieving global AI leadership, with a domestic AI industry exceeding USD 150 billion and AI technologies deeply embedded across all sectors of the national economy. This stage reflects a transition from adoption and adaptation to global norm-setting, where China seeks not only technological leadership but also influence over international standards, governance models, and ethical frameworks. AI is thus framed as a core pillar of national power, reinforcing China’s economic resilience, technological sovereignty, and strategic autonomy [New Generation Artificial Intelligence Development Plan (AIDP, 2017), p. 7].

Crucially, AIDP does not operate in isolation; it is embedded in China's broader economic development architecture. It reinforces the objectives of Made in China 2025, which prioritizes intelligent manufacturing, industrial robotics, digital factories, and high-tech supply chain automation. Through this alignment, China merges AI adoption with industrial upgrading, enabling simultaneous advances in productivity, production precision, and export competitiveness.

The practical impact of these policies is strongly visible in the manufacturing sector, where AI-driven automation, predictive maintenance, and process optimization have become central to competitiveness. This dynamic is consistent with empirical evidence showing that Chinese firms with integrated digital and AI capabilities achieve significantly higher productivity and operational efficiency than traditional firms (Journal of Economic Structures, 2023, p. 9). These improvements reflect not only technological sophistication but also China’s deliberate construction of an integrated innovation system—one that connects research institutions, industrial clusters, provincial governments, and state-owned enterprises into a single developmental network.

At the regulatory level, China has developed several legislative instruments that guide responsible AI deployment. The Cybersecurity Law (2017), Data Security Law (2021), and Personal Information Protection Law (2021) form the foundation of data governance, shaping how firms collect, store, and use information. Additionally, the CAC’s Provisions on Algorithmic Recommendation Services (2022) and Interim Measures for Generative AI Services (2023) regulate algorithmic transparency, content governance, and model accountability. These instruments differ from U.S. frameworks in both structure and purpose: instead of emphasizing voluntary standards, China embeds AI governance directly into binding regulatory mechanisms that reflect national security priorities and social risk considerations.

A distinctive feature of China’s AI economy is the heavy involvement of digital platform giants. Companies such as Alibaba, Tencent, Baidu, and Huawei operate expansive AI ecosystems that combine cloud computing, big data resources, chip development, and industrial AI solutions. Their platforms function as both commercial enterprises and national technological infrastructure. They enable rapid AI diffusion by providing SMEs with ready-made tools—cloud-based machine learning, automated marketing systems, logistics optimization engines, and customer analytics solutions. Evidence indicates that such digital empowerment substantially improves innovation output and cost efficiency among small and medium enterprises [X.Gao, Hua Feng, 2023, p. 17], showing that China’s AI influence extends beyond large corporations into the broader entrepreneurial environment.

China’s financial sector has also become a laboratory for AI-driven economic modernization. AI-enabled credit scoring, automated compliance, and risk analytics have expanded financial inclusion and reduced transaction costs across consumer and business markets. However, these innovations also introduce systemic risks such as algorithmic bias, data concentration, and platform dominance,

prompting ongoing regulatory responses. China's dual focus—promoting innovation while centralizing oversight—demonstrates its attempt to maintain stability in a fast-expanding digital economy.

Finally, China's strategy incorporates regional experimentation. Provinces like Beijing, Shanghai, Guangdong, Zhejiang, and Anhui run AI pilot zones, creating specialized clusters for autonomous vehicles, smart manufacturing, fintech, and digital trade. These zones allow policy experimentation, accelerate commercialization cycles, and create competitive pressure between regions—mechanisms that contribute to rapid national diffusion.

China's AI strategy illustrates how a state-coordinated ecosystem can accelerate economic transformation. AI is positioned not only as a technological asset but also as a cornerstone of industrial upgrading, digital sovereignty, and global competitiveness. Compared with the U.S. system, China offers a model characterized by stronger central planning, deeper integration with industrial policy, and more extensive regulation of data and digital platforms. For Azerbaijan, China's experience demonstrates the value of multi-level coordination, long-term industrial planning, and strategic investment in AI-enabled manufacturing, logistics, and SME digitalization—areas that align closely with Azerbaijan's economic diversification objectives.

After analysis of the United States and China, let's take a look at Spain experience. Spain's strategic posture demonstrates how a mid-sized European economy aligns national capabilities with continental regulatory ambitions. While the previous sections highlighted how innovation-driven and state-directed models shape AI development, Spain illustrates a hybrid approach: combining strong EU-level legal alignment with domestic policies that prioritize ethical governance, industrial modernization, and the social inclusiveness of digital transformation. As a result, AI becomes not merely a technological priority, but a structural policy tool for balanced regional development, productivity growth, and business competitiveness.

Spain's Estrategia Nacional de Inteligencia Artificial (ENIA, 2020) serves as the country's principal blueprint for long-term AI deployment. Its core objective is to integrate AI into priority domains—including industry, public administration, mobility, education, and health—while ensuring that technological expansion remains socially responsible, territorially cohesive, and ethically aligned. ENIA operationalizes this vision through six interconnected lines of action, each addressing a foundational challenge in Spain's digital transition:

- Enhancing scientific research and AI talent by improving R&D capacity and strengthening links between universities, research centers, and industry.
- Promoting business adoption of AI, especially among SMEs, by supporting experimentation, pilots, and sector-specific digitalization programmes.
- Developing digital infrastructures and data platforms to support scaling of AI solutions across the economy.
- Enabling safe regulatory environments and regulatory sandboxes to test emerging AI applications before full-scale deployment.
- Integrating AI into public administration to improve service efficiency, transparency, and citizen-oriented digital solutions.
- Fostering national and European value chains, including through strategic investments and coordinated industrial policies.
- Strengthening ethical, trustworthy, and human-centric AI governance, anticipating risks while supporting innovation. [ENIA, 2020, p. 10]

Together, these strategic lines aim to narrow Spain's historical productivity gap relative to northern Europe and to support SME digitalization—an essential objective given that SMEs account for more than 99% of Spanish enterprises. Moreover, ENIA explicitly integrates a territorial cohesion perspective by encouraging AI diffusion beyond metropolitan hubs such as Madrid, Barcelona, and Valencia, ensuring that less industrialized regions also benefit from digital modernization.

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This long-term strategic direction is reinforced by the Plan de Recuperación, Transformación y Resiliencia (PRTR), supported by EU NextGeneration financing. Within this structure, the España Digital 2026 agenda translates ENIA’s vision into short- and medium-term actions: expanding national data infrastructures, enhancing cybersecurity resilience, accelerating SME digitalization, and incentivizing AI adoption in sectors such as logistics, agriculture, advanced manufacturing, and tourism. Given tourism’s central role in Spain’s economy, AI-driven optimization of visitor flows, pricing systems, and service personalization represents a major pillar of Digital Spain’s implementation logic. The interaction between ENIA (strategic vision) and España Digital 2026 (operational execution) creates a dual-channel governance model that combines long-term structural transformation with measurable technological milestones.

Spain’s integration into the European AI ecosystem further shapes domestic policy. The EU AI Act, with its binding requirements on transparency, data governance, and high-risk system oversight, directs how Spanish firms build and deploy AI solutions. While compliance introduces adaptation costs—particularly for SMEs—the long-term effect aligns with empirical arguments that harmonized regulatory systems reduce uncertainty and stimulate investment by clarifying operational standards across large markets. And also well-structured digital governance tends to accelerate diffusion of general-purpose technologies by enabling firms to internalize predictable implementation pathways (p. 138). Spain’s regulatory trajectory reflects precisely this type of predictable governance environment.

Research capacity also forms a central pillar of Spain’s approach. National R&D programmes, as well as investments in applied research infrastructures such as the Barcelona Supercomputing Center, strengthen the innovation ecosystem necessary for advanced AI commercialization. This corresponds with broader economic observations that strong public–private research linkages increase countries’ “absorptive capacity,” determining how effectively firms convert general-purpose technologies into productivity gains. Spain’s strategic investments thus aim not only to generate research but also to ensure that research outcomes translate into industrial capabilities.

In parallel, the country’s economic structure offers fertile ground for AI uptake. Spain’s manufacturing base—automotive production, pharmaceuticals, and food processing—has increasingly integrated AI models for predictive maintenance, supply-chain optimization, and energy-efficiency management. Service sectors such as tourism and finance apply machine learning for demand forecasting, customer profiling, and risk analytics. While Spain still trails northern Europe in overall adoption rates, the combined impact of ENIA, España Digital 2026, PRTR funding, and the EU AI Act is steadily narrowing these gaps by lowering knowledge barriers, incentivizing experimentation, and reducing market uncertainty. This reflects arguments that coordinated policy systems yield stronger economic returns from AI adoption than fragmented ones. [J.Bessen, 2022, p. 89]

Spain has reinforced ENIA with Digital Spain 2025, a comprehensive agenda positioning AI as a driver of productivity, sustainability, and administrative modernization. Digital Spain expands the AI framework into areas such as 5G deployment, cybersecurity, public service innovation, e-government, and digital rights. The strategy underlines that technological development must be accompanied by ethical safeguards, introducing the “Charter of Digital Rights” to protect citizens in AI-mediated environments. [Digital Spain 2025, p. 18]. This linkage between innovation and rights-based governance is a central feature of the Spanish–European model and provides an alternative reference point for Azerbaijan, which is seeking to ensure responsible AI adoption.

In 2024, Spain deepened its commitment with a new national AI strategy aimed at expanding computational capacity, supporting the development of Spain’s own large language model (ALIA), strengthening cybersecurity capabilities, and creating a regulatory institution dedicated to oversight—the Spanish Agency for the Supervision of Artificial Intelligence (AESIA). AESIA represents one of the first national-level AI regulatory bodies in the EU, reflecting Spain’s ambition not only to adopt AI but to govern it proactively). This evolution positions Spain as a frontrunner within Europe’s human-centric AI vision.

Spain's AI governance model represents a balanced, integrative framework that aligns national development priorities with European regulatory harmonization, strengthens research capacity while enhancing ethical oversight, and supports business innovation without compromising social cohesion. By embedding AI within its broader modernization agenda, Spain not only prepares for technological transformation but positions itself as an active architect of an inclusive, sustainable, and regionally balanced digital economy.

As the analysis moves from Spain's EU-aligned regulatory model to the South Caucasus, Azerbaijan presents a different yet strategically coherent trajectory—one in which AI development is inseparable from the broader national objectives of economic diversification, institutional modernization, and transition toward knowledge-intensive growth. Unlike the mature innovation ecosystems of North America, Western Europe, or East Asia, Azerbaijan approaches AI not as an incremental enhancement to existing technological capacities but as a foundational instrument for reshaping its economic structure and reducing historical reliance on hydrocarbon revenues. This positions AI as a structural pillar within the country's long-term development vision rather than a standalone technological agenda.

Azerbaijan's overarching direction is set by "Azerbaijan 2030: National Priorities for Socio-Economic Development," which embeds digital transformation, human capital advancement, innovation-driven competitiveness, and sustainable economic restructuring at the center of future national development. Within this strategic architecture, AI functions simultaneously as an economic catalyst—enhancing productivity in traditional sectors—and as a governance tool, improving state-service efficiency, transparency, and decision-making quality. ["Azerbaijan 2030: National Priorities for Socio-Economic Development"] This vision aligns with global observations that countries undergoing economic transition tend to experience amplified gains from general-purpose technologies when policy coordination is strong and reform horizons extend over multiple planning cycles. Azerbaijan's long-term development priorities reflect precisely this coordinated strategic orientation.

The foundations of this orientation were laid through earlier initiatives such as the National Strategy for the Development of the Information Society (2014–2020), which expanded digital infrastructure, strengthened broadband accessibility, and supported e-government systems. [National Strategy for the Development of the Information Society] These developments created the baseline capacity necessary for more advanced AI applications. The sequencing—digital readiness preceding large-scale AI integration—mirrors global patterns of technological absorption, where infrastructure and digital literacy form prerequisites for effective AI. Azerbaijan's approach demonstrates such alignment between foundational capability-building and strategic technological upgrading.

Based on these foundations, institutional reforms have accelerated AI-related capacity development. The Innovation Agency, the High-Tech Park, the Azerbaijan Digital Hub initiative, and the modernization agenda of the Ministry of Digital Development and Transport collectively strengthen the ecosystem for technological entrepreneurship, support start-up formation, and promote public-private partnerships in digital services. These institutions foster technological experimentation in sectors such as transport, cross-border trade, customs automation, smart city development, and digital financial services. Their role corresponds with evidence that innovation agencies in transitioning economies serve as key intermediaries for expanding private-sector absorptive capacity and bridging structural gaps that typically hinder SME adoption of advanced technologies. Thus, institutional modernization in Azerbaijan forms part of a broader developmental rationale aimed at embedding technological competence across the economy.

This evolving policy landscape is now consolidated in the National Artificial Intelligence Strategy of Azerbaijan for 2025–2028, the country's first dedicated AI roadmap. The strategy articulates a comprehensive vision structured around several core goals:

- establishing a competitive national AI ecosystem,
- developing AI-related human capital,
- promoting AI adoption in priority economic sectors,

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- enhancing digital and data infrastructures,
- ensuring ethical, secure, and transparent use of AI, and integrating Azerbaijan into the global AI economy through international cooperation. [National Artificial Intelligence Strategy of Azerbaijan for 2025–2028]

These objectives are supported by strategic directions that emphasize research and innovation capacity, the creation of sector-specific AI platforms, the modernization of regulatory and cybersecurity frameworks, and the introduction of AI governance principles in public administration. The strategy also prioritizes the development of open data ecosystems, advanced analytics, and high-performance computing resources, recognizing them as essential enablers for both state-driven digital governance and private-sector AI integration. By aligning technological goals with economic-structural reforms, the strategy constructs a developmental path that uses AI as a mechanism for productivity enhancement, competitiveness, and export-oriented diversification.

AI adoption directly supports Azerbaijan’s diversification agenda. In logistics and energy infrastructure, predictive analytics improve maintenance efficiency and reduce operational risks. In agriculture—one of the main non-oil focus areas—AI contributes to precision farming, real-time crop monitoring, and water-use optimization. Manufacturing firms increasingly experiment with automation, process optimization, and quality-control algorithms. It shows that resource-rich economies can accelerate diversification when AI investment is strategically targeted and supported by parallel improvements in digital infrastructure. Azerbaijan’s sectoral modernization programs demonstrate such targeted intent.

The governance dimension further strengthens this trajectory. Azerbaijan’s internationally recognized ASAN Service (ASAN Xidmət) model provides a strong institutional foundation for embedding AI into public service delivery. Machine-learning systems are being introduced in administrative workflows, fraud detection, and transaction processing, improving efficiency and reducing administrative burdens. While the country has not yet adopted a comprehensive AI law, ongoing policy discussions focus on data protection, algorithmic accountability, cybersecurity, and ethical AI principles. Compared with the highly codified regulatory model of Spain, Azerbaijan’s approach is more flexible and experimental—reflecting its stage of institutional evolution—but this flexibility also increases the importance of establishing long-term regulatory coherence to ensure reliable and responsible future AI deployment.

Azerbaijan’s strategic and legislative trajectory reveals a dynamic developmental model shaped by the imperatives of economic transformation, innovation-led growth, and institutional modernization. Rather than replicating the models of the United States, China, or Spain, Azerbaijan is developing an AI path tailored to its national context—balancing infrastructural investment, human capital development, sector-specific modernization, and emerging regulatory frameworks. AI is thus positioned not as an isolated technological agenda but as an integrated component of national progress and economic restructuring, enabling the country to navigate global technological shifts while strengthening its competitiveness in the post-oil era.

The comparative analysis of the United States, China, and Spain reveals several strategic components that Azerbaijan can meaningfully adapt to strengthen its emerging AI ecosystem. While the country has made notable progress in digital transformation and institutional modernization, the current architecture would benefit from targeted enhancements that improve innovation capacity, increase regulatory trust, and guide sectoral development with measurable outcomes. Drawing on the strengths of the three international models examined, three priority directions emerge as particularly relevant for Azerbaijan’s next stage of AI policy evolution.

First, the American experience underscores the importance of strong commercialization mechanisms that connect research institutions with the private sector. In the United States, federally supported AI hubs play a critical role in transforming scientific knowledge into market-ready solutions, reducing the gap between laboratories and industry. Azerbaijan, whose innovation system still faces challenges in technology transfer, would benefit from establishing 2–3 sectoral AI Commercialization

Hubs in strategically chosen domains such as Energy and Industry, Agriculture and Food Systems, and Public Services and GovTech. These hubs would serve as platforms for applied research, prototyping, and pilot testing, helping firms—especially SMEs—experiment with AI tools in low-risk environments. Situating these hubs within existing technology parks in Baku and the regions would minimize infrastructure costs while accelerating collaboration between universities, research centers, and industrial actors. By allocating seed funding and inviting industry partners to co-develop solutions, Azerbaijan can replicate the U.S. model of ecosystem-driven innovation and significantly increase the commercialization rate of locally developed technologies.

Second, China’s emphasis on long-term, sector-specific strategic planning provides a valuable template for Azerbaijan’s structural transformation goals. China’s success in scaling AI adoption is rooted not only in investment volume but also in the clarity of its sectoral roadmaps, each equipped with concrete targets, implementation schedules, and evaluation mechanisms. Azerbaijan’s diversification agenda naturally aligns with such a planning approach. Developing detailed AI sectoral roadmaps for Energy and Oilfield Services, Agriculture and Agritech, Transport and Logistics, Tourism, and Public Administration would provide a coherent framework for decision-making and investment prioritization. These roadmaps should include KPIs such as adoption levels, productivity improvements, number of pilot projects, and human-capital requirements. To ensure relevance and technical accuracy, the roadmap design should be led by ministry-level taskforces working jointly with academia, industry associations, telecom operators, and digital service providers. Over a 12–18 month period, this process would create a clear, measurable, and strategically aligned national AI development trajectory—one capable of anchoring both domestic reforms and international cooperation.

Finally, Spain’s governance model demonstrates that technological modernization must be matched with public trust, ethical safeguards, and tools that support responsible deployment. As Azerbaijan expands AI use in public services, agriculture, logistics, and industrial operations, the need for a transparent and human-centric regulatory environment becomes increasingly important. Adapting the Spanish approach, Azerbaijan could establish a National AI Ethics Statement supported by a voluntary “AI Quality Label” that certifies compliance with core principles such as transparency, fairness, explainability, and data protection. This label could be tied to eligibility for participation in government-funded pilot programs or public procurement processes, thereby incentivizing responsible development without imposing immediate heavy regulatory burdens on emerging firms. The development of this framework should involve ethicists, civil society, business representatives, and technical experts, ensuring that the resulting guidelines are both internationally aligned and locally applicable. Providing SMEs with a practical checklist would further support widespread, trustworthy AI adoption across the economy.

These three strategic priorities—AI commercialization hubs, sectoral roadmaps with measurable targets, and a human-centric governance package—offer a balanced and realistic pathway for strengthening Azerbaijan’s AI ecosystem. Each draw on international best practices while remaining aligned with Azerbaijan’s institutional capacities, economic structure, and long-term development vision. If implemented cohesively, they would not only accelerate technological absorption and innovation but also reinforce public trust, enhance regulatory clarity, and position Azerbaijan more competitively within the global AI landscape.

Conclusion

This study demonstrates that artificial intelligence has become a structural driver of economic transformation rather than a standalone technological innovation. The comparative analysis of the United States, China, Spain, and Azerbaijan shows that effective AI integration depends on coordinated strategy, institutional capacity, sectoral prioritization, and governance mechanisms that balance innovation with trust. Although national models differ in form and execution, all successful approaches embed AI within broader economic, industrial, and regulatory frameworks.

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The United States illustrates how strong research–industry linkages, flexible regulatory instruments, and market-driven innovation accelerate AI commercialization. China highlights the effectiveness of long-term, state-coordinated planning and sector-specific roadmaps in rapidly scaling AI adoption across manufacturing, logistics, and digital platforms. Spain demonstrates how ethical governance, SME-focused support, and regulatory predictability—shaped by EU standards—can foster inclusive and sustainable AI diffusion. Together, these models confirm that fragmented or purely technology-focused policies are insufficient to realize AI’s full economic potential.

Against this background, Azerbaijan’s emerging AI strategy reflects clear ambition and growing institutional readiness, particularly in linking AI development to economic diversification, public-sector modernization, and human capital formation. However, the analysis indicates that further progress requires moving from high-level strategic objectives to concrete implementation tools. In particular, Azerbaijan would benefit from strengthening AI commercialization mechanisms, introducing sector-specific roadmaps with measurable targets, and developing a human-centric governance framework to enhance trust and regulatory clarity.

Overall, the findings suggest that Azerbaijan’s AI trajectory should follow a context-specific path rather than replicating advanced economies’ models. By selectively adapting international best practices to its institutional and economic structure, Azerbaijan can leverage AI as a catalyst for productivity growth, post-oil diversification, and long-term competitiveness. The successful integration of AI will ultimately depend on policy coherence, institutional coordination, and the ability to translate technological potential into measurable economic outcomes.

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"THE ECONOMIC REVIEW" IN THE SERVICE OF PROMOTING SUBJECTS RELATING TO ECONOMICS AMONG THE ROMANIAN PUBLIC

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Abstract: *Throughout its early years, „Revista Economică” (the “Economic Review”) served as an acknowledged advisor to Romanian business and financial circles, disseminating the expertise and experiences of individuals who focused solely on economic research. Initially, without omitting the problems of agriculture, the program for spreading economic knowledge was primarily focused on financial and accounting issues. Since „Revista Economică” (the “Economic Review”) was solely funded by the Romanian banks in Transylvania, its original goal was to serve their interests. This aspect was highlighted by the development of the themes it addressed and the implementation of its original program. Nevertheless, it recognized the interdependencies between financial institutions and was not restricted to handling banking matters in the traditional sense of the word. In time, “The Economic Review” broadened both its field of activity and the thematic approached, dealing with topics related to all branches of Romanian life and activity.*

Keywords: *banking system, banking policy, bank reform, life insurance, insurance premiums and reserves, promissory notes, land deeds, effects score, public effects, accounting*

1. Introduction

By publishing educational materials in the areas of accounting, insurance, finance, banking organization, etc., the editorial staff of „Revista Economică” (the “Economic Review”) provided strong support for the leaders of Transylvania in their increased efforts to disseminate and systematize economic knowledge among the Romanian population at the end of the 19th and the beginning of the 20th centuries. Having developed into a legitimate economic school with the most well-known economists of the day among its members (Cornel Diaconovici, Ioan I. Lapedatu, Partenie Cosma, Popp Constantin, Vasile C. Osvadă, Romul Simu, Ioan Vecerdea, etc.), the “Economic Review” essentially attempted to fill the gap in the demands of the Romanian public and experts for economic literature.

Prior to the publication of „Revista Economică” (the “Economic Review”) in 1899, the only Romanian organization in Transylvania that focused on the advancement of economics didactic literature was the small group of economic science professors at the Commercial School in Braşov. During the aforementioned period, the teaching staff of that educational establishment stepped up their efforts to create textbooks and treatises on theoretical political economy and concrete economics for use in high schools, seminaries, pedagogical schools, and specialized schools with an economic profile.

The textbooks and treatises on political economy, accounting, trade, commodity science and others could not satisfy the needs of Transylvanian Romanians for such specialised literature. Works with a practical and educational nature that could serve as a guide for economic activities, particularly those involving finance and banking, were still in short supply. The officials of Romanian banks, who lacked education and training in specialized schools in the banking and financial industry, essentially needed specialized books.

The series of contributions to the development of economic disciplines, published in “Revista Economică” (the “Economic Review”), began, perhaps predictably, with two publications on

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improving banking administration, procedures, and policies and life insurance, two fields of literature that were not widely available to the Romanian public.

In the early 1900s, the Transylvanian Romanians had already established a fairly developed banking system. They did not, however, have insurance banks. Actually, the general public did not even know much about the field. It had to be made known and practiced precisely for the advantages it created for all economic agents. Although they had a fairly large number of banks, the Romanians still administered them empirically. This was one of the factors that hindered the progress of Romanian banks in Transylvania.

Through its most valuable collaborators, "Revista Economică" (the "Economic Review"), which was established to mediate financial and banking advancement, produced specialized works in economic disciplines that were lacking among those working in the banking and financial systems. These disciplines included public effects, accounting, insurance theory, banking technique and administration, the role of the National Bank of Austria-Hungary as the Central Bank, and more.

2. The issue of insurance

The Theory of Life Insurance, by Ioan I. Lapedatu, is the first major work published in „Revista Economică" (the "Economic Review"), in 1900.

In the last years of the nineteenth century, the author noted, Romanians were starting to learn more about life insurance, which had long been common in economically developed countries. However, many people were still wary of and even afraid of that type of insurance, especially because even the intelligentsia were unaware of the structure of insurance companies or the methods used to calculate and operate such insurance. In the author's opinion, the insurance companies were also partially to blame for the lack of explicit and thorough advertising of life insurance.

The author felt it was indeed appropriate to present the calculations that applied to life insurance in multiple chapters because Romanians were generally unaware of the way insurance was indeed calculated.

According to the author, one must be persuaded that knowing the life expectancy of the individuals who come to insure themselves was vital to satisfying both contractual parties in any life insurance case. Even though that depended on the capriciousness of Providence, it appeared to be an insurmountable barrier to determining life insurance. Nevertheless, an effort was made to identify a way to get around that barrier and make the insurance calculations in such a way as, even if they did not exactly match mathematically, they would at least be close to reality.

Ioan I. Lapedatu - after having outlined in general terms the method of calculating premiums and reserves for life insurance - included tables with premiums, calculated for different cases and different ages, which could be easily understood by insurers.

“It should be noted, however, that the premiums in these tables, which are used in practice, will not correspond to the mathematical premiums, but the former will always be somewhat higher, because the institute adds 2-3 percent as administration expenses, etc. The Institute is justified in this addition, since it serves as an insurer, and even as an insurer worthy of great trust, constitutes a great benefit for people who choose insurances." (Lapedatu, 1900:47)

Because it served as the foundation for banking operations, the author argued that employees had to be knowledgeable about the mathematical theory of insurance. Not just that, though. Understanding insurance laws was also essential because different statutes and regulations could only be created within their bounds.

The author concluded his work by writing that, despite their long history, life insurance institutions could still be considered modern institutions because only recently had their importance and enormous benefits come to light. Their importance was increasingly recognized, particularly in that period of time, when industrial occupations were growing in number. Every day, the number of insurance institutes rose in all prosperous nations. The author pointed out that, even though they were civil servants with pension rights, Englishmen, Germans, Danes, Belgians, and Dutchmen wanted to

protect their future and their families' futures. Furthermore, as it happened in the case of Germany, thoughtful lawmakers were considering making insurance mandatory in certain situations. As a result, life insurance companies were expected to play a significant role in the near future.

Lapedatu also suggested that, in his homeland, insurance institutes had found quite fertile ground. Although there were many well-established, long-standing institutions that provided adequate guarantees, the majority of them were foreign, particularly American or English institutions. However, at that moment, there was still a shortage of such institutions in Romania." (Lapedatu, 1900:48)

Ioan L. Lapedatu spearheaded a genuine effort to persuade the Romanians to set up their own insurance companies as soon as possible. Because of their desire to work in Romanian banks and other newly emerging Romanian institutions, as well as their growing interest in industrial and commercial jobs, Romanians needed to insure themselves against illnesses, accidents, and death. Ioan I. Lapedatu foresaw that the start would be challenging. Only after twelve years, and at the author's insistence, did the Romanians manage to develop an interest in an insurance company: the "**General Insurance Bank.**"

As a student in Budapest, I.I. Lapedatu specifically attended the Insurance Mathematics classes taught by the renowned math professor Gustav Schöltz, as shown in his work "**Theory of Insurance on Life.**"

"I attended one of his most focused seminars. My diligence was appreciated by G. Schöltz, an actuary at a major insurance company. He was a huge help to me. That year, I also wrote a study on the mathematics of life insurance, which I sent to Sibiu's „Revista Economică" (the "Economic Review"), an organ of Romanian banks that was issued under Diaconovici's direction. I believe the study was well received [...] as it was published in several consecutive issues. Diaconovici, who on his way to Budapest tried to get to know me, confirmed this and urged me to continue the collaboration. That study, in an extended form, appeared under the title "Theory of Life", as the first textbook of its kind in our country, that of the Romanians in Transylvania, in 1902, in the Ciurcu et. Co. Publishing House." (Lapedatu, 1898: 94-95). The issue of insurance and the organization of institutions in the field remained a constant concern for Romanian economists.

3. Issues relating to the reform of banks

It had been nearly 30 years since the first Romanian bank, "Albina," was founded in Sibiu, in 1872. In 1900, the Transylvanian Romanians owned more than 80 financial institutions, managed roughly 50 million crowns of foreign funds, and had their own wealth of nearly 15 million crowns. It became apparent to the Romanian bank leaders that their institutions were growing haphazardly, anarchically, without a plan, and without any scientific support. They realized that the growth in the number of Romanian banks no longer signified advancement for the future of their financial organization. After a while, the foundations current had to give way to a consolidation current.

The discussions regarding the imminence of the reform and the clarification of its issues lasted for approximately 3 years. Romanians had no economic schools, no financial teaching institutes, no professors in the field. It wasn't until after 1900 that bank officials, with more advanced degrees in economics, began make their presence felt, though still sporadically.

Cornel Diaconovici, who started the banking reform in Romania, wrote a book entitled "Problems of Bank Reform" to compensate for the lack of government-issued manuals, schools, and instructions. It can be thought of as a sort of manual, guide, or brief treatise that synthesized methods and means so that the greatest possible results could be obtained with the least amount of sacrifice. The work "Problems of Bank Reform" synthesized issues related to banking technique, management, and policy. It was a synthetic work, issued in 1901 by the Publishing House of the Delegation of Romanian Banks in a separate volume. Despite having only 102 pages, it was remarkably consistent.

Cornel Diaconovici did not offer a comprehensive analysis of the issues surrounding bank reform or development of comprehensive plans to improve a complex and sizable organization that would include the Romanian banks. He limited his investigation to identifying, based on credible

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studies and research, the flaws in the Romanian Transylvanian financial system that, at the time, might have endangered the continued existence or the sound growth of banks, as well as the interests of the Romanian people as a whole, while looking for suitable methods and tools to eliminate and correct problems.

"The primary flaws in the current structure of financial institutions, including the Romanian ones, have been grouped into two administrative and control categories in the course of the discussions that have been taking place on that topic for approximately two years, both in general financial circles overseas and particularly in Romania's leading circles. The former encompasses the absence of mobile capital, while the latter focuses on the shortage of technical and control apparatus." (Diaconovici, 1901: 102)

Given their position within the Austro-Hungarian Empire, the author of "Problems of bank reform" suggested that the Transylvanian Romanians were called to action and had to address the shortcomings in the banking system using their own authority. The implementation of reforms was expected to be straightforward. One was not supposed to expect the regulation of the bank reform through the provisions of the legislature or those of large financial institutions; instead, the appeal was to inaugurate a social-autonomous action through which banks were to provide their own guarantees of existence and development. According to rational economy, which required that the greatest results had to be achieved with the fewest sacrifices, the guiding principle was that of safeguarding the future rather than short-term interests.

The main problem of bank administration - said Cornel Diaconovici -, was that of solvency, meaning that banks had to avoid being, even temporarily, in a situation of ceasing their payments. In their administration, banks had to take care that active businesses were always sized according to passive businesses. The bank run the risk of appearing to be insolvent if the natural relationship between assets and liabilities was ignored, as evidenced by the imbalances occurring between them. During that period, Romanian banks faced significant challenges, one of which was the mobilization of managed capital. Their liabilities were primarily mobile, but their assets or receivables were immobile, which generated significant issues.

Since Romanian banks were deposit banks, the public's confidence in their solvency had to be unwavering and total because "only complete confidence that the depositor will receive his savings unconditionally as soon as he needs them will be able to persuade him not to keep them unproductive for a single moment, but to deposit them where he knows they are completely safe and productively placed." (Diaconovici, 1901: 125-126)

Therefore, banks had to set up their operations to provide all the assurances depositors needed in relation to the security and freedom of their money. Therefore, they had to conduct mobile business, which could be instantly turned into cash when needed.

These companies were mostly pawnshops and discount stores. For the bank to remain solvent, however, the investment of deposits in short-term ventures needs to be complemented by other assets, such as rediscount enterprises, cash on hand, and adequate reserves of public effects. A good idea was considered that of having longer payment terms.

Banks managed and used **foreign capital**, but their businesses - explained Cornel Diaconovici - had to be based primarily on their own capital and reserves, and the size had to be proportionate to the risks.

Romanian banks, Cornel Diaconovici stated, were discount banks, but despite that, discount could not be the most appropriate form for satisfying the credit needs of the Romanian population, since Romania was predominantly an agrarian country.

„In addition to being too inexperienced in the economic and financial sphere to be able to use this type of credit with enough expertise and regularity, Romania was seen primarily as an agricultural component, lacking trade and industry, which was able to use productive credit, typically only for agricultural investments that had long-term amortization and did not pay off right away. " (Diaconovici, 1901: 149)

Cornel Diaconovici believed it would have been more suitable for Romanian banks to offer mortgage loans backed by financial documents because Romanians were still an agricultural people. But in that case, a contradiction arose because bank deposits were mobile. However, by giving the big organizations that handled land deed issuance on their mortgage claims, the small banks could reconcile the contradiction. As a result, by assigning mortgage loans, small banks, such as the Romanian ones, could have mobilized a significant portion of the foreign capital placed in long-term loans and converted that significant share into loans for promissory notes, which, by their very nature, complied with the requirements of the promissory note law and the promissory note's nature. That would have allowed the Romanian banks to maintain a substantial reserve of bills of exchange and would have also significantly reduced the rediscount, which had become risky for them.

Cornel Diaconovici asserted that the reserves of bills of exchange constituted a completely secure resource that could be utilized during emergencies. Nonetheless, it was important to remember that Romanian banks were not speculative, so their reserve of bills of exchange could only be as much as the national average. The establishment of the bill stock was seen as a sign of the bank's stability and as an easily realizable mobile reserve.

Real estate was considered the most immovable capital investment. It was not recommended to purchase real estate for speculative purposes. Only those that secured endangered claims could be purchased and only if an absolute necessity arose.

According to C. Diaconovici, advertising was a tool used by both the public and the shareholders in order to exert control. In the materials he published, the author brought attention to the need to avoid portraying the situation of a bank only in a positive light because the truth would still be revealed, permanently damaging the bank management's reputation with depositors, shareholders, and the general public.

With reference to the control exerted by expert auditors, C. Diaconovici believed that it should not be considered as an imposition of external control, since it did not violate the autonomy of banks, and its results were discreet and communicated only to the management of the bank being audited.

Regarding personnel policy, the author of "Problems of Bank Reform" suggested, in a special chapter entitled "Civil Servants", some ways to improve living, intellectual, and professional standards, so as the general standards at the time would be met. He demonstrated how teachers and priests served as the first civil servants in Romanian banks, while lawyers and those without advanced degrees served as managers. There was still a shortage of qualified personnel at the turn of the century. C. Diaconovici suggested the idea of offering practical qualification courses to current employees and gradually replacing the unqualified civil servants with qualified employees. The author also argued that it was not advisable to hire new civil servants unless they possessed the required qualifications and the economic training for managerial roles. Raising salaries would improve the standard of living. It was considered advisable that bank civil servants should be well paid and also benefit from insurance from insurance companies, to cover accidents and other benefits, such as old age pensions.

"In order to raise the intellectual level of bank officials and to create a well-qualified staff for the administration and management of banks in the future, they will insist on the establishment of a practical course, through which technical personnel will prepare themselves specifically for banking business and, as far as the available means are concerned, they will prefer candidates with academic qualifications for the management positions." (Diaconovici, 1901:210)

The reform put forth by Cornel Diaconovici needed the free acceptance of individual banks in order to succeed. However, the banks could only support the reform if they banded together to secure their future in accordance with the solidarity principle, which gave each bank rights and responsibilities by establishing mutual guarantees that they would support the consolidation of the organization. Using the following formula, Cornel Diaconovici suggested that the reform be approved at the Conference of Romanian Banks, which was scheduled to take place soon after the "Problems of Bank Reform" emerged:

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"The Romanian banks should associate for the consolidation of their organization, which will carry out the reforms established, through the Conference of Bank Directors; they should declare solidarity and in case of need, will give each other all possible assistance to ensure their existence and future. At the same time, they will prefer each other in their business relations and will reserve the available means primarily for their own needs." (Diaconovici, 1901:218)

Cornel Diaconovici, the director and editor of the "Economic Magazine," was primarily responsible for formulating the principles and strategy for the reform of Romanian banks, according to Ioan I. Lapedatu. Primarily motivated by his awareness of the needs financial organizations had, he was among the first to propose the slogan of consolidation. Every positive, contemporary idea that was energizing the world was seized at the perfect time and skilfully and delicately tailored to the particular needs of Romanian banks.

The lengthy collection of articles on the issues surrounding bank reform is arguably one of the best pieces of banking literature ever produced by Romanians worldwide. The principles outlined in those articles served as the foundation for previous Romanian bank conferences and works, and continued to be the most crucial tenets that guaranteed the survival of Romanian financial institutions. And, regarding the merit of the "Economic Review", the same Ioan I. Lapedatu said that even if it had limited itself only to publishing issues related to the reforms of Romanian banks, it would still have fully deserved its existence.

4. Accounting

Issues relating to bank accounting accuracy and accounting discipline were permanently reflected in the pages of „Revista Economică" (the "Economic Review"). The editorial staff published numerous articles on the need to introduce a single accounting system in Romanian banks. This requirement was recorded as one of the tasks included in the agendas of expert auditors in the case of conducting bank audits. The accuracy and consistency of accounting balance sheets, their representation of reality, and the "Profit and Loss" account were the subject of numerous articles.

The work entitled "*The fundamental principles of double-entry accounting*" can be considered one of the most illustrative contributions in the field of accounting science that was published in Romania up at that time. Originally issued in "Revista Economică" (the "Economic Review"), no. 45-49, the study was published by Ioan I. Lapedatu under the title "Studii de contabilitate" (Studies in accounting) in Sibiu, at Tiparul Tipografiei Archidiecesane, 1904. In the introduction, the author aimed to clarify, to the best of his ability, a much-discussed and controversial issue in foreign specialized literature, namely: the fundamental principles of double-entry accounting.

The author warned that "Although accounting literature has a history of hundreds of years, specialists began to deal more seriously with the issue of its fundamental principles only in the second half of the last century. This time coincides with the era when commercial education began to be given more importance by educators, when teachers were required not only to have knowledge of accounting, but also methodology and pedagogy." (Lapedatu, 1904: 234)

Lapedatu argued that There had been many discussions among theorists regarding double-entry accounting because every position (amount, commercial item) was recorded and entered twice in the ledger or master's registers: once in the debit of one account and again in the credit of another account. That meant that whenever there was a debtor, there was also a creditor, and vice versa. Attempts were made to demonstrate the reasoning behind that type of entry in the registers.

"Some have seen in this circumstance a legal affair; others - also starting from here - reduced the entire double-entry accounting system to a perfect mathematical equation. And measured by these divergent opinions, two theories were established, essentially different from each other. The former grouped themselves around the so-called personalist theory, the latter founded the materialist or mathematical theory." (Lapedatu, 1904: 378-379)

The personalist theory, whose supporters were mainly the Italians and the French, had long prevailed in double-entry accounting.

That theory, the author maintained, reduced every change in wealth for which double-entry accounting is applied to a legal transaction involving two or more people, necessitating the personification of each account. Therefore, the cash account was considered simply the warehouseman's merchandise account, or the cashier's account. A general rule was developed because every time wealth changed, one person gave and another received, and the value of the exchanged wealth, expressed in the respective currency was recorded (registered) twice: once in the credit of one account and once in the debit of another: **"the one who receives is the debtor, so his account must be debited, and the one who gives is the creditor and his account will be credited."**

Mathematical theory.

Mathematical theory was presented by the author as a more recent theory, which was introduced in schools only towards the end of the 19th century.

"This theory only records the increases, decreases, or diminutions of a fortune brought about by these changes; it does not reduce to legal transactions the changes that take place or are obtained in a fortune, about which double-entry accounting is kept. He will discover, by monitoring these changes, that they follow the laws of mathematical equations and that the double-entry accounting system as a whole is based on such equations."(Lapedatu , 1904: 8)

Mathematical theory, said Ioan I. Lapedatu, could only be applied to double-entry accounting, not to simple accounting. In the simple-entry accounting registers, records were kept of all parts of a person's active and passive assets; however, no records were kept of the difference between these assets and liabilities, that is, of net assets or capital. The result, in that case, was obtained only from the difference between assets and liabilities.

In "The Fundamental Principles of Double-Entry Accounting", the author brought to the attention of those interested in the discipline of accounting the theories of two main representatives of the mathematical method: F. Hügli and G.D. Augsburg, whose opinions largely corresponded, but between which there were also differences in the way they explained the nature of the group of accounts and current assets.

Although Ioan I. Lapedatu believed that the fundamental principles of double-entry accounting could be fully understood and explained only with the help of mathematical theory, he nevertheless admitted that it could be used in school only after the students had mastered the accounting technique. Therefore, for the introduction to accounting it was good to use the personalist theory and only in those cases when that theory could not be proven, the explanations of the mathematical theory had to be applied. However, as pointed out by Lapedatu, after the students had learnt the principles of accounting, they had to be informed on the defects of the personalist theory and carefully introduced to the only way that could clarify the fundamental principles of accounting: the **mathematical theory**.

5. Works from the specialized literature in the banking field published in the "Economic Review"

Upon his return to his native country, Ioan I. Lapedatu, a recent University of Budapest graduate, immediately became involved with the banking system and those who made efforts to bring Romanian banks up to European standards through significant reform. He came to understand, though, that working in the banking industry was not enough; he also needed to help spread economic knowledge and create specialized works that were in line with the level of expertise of the bank officials in the Romanian financial system. Along with disseminating knowledge about accounting and insurance, he also developed several works on banking and finance, which he initially published in the "Economic Review" and then printed in separate volumes, in order to allow for a wider distribution among the readers of such literature. One of the books with the help of which the editorial staff brought important clarifications for those who dealt with banking was entitled: "Public Effects". It was published in "Revista Economică" (The Economic Magazine), no. 15-19, from 1905, then printed, the same year in Sibiu, at the Tiparul Tipografiei Archidiecesane.

*"THE ECONOMIC REVIEW" IN THE SERVICE OF PROMOTING SUBJECTS RELATING TO
ECONOMICS AMONG THE ROMANIAN PUBLIC*

Ioan I. Lapedatu pointed out that the introduction of money into peoples' economic lives and the circulation of goods evolved in a surprisingly long way. The concurrent growth of the money and goods circulation, however, created a situation where money was no longer enough to meet the enormous demands of circulation, necessitating the search for alternative means and expedients. Credit allowed bills of exchange, paper money, banknotes, and checks to successfully replace money. They could be used as payment methods because bills of exchange, paper money, banknotes, checks, etc., represented specific economic values. They were referred to as ideal values, or simply securities, in contrast to real values, or values that had intrinsic value.

However, as Ioan I. Lapedatu explained, at a certain point, neither credit nor the securities of the aforementioned type were adequate. Instead, there were other securities based on credit that represented economic values. However, those were not used as direct means of payment. On the other hand, those securities were more in line with real values, being objects of purchase and sale with prices that fluctuated and changed like the prices of other exchange values. According to the author, securities had unique characteristics, which made them a distinct group of the utmost importance in financial and economic life worldwide. According to the author, it was challenging to provide a definition of securities at that time.

"In the commercial world, however, securities are understood only as those that arise from the financial needs of circulation. In this sense, securities are also called public effects. " (Lapedatu, 1905: 4) From the perspective of origin and provenance, they fell into two major categories, fundamentally distinct from one another: bonds and shares. The bond was defined as the legal relationship between a creditor and a debtor. The creditor provided the funds and obtained the bond, while the debtor issued the bond and got the loan amounts. Therefore, the sums that creditors landed to debtors, or bond issuers, were the source of the economic values that the bond represented.

On the other hand, shares were defined as a portion the assets belonging to an economic enterprise rather than sums of money that have been loaned to either public or private institutions or to businesses. Therefore, the owner of a share was not the creditor of an enterprise, but rather, he a co-owner who was legally entitled to certain rights regarding the management and control of the business, as well as a dividend, which is a portion of the income.

Explaining the concept of share in banking terms, the author wrote: "A share in the proper sense is nothing more than a part of the corporate capital of an enterprise established as a joint-stock company. However, this capital [...] is not a loan granted to the company and the shareholders are not its creditors, they, we could say, are owners, but owners only in idea, because in fact, in the sense of the law, the company is independent. The capital belongs to the company and it is obligated to a third party, not the shareholders. The liability of the shareholders is limited. They guarantee only up to the value of their share. But although the company is independent, the law also reserves certain rights to the shareholders, especially with regard to the management and control of the company. Of course, the most important favour granted to them by law is that they can dispose of the company's profit, as long as there is a profit, and they can distribute it among themselves in parts proportional to the value of their shares, parts that are called dividends." (Lapedatu , 1905:117)

Following an explanation of the economic evolution from the earliest days of money circulation to the emergence of credit and securities known as public effects, the author proceeded to the discussion of state loans and the factors that made them necessary. According to the author, the budget preliminaries under the expense heading could not coincide with reality, therefore the State might demand ever greater expenses. Thus, very expensive headings for budgets appeared: railways, navigation channels, warehouses, instalments to be paid on previous loans, etc. The increase in spending forced the state to resort to loans. State loans, in the author's opinion, could take different forms. The state could issue bonds, which, in turn, were nominal or bearer. The issues could be direct or indirect. The indirect ones could be made through bankers and large banks that formed a consortium or syndicate. Not only merchants and bankers, but also small businessmen were presented as being interested in state loans.

An important form of loans were the non-amortizing ones. Those were „, described as loans, to which the state committed itself to its creditors only with certain annual interests. Since the creditors received those interests from the state permanently, just like an annuity, loans of that nature were known in practical life simply as an annuity. Lapedatu pointed out that annuities formed the permanent or perpetual debt of the state." (Lapedatu, 1905:16-17). Annuity securities were described as being either nominal or bearer. The author also discussed a second main group of consolidated state debts, i.e. the amortizable loans. For those loans, bonds were usually issued, which the state undertook to amortize, to pay over a period of time, more or less distant. Not all bonds, said the author, brought fixed interest. Thus, bonds were of two types: interest-bearing and interest-free. Those were redeemed by the state at a higher price and were called premium bonds. In addition to public effects, other effects had been introduced into commercial circulation, originating from the issues of various public and private institutions. From that category, the author discussed, in the material published in the "Economic Review", land deeds, communal obligations, shares, lottery tickets, etc.

Land deeds. The author of the work entitled "Public Effects" paid significant attention to land deeds, considering them of great importance in Transylvania, a region in a predominantly agrarian country, where the circulation of bills of exchange was restricted, but where mortgage loans had a relatively large share compared to industrial areas. "The big banks", wrote the Transylvanian economist, "but in the first place the land credit institutes, based on the loans they grant to the owners of land and real estate, and also based on the rights they gain by tabulating, first of all, the lands and real estate that serve as collateral for these loans, issue amortizable bonds with fixed annual interest, bonds that are called, unlike others, land deeds. The question arises why are they issued and what is the meaning of land deeds? Banks and land credit institutes, as a rule, do not have as much equity capital as it is necessary for loans. However, if they need such capital and since the loans granted are of long duration, the money placed in them would remain, for a long time, fixed capital, withdrawn from circulation. These two considerations determine the banks and land credit institutes, for the money they lack for the loans that are required, to address the general public, to take from this loan capital, which they then give to those who need it. It is quite clear, however, that banks and land credit institutions only have an intermediary role between the general public and those in need of loans, and the land deeds themselves are a means for capital to pass from capitalists to land and property owners.

A work that the economist Ioan I. Lapedatu dedicated to explaining in detail the mechanisms of bank operation and banking techniques was entitled: "**Practical Studies of Banking.**" (Lapedatu, 1905:18). To better understand the aforementioned mechanisms and techniques, the author took part, in the winter and spring of 1906, to a documentation and training internship in several large banks in Cluj and Budapest. The results were published under the title "**Practical Banking Studies**" in "Revista Economică" (The Economic Review), no. 12-22 of 1906, and then in a separate volume, in Sibiu, at Tiparul Tipografiei Archiepiscopale, also in 1906.

Ioan I. Lapedatu aimed to provide a comprehensive and cohesive explanation of the operations of banks, which was expected to make it easier for readers to grasp the various approaches to bank management. At the same time, the author gave readers useful information about banking matters, information that other writers could use to create systematic works, from a theoretical perspective. During his time at each of the banks he visited, Ioan I. Lapedatu studied every aspect of banking, including deposits, pawnbroker loans, mortgage loans, discounting bills of exchange, and pawnshop currency. He then went on to study house administration, accounting, and finally vocational chancellery. Readers are given a chronological account of everything the author witnessed and experienced. Ioan I. Lapedatu completed his internship in Budapest at the Central Financial Institute, Hozai Bank, Discount Bank, Commercial Bank, and Pesti Hozai. During his three weeks at the Central Mortgage Bank of Credit Institutes in Hungary, he also had the chance to learn more about the workings of a unique mortgage credit institute. Ioan I. Lapedatu, however, had to cancel his study trip because of strikes that crippled Austria-Hungary's economy. Nevertheless, he had enough material to create a work that would be helpful for the practice in the banking and financial industry.

6. Conclusions

The merit of the "Economic Review" lies in the fact that it contributed both to the education of the Romanian people by publishing scientific knowledge in various fields, and to the highlighting of the activities and the growth of the role of economic institutions in the life of the Romanian people. The "Economic Review" from Sibiu can be considered a cultural institution, with multiple functions in the economic, cultural, historical and social fields, being an organizational institution put at the service of the institutional development of the Romanian people.

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ECONOMIC EFFICIENCY AND DEVELOPMENT TRENDS OF APPLE PRODUCTION IN THE QUBA–KHACHMAZ ECONOMIC REGION IN AZERBAIJAN

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Abstract: *This study analyzes the economic efficiency and development trends of apple production in the Quba–Khachmaz economic region of Azerbaijan. Using statistical and analytical methods, including the Compound Annual Growth Rate (CAGR), the research evaluates changes in cultivated area, yield, and total production for the period 2020–2030. Findings reveal that although orchard areas have declined by over 20 percent, productivity has increased by more than 25 percent, indicating a shift toward intensive and resource-efficient agricultural practices. The transition to intensive and super-intensive orchard systems enhances production stability through technological innovation, improved irrigation, and sustainable resource use. These results demonstrate that modernization in fruit farming strengthens economic resilience and supports the transformation from extensive to intensive agriculture. The study contributes to the achievement of the UN Sustainable Development Goals (SDGs) by promoting sustainable agricultural growth, resource optimization, and environmentally responsible production models.*

Keywords: *Quba–Khachmaz Economic Region; apple production; economic efficiency; agricultural sustainability; intensive orchards; SDG 2 – zero hunger; SDG 12 – responsible consumption and production*

INTRODUCTION

Agriculture, as one of the fundamental pillars of the national economy, plays a crucial role in ensuring food security, increasing employment, and promoting the socio-economic development of regions. As a result of the state programs implemented to diversify Azerbaijan's non-oil sector, significant structural transformations have taken place in agriculture, particularly in fruit-growing. These changes are evident both in land use patterns and in production technologies. In recent years, traditional farming practices in many of the country's economic regions have gradually been replaced by intensive and super-intensive systems. Under such circumstances, the focus has shifted from the mere expansion of production volume to the efficient management of resources and the enhancement of productivity.

The Quba–Khachmaz economic region has been selected as a key subject of this study because apple production represents one of the main directions of regional specialization, both economically and socially. At the same time, the region stands out for its favorable soil and climatic conditions, agro-technical potential, and productivity indicators. However, in recent years, a decrease in cultivated areas has been observed, which can be explained by the restructuring and intensification of production. This situation raises an important question: how does the reduction of cultivated land affect total output, and what are the economic implications of this process? In recent years, market prices in the fruit sector have shown tendencies either to stagnate or decline, making the sales process unstable and risky for producers. Maintaining economic efficiency under such conditions requires farmers to demonstrate higher levels of performance and management skills (Lakner & Apáti, 2010). The development of post-harvest stages is considered one of the most effective ways to enhance economic efficiency. The adoption of modern processing, grading, packaging, and storage technologies extends

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the marketing period, meets consumers' expectations regarding quality and appearance, and ultimately contributes to higher average sales prices (Doluschitz, 2001; Möhring et al., 2007).

If we take a closer look at the European model, it becomes evident that the most widely cultivated fruit tree across Europe is the apple tree, which accounts for approximately 35 percent of all orchard areas, covering around 450 thousand hectares (European Union, 2015). In 2013, the total volume of apple production across the 28 member states of the European Union reached approximately 12 million tons (European Union, 2015). During that period, Poland emerged as the leading apple producer in the EU, with an annual output exceeding 3 million tons, followed by Italy and France. In Romania, the annual volume of apple production was recorded at around 503 thousand tons. However, the main challenge for Romania lies in its low productivity levels. Between 2003 and 2012, apple production in the country declined by about 43 percent (World Apple and Pear Association, 2015). The total area of apple orchards in Romania constitutes roughly 11 percent (51,226 hectares) of all apple-growing land within the European Union. By comparison, although France accounts for only about 8 percent of the total orchard area, its volume of apple production is four times higher than that of Romania (European Union, 2015).

Over the past 24 years, the total area of land planted with apple trees has declined in both the European Union and Romania. In Romania, this reduction has reached approximately 33 percent, while at the EU level, the decrease amounts to around 15 percent. The contraction in orchard areas is primarily attributed to improvements in productivity. Between 1990 and 2013, apple yield in Romania increased by roughly 8 percent, corresponding to an average annual growth rate of about 0.32 percent. During the same period, productivity across the European Union rose by 12 percent, reflecting a general trend toward more efficient and intensive cultivation systems.

Previous research has demonstrated that there is no significant difference in the organic matter content of soils between organic and conventional apple orchards (Gasparatos, D. et al., 2011). The main factors influencing apple production include the use of organic fertilizers, farmers' experience, and the availability of labor resources; together, these components account for approximately 48 percent of total production costs (Herencia, J.F. et al., 2008). Other scholars have identified six key factors affecting the profitability of apple production: yield levels, fruit quality (as reflected in grading results), orchard size, varietal diversity, production costs, and specialization in organic production and/or direct marketing (Stockdale, E.A. et al., 2001)

Due to farmers' limited knowledge and restricted access to appropriate technologies, fertilizers are often applied in excessive quantities (Murphy, K., 2012), leading to adverse environmental consequences. Organic farming systems and small-scale agribusinesses tend to benefit from higher market prices, which makes them economically more efficient (Murphy, K., 2012). However, the organic nature of production does not automatically guarantee its sustainability (Bravin, E. et al., 2015). For agricultural production to be sustainable, it must be profitable, of high quality, environmentally safe, and aligned with principles of social responsibility (Bravin, E. et al., 2015).

In most parts of the world, farmers have shifted from traditional to intensive production systems (Gul, M., 2005). Over the past fifty years, planting density in apple orchards has increased dramatically—from about 40 trees per acre to as many as 3,000 trees in some cases (Reganold, J.P. et al., 2011). Establishing high-density systems requires substantial investment, with the majority of costs associated with the purchase of seedlings. Although growing one's own seedlings can reduce initial expenses, it typically delays the onset of fruit-bearing by one year (Reganold, J.P. et al., 2011). Low-density systems, on the other hand, are considered economically inefficient since they require between five and eight years to reach full productivity (Gul, M., 2005). The choice of planting system varies depending on geographic location, cultivar and varietal diversity, soil type, rootstock selection, and local socio-economic factors (DeJong, T.M., et al 1999). The social aspect of sustainable development has received relatively little attention in the scientific literature; however, recent studies indicate that conceptual understanding in this area has begun to take shape. Although the notion of social stability

is often discussed in the context of social policy, it is increasingly recognized as an essential component in evaluating the social pillar of sustainable development.

The primary aim of this study is to evaluate the economic efficiency of apple production in the Quba–Khachmaz economic region and to identify future development trends in productivity, cultivated area, and production volume up to the year 2030.

In accordance with this aim, the following research objectives have been defined:

- To analyze the dynamics of apple production, cultivated area, and yield indicators in the region for the period 2020–2024;
- To identify the economic and structural factors underlying the reduction of cultivated areas;
- To assess the technological and managerial factors influencing productivity growth;
- To forecast key indicators for the year 2030 based on the Compound Annual Growth Rate (CAGR);
- To propose recommendations for the development prospects of fruit growing in the Quba–Khachmaz economic region based on the findings of the research.

METHODOLOGY

The study employs both statistical and analytical research methods. The main methodological approach is based on the Compound Annual Growth Rate (CAGR) formula, which is used to calculate the average annual growth rates of apple cultivation area, production volume, and yield for the period 2020–2024. This approach enables an objective assessment of the rate of change in key production indicators over time, providing a quantitative foundation for forecasting development trends up to 2030.

The Compound Annual Growth Rate (CAGR) is calculated using the following formula:

$$r = \left(\frac{Y_{end}}{Y_{start}} \right)^{\frac{1}{n}} - 1$$

where:

r – CAGR, the compound annual growth rate (Investopedia, CAGR);

Y_{start} – the initial value of the indicator (e.g., production volume, cultivated area, or yield);

Y_{end} – the final value of the indicator;

n – the number of years in the observed period.

This formula reflects the average annual rate at which a variable grows (or declines) over a given period, assuming the growth occurs at a compounded rate.

In addition, to forecast the dynamics of apple cultivation area, production volume, and yield for the period 2024–2030, the study employs a CAGR-based projection formula adopted by leading international economic and statistical institutions such as the OECD, FAO, and Investopedia. The formula is expressed as follows:

$$Y_{forecast} = Y_{start} \times (1 + r)^n$$

where:

$Y_{forecast}$ – the projected value for the target year;

Y_{start} – the base or initial value of the indicator;

r – the CAGR, representing the compound annual growth rate;

n – the duration of the projection period (in years).

This approach allows for estimating future performance trends under the assumption of constant compound growth, providing a reliable analytical framework for medium-term forecasting.

Furthermore, the study employs trend analysis, comparative analysis, graphical visualization techniques (including line and combo chart models), as well as empirical observations to enhance the validity and interpretability of the results.

CONCLUSIONS AND DISCUSSIONS

ECONOMIC EFFICIENCY AND DEVELOPMENT TRENDS OF APPLE PRODUCTION IN THE QUBA–KHACHMAZ ECONOMIC REGION IN AZERBAIJAN

The Quba–Khachmaz economic region is one of the largest and most specialized areas of Azerbaijan in terms of fruit production. Within the region’s agricultural sector, apple cultivation holds a distinctive position, playing a vital role both in meeting domestic market demand and in strengthening the country’s export potential. At present, the total area of fruit orchards across the region covers several thousand hectares, with apple orchards accounting for the predominant share of this land. This specialization has positioned Quba–Khachmaz as a key contributor to Azerbaijan’s fruit-growing industry and as a central hub for high-value agricultural production.

Table 1. *Apple orchards in the fruit-bearing stage (hectares)*

Economic Region and districts	2020	2021	2022	2023	2024
Quba–Khachmaz Economic Region	21500.3	21968.9	21317.8	18551.0	16702.3
Khachmaz District	4315.1	4364.9	3501.8	2574.6	2278.6
Quba District	13192.7	13196.2	13308.9	11324.2	9472.7
Qusar District	3533.4	3915.1	3983.2	4123.1	4421.7
Siyazan District	28.0	27.5	28.0	28.0	28.0
Shabran District	431.1	465.2	495.9	501.1	501.3

Source: State Statistical Committee of the Republic of Azerbaijan, 2024

As shown in Table 1, the total area of apple orchards in the fruit-bearing stage within the Quba–Khachmaz economic region is presented by year. An examination of the overall dynamics of apple orchards across the Quba–Khachmaz region reveals the following trend.

Table 2. *Overall Dynamics (Quba–Khachmaz Economic Region)*

Year	Total area (ha)	Annual change (ha)	Annual change (%)
2020	21,500.3	-	-
2021	21,968.9	+468.6	+2.2 %
2022	21,317.8	-651.1	-3.0 %
2023	18,551.0	-2,766.8	-13.0 %
2024	16,702.3	-1,848.7	-10.0 %

As the overall dynamics indicate, the total area of fruit-bearing apple orchards in the Quba–Khachmaz economic region decreased by approximately 22 percent during the period 2020–2024. According to the results of surveys conducted among local residents of the economic region, this decline is primarily attributed to the aging of existing orchards and the fact that newly planted trees have not yet reached the fruit-bearing stage. These factors have notably intensified the downward trend, particularly after 2022.

Table 3. *Apple production, tons*

Economic Region and districts	2020	2021	2022	2023	2024
Quba–Khachmaz Economic Region	214326.8	218528.0	225618.7	214048.3	206882.3
Khachmaz District	53381.9	52355.5	54648.4	45973.2	40135.1
Quba District	125328.9	129204.4	132134.6	124952.7	112920.1
Qusar District	32916.4	34764.2	35290.4	39965.2	50774.6
Siyazan District	198.0	203.0	203.2	199.0	191.0
Shabran District	2501.6	2000.9	3342.1	2958.2	2861.4

Source: State Statistical Committee of the Republic of Azerbaijan, 2024

Table 4. Overall dynamics of apple production in the Quba–Khachmaz economic region

Year	Total production (tons)	Annual change (tons)	Annual change (%)
2020	214,326.8	-	-
2021	218,528.0	+4,201.2	+2.0 %
2022	225,618.7	+7,090.7	+3.2 %
2023	214,048.3	-11,570.4	-5.1 %
2024	206,882.3	-7,166.0	-3.3 %

As observed from the overall production dynamics, total apple output in the Quba–Khachmaz economic region decreased by approximately 3.5 percent over the five-year period. Although a growth trend was evident between 2020 and 2022, production began to decline from 2023 onward. This decline during 2023–2024 can be attributed to several factors, including unfavorable weather conditions, aging orchards, the delayed fruit-bearing stage of newly planted trees, and—as clearly shown in Tables 1 and 2—a sharp reduction in orchard area. The regional dynamics can be summarized as follows:

- Quba District continues to account for over 55 percent of total production; however, its output declined by nearly 10 percent between 2020 and 2024.
- Khachmaz District experienced a sharp decrease of around 25 percent, which parallels the reduction in orchard area noted in earlier tables.
- Qusar District demonstrated rapid growth (+54%), primarily due to the introduction of new intensive orchards reaching the fruit-bearing stage.
- Siyazan and Shabran Districts showed only minor changes, though their combined share in total production remains relatively small—about 1.5 percent.

Table 5. Apple yield in the Quba–Khachmaz economic region (centners per hectare)

Economic Region and districts	2020	2021	2022	2023	2024
Economic Region and districts	98.6	99.5	105.8	115.4	123.9
Quba–Khachmaz Economic Region	123.7	119.9	156.1	178.6	176.1
Khachmaz District	95.0	97.9	99.3	110.3	119.2
Quba District	86.8	88.8	88.6	96.9	114.8
Qusar District	70.7	73.8	72.6	71.1	68.2
Siyazan District	58.0	43.0	67.4	59.0	57.1

Source: State Statistical Committee of the Republic of Azerbaijan, 2024

As presented in Table 5, the yield of apple production in the Quba–Khachmaz economic region for the period 2020–2024 is illustrated. Based on these statistical indicators, it is possible to analyze the overall dynamics of productivity within the region and identify key trends in yield performance over the observed years.

Table 6. Overall dynamics of apple yield in the Quba–Khachmaz economic region

Year	Yield (centners/ha)	Annual Increase (centners/ha)	Annual Increase (%)
2020	98.6	-	-
2021	99.5	+0.9	+0.9 %
2022	105.8	+6.3	+6.3 %
2023	115.4	+9.6	+9.1 %
2024	123.9	+8.5	+7.4 %

ECONOMIC EFFICIENCY AND DEVELOPMENT TRENDS OF APPLE PRODUCTION IN THE QUBA–KHACHMAZ ECONOMIC REGION IN AZERBAIJAN

Over the past five years, apple yield in the Quba–Khachmaz economic region has increased by approximately 25 percent (from 98.6 to 123.9 centners per hectare). Although a decline has been observed in both orchard area and total production in recent years, the introduction of new apple varieties, along with innovative cultivation techniques and modern technologies, has significantly contributed to the improvement of orchard productivity. Based on the statistical data provided by the State Statistical Committee of the Republic of Azerbaijan, it is possible to conduct calculations grounded in current and reliable information. From the above observations, it can be concluded that the Compound Annual Growth Rate (CAGR) of apple yield in the Quba–Khachmaz economic region for the analyzed period is as follows:

$$r = \left(\frac{16702.3}{21500.3}\right)^{\frac{1}{4}} - 1 \approx 0.78^{\frac{1}{4}} - 1 \approx 0.938 - 1 = -0.062 \approx -6.2 \% \quad (\text{Compound Annual Growth Rate for Cultivated Area - CAGR})$$

$$r = \left(\frac{206882.3}{214326.8}\right)^{\frac{1}{4}} - 1 \approx 0.9^{\frac{1}{4}} - 1 \approx 0.974 - 1 = -0.026 \approx -2.6 \% \quad (\text{Compound Annual Growth Rate for Production - CAGR})$$

$$r = \left(\frac{123.9}{98.6}\right)^{\frac{1}{4}} - 1 \approx 25^{\frac{1}{4}} - 1 \approx 1.058 - 1 = 0.058 \approx 5.8 \% \quad (\text{Compound Annual Growth Rate for Yield - CAGR})$$

Using the Compound Annual Growth Rate (CAGR) formula, calculations were carried out for the last four years in three directions: cultivated area, production, and yield. Based on this calculated data, it is possible to make a forecast for apple production in the Quba–Khachmaz economic region.

$$Y_{2030} = 16702.3 \times (1 + (-0.062))^6 = 16702.3 \times (1 - 0.062)^6 \approx 16702.3 \times 0.9^6 \approx 16702.3 \times 0.5 \approx 8351.15 \text{ ha} \quad (\text{Projected cultivated area for 2030 based on the Compound Annual Growth Rate})$$

Graph 1. Comparison of the existing (2024) and projected (2030) cultivated area indicators for the Quba–Khachmaz Economic Region

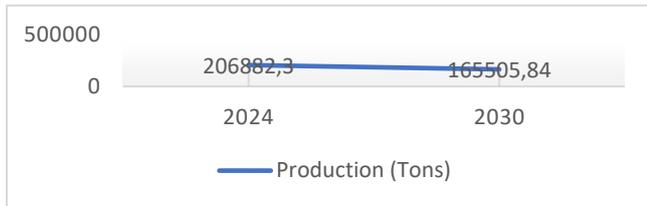


During the period 2024–2030, the total cultivated area of apple orchards in the Quba–Khachmaz economic region is projected to decline from 16.7 thousand hectares to 8.35 thousand hectares, representing an approximate 50 percent decrease (see Graph 1). This change is primarily associated with structural adjustments in the agricultural sector and the gradual elimination of traditional orchards with low productivity. Farmers have increasingly shifted toward intensive and super-intensive orchard systems, which are based on modern technologies and offer higher yields. The development of such systems is also reflected in the Strategic Road Map on the Production and Processing of Agricultural Products in the Republic of Azerbaijan, approved by the Decree of the President of the Republic of Azerbaijan No. 1138, dated December 6, 2016 (<https://e-qanun.az/framework/57124>). According to the report of the Agricultural Research Center under the Ministry of Agriculture, intensive and super-intensive orchards currently account for about 14 percent of all orchards in Azerbaijan. Consequently, traditional horticulture is gradually being replaced by modern intensive systems. Despite the reduction in cultivated area, production volume has not decreased at the same rate, since the increase in yield indicators has helped stabilize overall output.

Therefore, this trend demonstrates rising efficiency in agricultural production and indicates a qualitative transformation in resource utilization within the sector.

$Y_{2030} = 206882.3 \times (1 + (-0.026))^6 = 206882.3 \times (1 - 0.026)^6 = 206882.3 \times 0.694^6 \approx 206882.3 \times 0.8 \approx 165505.84 \text{ tons}$ (Projected apple production for 2030 based on the Compound Annual Growth Rate)

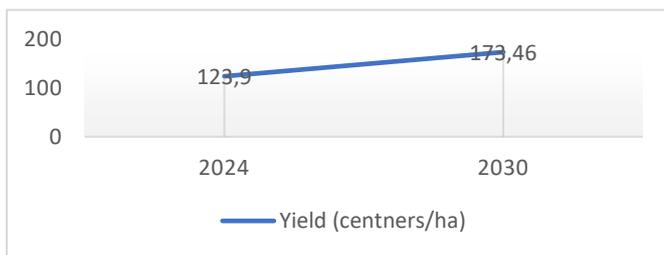
Graph 2. Comparison of the existing (2024) and projected (2030) apple production indicators for the Quba–Khachmaz Economic Region



Between 2024 and 2030, the total volume of apple production in the Quba–Khachmaz economic region is projected to decrease from 206,882 tons to 165,505 tons, reflecting an approximate 20 percent decline. However, this reduction is considerably smaller compared to the nearly 50 percent decrease in cultivated area, indicating a relatively stable production dynamic. This situation suggests that while the structure of production is undergoing transformation, overall output remains stable due to increased productivity. Moreover, the observed improvement in yield contributes to the more efficient use of resources such as labor, water, and energy. Therefore, the decline in production volume should not be interpreted as an economic setback but rather as evidence of a transition toward a more efficient and resource-saving production model, emphasizing sustainability and optimization in agricultural management.

$Y_{2030} = 123.9 \times (1 + 0.058)^6 \approx 123.9 \times 1.4 \approx 173.46 \text{ centners/ha}$ (Projected apple yield for 2030 based on the Compound Annual Growth Rate)

Graph 3. Comparison of the existing (2024) and projected (2030) apple yield indicators for the Quba–Khachmaz Economic Region



During the same period, the yield of apple orchards in the Quba–Khachmaz economic region is projected to increase from 123.9 to 173.46 centners per hectare, representing an approximate 40 percent growth (see Graph 3). This improvement is associated with the widespread adoption of intensive horticultural technologies, the expansion of drip irrigation systems, the use of high-yielding rootstocks, and the cultivation of varieties adapted to local climatic conditions. According to the calculations, the average annual growth rate of yield is around 5.8 percent. This dynamic indicates that the application of modern agro-technologies enables a higher output per hectare, thereby offsetting the negative effects of reduced cultivated area on total production. One of the main reasons behind the transition to intensive and super-intensive orchard systems is precisely the pursuit of such benefits and the overall improvement of economic efficiency. As can be seen from Tables 1 and 3, the case of Quba District clearly illustrates this relationship. Between 2020 and 2024, the cultivated area decreased by

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about 3,720 hectares, while total production declined by 12,408.8 tons, indicating a negative correlation. However, yield increased by 24.2 centners per hectare, showing a positive correlation, since the development of intensive and super-intensive orchards directly contributes to higher productivity. According to the Agricultural Research Center under the Ministry of Agriculture of the Republic of Azerbaijan, the total area of intensive and super-intensive apple orchards in Quba District alone now exceeds 1,000 hectares. Specifically, while traditional orchards typically contain up to 650 apple trees per hectare, intensive orchards include between 650 and 1,249 trees, and super-intensive orchards feature 1,250 trees or more per hectare (<https://apa.az/aqrar-senaye-kompleksi/Azrbaycandanvi-intensiv-v-superintensiv-tipli-meyv-baglarina-dair-tblr-muyynlsib-coloredCDVLcolor-616079>). In conclusion, technological innovations play a crucial role in enhancing agricultural efficiency and ensuring the stability of production, supporting the sustainable development of fruit growing in the Quba–Khachmaz economic region. In conclusion, technological innovations make a significant contribution to enhancing efficiency in agriculture and maintaining the stability of production.

The Quba–Khachmaz economic region stands out as one of the key pillars of Azerbaijan’s fruit-growing potential. Although the total area of apple orchards in the region declined between 2020 and 2024, yield levels increased significantly. This fact demonstrates that agriculture in the region has shifted from a volume-based approach toward a quality- and efficiency-oriented production model. As a result of the more optimal use of resources, economic efficiency has improved, and the overall quality of production has increased.

The analyzed data lead to the following conclusions:

1. The study revealed that between 2020 and 2024, the total area of apple orchards decreased by 22 percent. This decline is mainly associated with the biological aging of old orchards, the fact that newly planted trees have not yet reached the fruit-bearing stage, and the transition of farmers to intensive production systems. Although the reduction in cultivated area might appear negative, it actually reflects structural renewal in agriculture, the adoption of modern technologies, and more purposeful resource utilization.
2. Statistical analysis of the five-year period showed that while total apple production in the Quba–Khachmaz region decreased from 214 thousand tons to 206 thousand tons, yield increased from 98.6 to 123.9 centners per hectare. Thus, despite the slight decline in production volume, the yield per hectare rose by 25 percent. This indicates that the region maintains efficiency through improvements in product quality and technological innovation.
3. The study found that production dynamics vary among districts. The Quba District continues to account for the largest share of total production, although it experienced a 10 percent decrease. In Khachmaz District, the decline was sharper, reaching about 25 percent. In contrast, Qusar District demonstrated over 50 percent growth due to the entry of new intensive orchards into production. These regional differences show that technological modernization and the level of agro-technical expertise play a decisive role in production efficiency.
4. Calculations based on the Compound Annual Growth Rate (CAGR) method reveal an interesting trend for 2030. It is projected that the area of apple orchards will decline from 16.7 thousand hectares to 8.35 thousand hectares, while yield will increase by 40 percent, reaching 173.46 centners per hectare. Production volume, however, will fall by only about 20 percent. These results indicate that in the future it will be possible to achieve higher output with less land, marking a shift from extensive to intensive agricultural development.
5. The findings suggest that apple production in the Quba–Khachmaz region has entered a quality-oriented phase. The reduction in cultivated area does not negatively affect the economic value of production, since more output is obtained per hectare. This process is accompanied by resource optimization, water and energy conservation, and an increase in labor productivity. As a result, agriculture is evolving into a model that achieves higher returns with lower resource consumption.

6. The development of intensive and super-intensive horticulture fully aligns with the state's "Strategic Road Map for the Production and Processing of Agricultural Products." By 2030, the main goal is the gradual replacement of traditional orchards with modern systems. This transition is crucial not only for economic stability but also for environmental sustainability. Ultimately, the reforms implemented in the region contribute to the formation of a sustainable agricultural model and the strengthening of an export-oriented fruit-growing sector in Azerbaijan.

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DO PROFITABLE FIRMS EARN HIGHER STOCK RETURNS IN FRONTIER MARKETS? EVIDENCE FROM THE COLOMBO STOCK EXCHANGE

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Abstract: *This study investigates the validity of the profitability anomaly in the Colombo Stock Exchange (CSE) by examining whether firms with higher profitability earn higher expected returns. Using monthly data for all listed non-financial firms from April 2010 to December 2023, two profitability measures, operating profitability and cash profitability, are analyzed through portfolio sorts and monthly cross-sectional regressions controlling for standard risk factors, including Beta, Size, Value, Investment, and Momentum. Portfolios are formed based on quintiles of operating profitability and quartiles of cash profitability, rebalanced monthly to reflect changing firm characteristics. The results reveal that neither operating nor cash profitability consistently predicts stock returns once these factors are considered. Although high-profitability firms tend to show slightly positive coefficients, these effects are economically small and statistically insignificant, indicating only a weak and tentative profitability premium. The findings demonstrate that profitability has limited incremental predictive power in the CSE and that its effect is conditional and context-dependent. Profitability should therefore be viewed as a complementary rather than a standalone determinant of stock returns. This study contributes to asset pricing literature by extending the examination of the profitability anomaly to a frontier market context, offering insights for both researchers and practitioners into the role of firm characteristics in explaining expected returns.*

Keywords: *Profitability anomaly, Operating profitability, Cash profitability, Stock returns, Frontier markets.*

1. INTRODUCTION

The profitability anomaly, where firms with higher profitability tend to earn higher future stock returns, has been widely documented in developed equity markets. Early studies, such as Rosenberg, Reid, and Lanstein (1985) and Basu (1983), highlighted that firm characteristics, including earnings and book-to-market ratios, can predict cross-sectional returns beyond traditional market risk. Fama and French (2015) formalized profitability as a distinct factor in their five-factor model, showing that operating profitability improves the explanation of expected returns beyond the traditional market, size, and value factors. Their findings suggest that highly profitable firms are often lower risk or represent superior investment opportunities, commanding a return premium.

Subsequent research has explored the profitability anomaly in global and emerging markets. Hou, Xue, and Zhang (2015) emphasized that profitability, whether measured through operating profits or cash flows, is a key driver of expected returns across international equity markets. However, evidence from emerging and frontier markets presents a mixed picture. Market-specific factors such as lower liquidity, less investor participation, and institutional constraints may limit the predictive power of profitability in these settings.

Further studies have examined the interaction of profitability with other well-known risk factors. McLean and Pontiff (2016) argued that many characteristic-based anomalies, including profitability, may be weakened when controlling for correlated factors such as size, value, investment,

or momentum. Novy-Marx (2013) suggested that cash-based profitability measures may capture different aspects of firm quality than accounting-based operating profitability, highlighting the importance of considering multiple profitability metrics. Momentum, a widely documented anomaly in developed markets (Jegadeesh & Titman, 1993), may also interact with profitability, either reinforcing or counteracting expected return patterns.

Despite the extensive literature in developed and emerging markets, frontier markets remain relatively underexplored. The unique institutional structures, lower trading volumes, and informational inefficiencies in frontier markets may alter the strength and significance of profitability effects. Evidence from markets such as the Colombo Stock Exchange is limited, and prior studies suggest that traditional factor premiums may behave differently due to market-specific risks. This gap motivates a focused investigation into whether profitability anomalies, both operating and cash-based, exist in the Colombo Stock Exchange and whether standard risk factors continue to explain cross-sectional returns effectively. The literature indicates that while profitability is a theoretically and empirically relevant factor in asset pricing, its predictive power is context-dependent. Examining profitability in frontier markets is crucial to understanding their broader applicability and the role of firm-specific characteristics in shaping returns. This study contributes to the literature by investigating the validity of operating and cash profitability anomalies in the Colombo Stock Exchange, considering their incremental explanatory power alongside conventional risk factors such as Beta, Size, Value, Investment, and Momentum.

2. METHODOLOGY

This study examines the validity of the profitability anomaly in the Colombo Stock Exchange (CSE) by analyzing whether firms with higher profitability generate higher expected returns, and whether this effect persists after controlling for standard risk factors. Two measures of profitability are employed: Operating Profitability (OP), calculated as operating income scaled by total assets, and Cash Profitability (CP), measured as cash flows from operations relative to total assets. These measures capture different dimensions of firm efficiency and quality, following the approaches of Fama and French (2015) and Novy-Marx (2013).

The sample consists of monthly stock returns from all listed non-financial firms on the Colombo Stock Exchange from April 2010 to December 2023. Firms with missing financial data or extreme outliers are excluded to ensure robust estimation. The analysis considers both market-traded returns and firm-specific accounting information to calculate the profitability measures and other firm characteristics.

To investigate the profitability effect, stocks are sorted into quintiles for OP and quartiles for CP, ranging from low (weak) to high profitability. Portfolios are rebalanced monthly to reflect updated profitability, allowing cross-sectional comparisons of returns across firms with differing profitability levels. This sorting approach facilitates a direct test of whether higher profitability is associated with higher expected returns.

The study employs monthly cross-sectional regressions to estimate the relationship between portfolio returns and standard risk factors, including Beta, Size, Value, Investment, and Momentum, along with the firm's profitability measure (OP or CP). Average slope coefficients and associated t-statistics are computed for each profitability-sorted portfolio, with robust standard errors to account for heteroskedasticity. Particular attention is given to the magnitude and significance of the profitability coefficients and the patterns of factor exposures across portfolios to determine whether OP or CP contributes meaningfully to expected returns.

This methodology follows the approach of prior studies on profitability anomalies (Fama & French, 2015; Hou et al., 2015), extending it to a frontier market context. By combining portfolio sorting with multifactor regressions, the study rigorously tests whether profitability measures provide incremental explanatory power for cross-sectional stock returns in the CSE and whether high-profitability firms earn a consistent return premium.

3. RESULTS AND DISCUSSION

3.1 Preliminary Analysis

Before performing the cross-sectional regressions, preliminary analyses were conducted to understand the characteristics of the data and ensure its suitability for further modeling. Descriptive statistics were calculated to summarize the variables, and correlations were examined to explore potential relationships. Multicollinearity among predictors was assessed using the raw data, and variables showing potential issues were subsequently transformed to their logarithmic form. These steps allowed identification and correction of highly interrelated variables, providing a reliable foundation for the subsequent regression analyses.

3.2 Sort Analysis

Profitability sorts were performed to analyze the impact of firm profitability on stock returns. Two proxies, cash profitability and operating profitability, were used to capture different dimensions of earnings efficiency. Stocks were grouped into quintiles for each proxy, and average monthly returns were calculated for both equal-weighted and value-weighted portfolios.

The sort analysis revealed performance patterns associated with profitability and how differences in cash and operating profitability are reflected in cross-sectional stock returns. Returns were examined over the full sample period, across varying market conditions, and within subperiods to assess the robustness and temporal stability of these effects, providing a foundation for subsequent regression analyses.

This table presents the average monthly returns for portfolios formed based on operating profitability, using both value-weighted and equal-weighted sorting methods. Returns are reported across various portfolio groups ranging from weak to robust profitability.

Table 1 breaks down performance during up and down-market conditions, as well as over two distinct time periods (2010–2019 and 2019–2023). Additionally, it includes the RMW (Robust Minus Weak) factor, along with associated t-statistics and p-values to assess statistical significance.

Table 1. *Value- and equal-weight average monthly returns for portfolios formed using sorts on operating profitability*

	Weak	2	3	4	Robust	RMW	T-statistic	P-value
EW	-0.0094	-0.0050	-0.0094	-0.0068	-0.0074	0.0020	0.5880	0.5573
VW	-0.0121	-0.0039	-0.0066	-0.0073	-0.0043	0.0078	1.0643	0.2887
Up Markets								
EW	0.0389	0.0443	0.0357	0.0416	0.0495	0.0106	1.8608	0.0666
VW	0.0309	0.0339	0.0386	0.0405	0.0429	0.0119	0.8584	0.3933
Down Markets								
EW	-0.0521	-0.0485	-0.0494	-0.0497	-0.0577	-0.0056	-1.4513	0.1503
VW	-0.0502	-0.0373	-0.0467	-0.0497	-0.0461	0.0041	0.6531	0.5154
2010–2019								
EW	-0.0023	-0.0155	-0.0080	-0.0082	-0.0089	-0.0066	-0.8122	0.4176
VW	-0.0015	-0.0147	-0.0095	-0.0132	-0.0123	-0.0108	-1.3315	0.1844
2019–2023								
EW	-0.0133	0.0027	-0.0055	-0.0101	-0.0006	0.0128	0.6840	0.4954
VW	-0.0177	0.0069	-0.0025	0.0018	0.0059	0.0236	1.0728	0.2859

Source(s): Created by authors

The table presents average monthly returns of portfolios sorted by operating profitability using equal- and value-weighted approaches, ranging from weak to robust profitability. It also reports the RMW (Robust Minus Weak) factor, t-statistics, and p-values to assess the profitability premium.

Across the full sample, equally weighted portfolios show slightly higher returns for more profitable firms, with an RMW of 0.0020, t-statistic 0.5880, and p-value 0.5573, while value-weighted portfolios yield an RMW of 0.0078, t-statistic 1.0643, and p-value 0.2887. Both indicate a positive but statistically insignificant profitability premium.

Market conditions influence this relationship. In up markets, equal-weighted portfolios rise from 3.89% for weak to 4.95% for robust portfolios, with an RMW of 0.0106, t-statistic 1.8608, and p-value 0.0666, suggesting marginally significant outperformance by profitable firms. Value-weighted portfolios show a similar, though insignificant, trend with an RMW of 0.0119. In down markets, returns are negative across all portfolios; the equal-weighted RMW is -0.0056 with a t-statistic of -1.4513, and the value-weighted RMW is 0.0041 with a t-statistic of 0.6531, indicating that profitability offers little downside protection. The 2010–2019 period shows no significant profitability premium, with equal-weighted RMW of -0.0066 and value-weighted RMW of -0.0108, while in 2019–2023, the premium reemerges slightly, with equal-weighted RMW of 0.0128 and value-weighted RMW of 0.0236, though again without statistical significance.

Profitability appears to offer modest return enhancements, particularly in equal-weighted portfolios and during strong markets, but the evidence for a consistent premium is weak. These results align with Fama and French (2015), who identified profitability as a key return driver, but also with Novy-Marx (2013), who noted that its strength depends on firm size and weighting. Equal-weighted portfolios, which emphasize smaller firms, exhibit somewhat stronger RMW effects. The state-dependent pattern positive in up markets and absent or negative in down markets echoes findings by Cohen, Polk, and Vuolteenaho (2003), suggesting profitability is a procyclical characteristic rather than a defensive quality factor, contrasting with Asness, Frazzini, and Pedersen (2019).

Temporal variation in the premium, consistent with Barillas and Shanken (2018), may reflect changing macroeconomic conditions and investor preferences, while evolving accounting practices discussed by Li, Sun, and Zhao (2020) could also affect how profitability signals firm quality. The overall mixed evidence supports theories such as the q theory of investment proposed by Lettau and Ludvigson (2001), which link profitability to cyclical risk rather than pure quality. Finally, differences between equal- and value-weighted portfolios underscore the importance of portfolio construction, as noted by Fama and French (1996) and Daniel and Titman (1997).

Table 2 presents the average monthly returns for portfolios formed by sorting stocks based on cash profitability, using both equal-weighted and value-weighted approaches. Portfolios range from Weak to Robust cash profitability groups. The table reports returns for the full sample period, as well as for up and down-market regimes, and two subperiods (2010–2019 and 2019–2023). The RMW column shows the difference in returns between the robust and weak portfolios, with corresponding t-statistics and p-values testing the significance of this spread. Results indicate that cash profitability does not produce a statistically significant return premium in either weighting scheme or market condition, suggesting limited pricing power of cash profitability as a factor in explaining cross-sectional stock returns.

Table 2. Value- and equal-weight average monthly returns for portfolios formed using sorts on cash profitability

	Weak	2	3	4	Robust	RMW	T-statistic	P-value
EW	-0.0049	-0.0082	-0.0097	-0.0097	-0.0060	-0.0011	-0.1219	0.9031
VW	-0.0034	-0.0085	-0.0050	-0.0164	-0.0055	-0.0022	-0.2142	0.8305
Up Markets								
EW	0.0463	0.0370	0.0408	0.0333	0.0480	0.0017	0.1686	0.8664
VW	0.0571	0.0337	0.0418	0.0186	0.0418	-0.0153	-1.0758	0.2841
Down Markets								
EW	-0.0503	-0.0482	-0.0545	-0.0477	-0.0538	-0.0035	-0.3824	0.7026
VW	-0.0569	-0.0458	-0.0465	-0.0474	-0.0474	0.0095	1.0059	0.3159
2010–2019								
EW	-0.0059	-0.0067	-0.0133	-0.0083	-0.0112	-0.0053	-0.6394	0.5232
VW	-0.0043	-0.0086	-0.0118	-0.0105	-0.0122	-0.0079	-0.8057	0.4215
2019–2023								
EW	-0.0093	-0.0021	-0.0074	-0.0104	0.0025	0.0118	0.6264	0.5323
VW	-0.0116	0.0091	-0.0002	-0.0054	0.0091	0.0208	0.8930	0.3740

Source(s): Created by authors

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The table reports average monthly returns of portfolios sorted by cash profitability using equal- and value-weighted methods. Portfolios range from weak to robust groups, and the RMW, t-statistics, and p-values assess the profitability premium. Across the full sample, neither weighting scheme shows a significant cash profitability premium. Equal-weighted portfolios produce an RMW of -0.0011, t-statistic -0.1219, and p-value 0.9031, while value-weighted portfolios yield -0.0022, t-statistic -0.2142, and p-value 0.8305. In up markets, returns increase slightly with profitability but remain statistically insignificant. In down markets, results are mixed: equal-weighted RMW is -0.0035, and value-weighted RMW is a small positive 0.0095, both insignificant. Subperiods show similar patterns with no meaningful premium in 2010–2019 or 2019–2023, though recent years display a weak positive trend under value weighting. Cash profitability does not generate a reliable return premium under either weighting approach or market condition. Unlike operating profitability, it fails to distinguish higher-returning firms or provide downside protection, with RMW values consistently near zero.

These findings contrast with Fama and French (2015), who show that operating profitability predicts returns, and support evidence from Loughran and Ritter (1995) and Cohen, Frazzini, and Malloy (2008), who argue that cash flow measures are less informative about firm quality. The weak and unstable results also echo Cohen, Polk, and Vuolteenaho (2003) and Asness, Frazzini, and Pedersen (2019), indicating that profitability effects depend on economic conditions and do not always offer protection in downturns. The persistent insignificance of the cash profitability premium across periods aligns with Barillas and Shanken (2018), suggesting time-varying factor relevance. The evidence suggests that cash profitability is not a robust pricing factor, offering limited explanatory power compared with operating profitability.

3.3 Cross-sectional regressions

Monthly cross-sectional regressions were performed to examine the relationship between stock returns and firm-specific factors. Both univariate and multivariate models were estimated to assess individual and joint effects. Average slopes and t-statistics were reported for univariate regressions, while multivariate regressions evaluated all factors simultaneously, controlling confounding effects.

Table 3. *Average slopes and t-statistics from monthly cross-section regressions*

Beta	Firm Size	Firm Value	Operating Profitability	Cash Profitability	Investment	Momentum
0.005958						
0.589326						
			0.000902			
			0.060649			
				0.000865		
				0.080376		
	0.000005	0.001099	-0.000447			
	0.153839	0.070034	-0.001877			
0.006336	0.000007	0.000858	-0.000258			
0.616891	0.169590	0.034702	0.018320			
	0.000005	0.000885		0.000460		
	0.152299	0.064088		0.027836		
	0.000007	0.001132	-0.000118		-0.000001	
	0.145200	0.069060	-0.008000		0.027398	
0.005619	0.000009	0.000919	0.000017		-0.000001	
0.587069	0.160169	0.034124	0.012549		0.038865	
				0.000797	0.000013	-0.217570
				0.090857	0.134005	-0.360433
	0.000009	0.001200		0.000417	-0.000003	-0.224673
	0.166837	0.084268		0.037443	0.037384	-0.367117
	0.000010	0.001405	-0.000700		-0.000005	-0.225490
	0.168128	0.088440	0.004672		0.036222	-0.368723
0.004331	0.000008	0.000921	0.000161		-0.000011	-0.065759
0.165040	0.173148	0.061008	0.019619		0.029958	-0.098371
0.004372	0.000008	0.000688		0.000692	-0.000008	-0.065203
0.168136	0.171013	0.054267		0.049581	0.034025	-0.096604

Source(s): Created by authors

Table 3 presents regressions examining the impact of profitability, using a stepwise approach in which variables are added sequentially: Beta, Firm Size, Firm Value, Operating Profitability, Cash Profitability, Investment, and Momentum. This method highlights how the coefficients for operating and cash profitability change as additional firm- and market-level factors are incorporated, with coefficients reported only for variables included at each stage.

The table presents the average slopes and t-statistics from monthly cross-sectional regressions of stock returns on key firm characteristics, including market beta, firm size, firm value, operating profitability, cash profitability, investment, and momentum. These results provide insight into how each variable contributes to explaining the cross-sectional variation in expected stock returns.

Across specifications, market beta exhibits a small and statistically insignificant slope, with an average value near 0.006 and t-statistics typically below the conventional significance threshold of 2. This indicates that systematic risk, as measured by beta, does not explain much of the variation in average returns, consistent with the extensive literature documenting the weak empirical relationship between beta and realized returns in post-CAPM studies (Fama & French, 1992; Fama & French, 2015). The firm size coefficient is positive but economically small, with slopes generally around 0.000005 to 0.000009 and t-statistics below 0.2. This lack of significance suggests that the traditional size effect, where smaller firms outperform larger ones, is not pronounced in this sample. Similarly, the firm value coefficient is positive but modest, with small t-statistics, implying limited evidence for a persistent value premium once other factors are controlled for (Fama & French, 1993; Daniel & Titman, 1997).

Turning to profitability measures, operating profitability shows a small positive slope across most specifications, with average coefficients around 0.0004 to 0.0009 and t-statistics typically between 0.02 and 0.08. Although positive, these coefficients are not statistically significant, indicating that while firms with higher operating profitability tend to earn slightly higher returns, the relationship lacks strength at the cross-sectional level (Fama & French, 2015; Novy-Marx, 2013). The cash profitability coefficients are even weaker, often near zero or slightly negative, and accompanied by very low t-statistics. This confirms that cash-based profitability measures do not provide meaningful explanatory power for stock returns, aligning with earlier portfolio-level evidence that found no significant cash profitability premium (Cohen, Frazzini, & Malloy, 2008; Loughran & Ritter, 1995).

The investment variable exhibits consistently negative coefficients, typically around -0.0002 to -0.0003, though t-statistics remain below conventional significance levels. This pattern is directionally consistent with the Fama and French (2015) five-factor model, which predicts that firms investing more tend to have lower expected returns. However, the insignificance of these coefficients suggests that the investment effect is weak in this sample.

The momentum factor displays negative slopes with t-statistics between -0.09 and -0.36, suggesting that recent winners do not continue to outperform in this dataset. This weak and negative relationship may reflect sample-specific characteristics or overlapping effects with other explanatory variables (Barberis, Shleifer, & Vishny, 1998).

The cross-sectional regressions indicate that none of the examined firm characteristics, beta, size, value, profitability, investment, or momentum, exhibit strong or statistically significant effects on average returns. Operating profitability shows the most consistent positive relationship, while cash profitability remains uninformative. These results reinforce the findings from the portfolio analyses: operating profitability provides some indication of return differences across firms, but cash profitability fails to do so. The weak coefficients and low t-statistics across factors may reflect the influence of overlapping effects, short sample length, or changing market conditions that reduce factor persistence. Consistent with Barillas and Shanken (2018), factor premiums can vary over time as investor preferences and macroeconomic environments evolve. The limited explanatory power of profitability and investment also suggests that, within this sample, cross-sectional variations in returns are not strongly driven by fundamental accounting measures, echoing similar findings in smaller or more recent datasets (Fama & French, 2015; Lettau & Ludvigson, 2001).

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Table 4 presents the estimated regression coefficients and their corresponding average t-statistics for each operating profitability quintile, from the lowest (Weak) to the highest (Robust). By examining variations in factor loadings across these profitability-based portfolios, the table highlights where the effects of operating profitability are weak or robust, offering a granular perspective on its influence on cross-sectional returns.

Table 4. *Average slopes and t-statistics from monthly cross-section regressions on Operating Profitability sorts*

	Coefficients					Average T-Statistics				
	Weak	2	3	4	Robust	Weak	2	3	4	Robust
const	-0.0085	-0.0030	-0.0085	-0.0083	-0.0131	-0.1622	-0.0932	-0.0181	-0.0773	-0.3182
Beta	0.0068	0.0011	-0.0023	0.0068	0.0046	-0.1060	-0.1490	0.0271	0.2402	0.0289
Size	0.0000	0.0000	0.0000	0.0000	0.0000	-0.0363	0.0858	0.0331	-0.1493	0.0814
Value	-0.0002	-0.0013	0.0022	-0.0040	-0.0021	-0.0595	-0.0982	0.0899	-0.0035	0.0833
OP	-0.0065	-0.0453	-0.0066	0.0302	0.0158	0.0655	-0.0522	-0.0797	-0.0011	0.0358
Invst	0.0001	0.0001	0.0000	0.0000	0.0001	0.1006	-0.0188	0.0277	0.0065	0.0088
Mom	-0.1138	-0.0267	-0.1113	0.0657	-0.0004	-0.0525	-0.0094	-0.0144	0.1247	0.0087

Source(s): Created by authors

The tables present results from monthly cross-sectional regressions examining the relationship between stock returns and firm characteristics, including Beta, Size, Value, Operating Profitability (OP), Investment, and Momentum. Stocks are grouped into quintiles based on Operating Profitability to examine variations across profitability levels. The analysis provides insights into the explanatory power of traditional and profitability-based factors in explaining cross-sectional return differences.

Across OP-sorted portfolios, intercepts are consistently negative, ranging from -0.0030 to -0.0131, with low t-statistics between -0.0181 and -0.3182, indicating no significant abnormal returns unexplained by the factors. Beta coefficients fluctuate around zero, ranging from -0.0023 to 0.0068, and show no significant pattern, suggesting that systematic risk has limited explanatory power once other factors are included. Similarly, Size coefficients are near zero with negligible t-statistics, confirming the absence of a size-related return premium in these portfolios.

The Value coefficients are small and mixed, between -0.0040 and 0.0022, and largely insignificant, implying that value orientation does not strongly influence returns after controlling for other variables. Operating Profitability shows small, mostly insignificant coefficients, slightly positive in higher OP quintiles, but inconsistent overall. This indicates that while OP may be positively related to returns in theory, its marginal explanatory power diminishes when other common factors are included. Investment coefficients are close to zero, while Momentum shows weak and mostly insignificant patterns, with mildly negative coefficients in low-OP portfolios but no systematic trend across quintiles. None of the factors display consistent or significant coefficients across OP quintiles, suggesting that sorting by profitability does not yield distinct or predictable differences in factor exposures or abnormal returns.

These regression results reveal the limited explanatory power of profitability-based factors. The lack of strong and consistent coefficients across all factors suggests that return variation in this sample is not primarily driven by standard firm-level characteristics or profitability measures. These results echo broader evidence questioning the robustness of certain anomalies in recent periods and support the argument that factor relevance can vary over time and market conditions, as noted by Barillas and Shanken (2018).

From a theoretical perspective, these findings highlight the context-dependent nature of profitability as a priced risk factor. While Operating Profitability is a key component in models such as Fama and French (2015), its influence appears weaker once additional factors are included. This outcome supports prior studies, including Loughran and Ritter (1995) and Cohen, Frazzini, and Malloy (2008), which suggest that profitability measures may not fully capture firm quality or growth potential

Table 5 presents the estimated regression coefficients and their corresponding average t-statistics for each cash profitability quintile, from the lowest (Weak) to the highest (Robust). By examining variations in factor loadings across these profitability-based portfolios, the table highlights where the effects of cash profitability are weak or robust, offering a persistent perspective on its influence on cross-sectional returns.

Table 5. Average slopes and t-statistics from monthly cross-section regressions on Cash Profitability sorts

	Coefficients					Average T-Statistics				
	Weak	2	3	4	Robust	Weak	2	3	4	Robust
const	-0.0044	-0.0070	-0.0107	-0.0435	-0.0150	-0.2390	-0.1742	-0.1394	-0.2116	-0.3785
Beta	-0.0003	-0.0019	0.0037	0.0115	0.0068	-0.0147	-0.1947	0.1277	0.0127	0.2463
Size	0.0001	0.0000	0.0001	0.0000	0.0000	0.0736	0.0643	0.0584	-0.0019	0.0112
Value	-0.0006	0.0000	0.0012	0.0007	-0.0024	-0.0370	0.1038	0.0988	0.0067	0.0631
CP	-0.0010	-0.0053	-0.0165	0.0799	0.0057	0.0485	-0.0428	-0.0070	0.1098	0.0962
Invst	-0.0001	-0.0002	0.0004	0.0002	-0.0004	0.0053	-0.0785	0.0099	0.0349	0.0014
Mom	-0.0805	0.0143	-0.1352	-0.1538	0.1894	-0.0563	0.0259	-0.0448	0.0012	0.1313

Source(s): Created by authors

The table reports average slopes and t-statistics from monthly cross-sectional regressions of stock returns on standard risk factors, Beta, Size, Value, Investment, and Momentum, alongside Cash Profitability (CP). Portfolios are sorted into five groups based on CP.

Intercepts across CP portfolios are generally negative but statistically insignificant, suggesting no abnormal returns beyond the included factors. Beta, Size, and Value coefficients fluctuate around zero with weak t-statistics, indicating limited explanatory power within these cash profitability-sorted portfolios. Investment effects also appear negligible.

CP coefficients display mixed and mostly insignificant patterns: slightly negative or near-zero effects in low-to-moderate CP groups and a weakly positive effect in the highest profitability group. This pattern hints at a potential return premium for highly cash-profitable firms, though statistical support is limited. Momentum shows some inconsistent effects across portfolios but lacks robust significance overall.

These results align with academic evidence suggesting that profitability, while often viewed as a priced characteristic, may offer limited incremental explanatory power once standard factors are accounted for. The weak Beta significance further illustrates the challenges faced by CAPM in explaining cross-sectional returns. Similarly, Size, Value, Investment, and Momentum fail to generate strong or consistent effects, possibly reflecting interactions with profitability or sample-specific variations.

Overall, the findings imply that high cash profitability may be associated with slightly higher returns, but these effects are not robust in monthly cross-sections when controlling for common risk factors. This underscores the conditional and often fragile nature of profitability premiums, emphasizing the need for models that capture nonlinearities, interactions, or time-varying dynamics. Researchers and practitioners should therefore view cash profitability as informative but not decisive on its own, best interpreted within a broader multifactor framework.

4. CONCLUSION

This study investigated whether profitable firms earn higher stock returns in the Colombo Stock Exchange (CSE) using data from April 2010 to December 2023. Two profitability measures, operating profitability and cash profitability, were analyzed through portfolio sorts and monthly cross-sectional regressions while controlling for standard risk factors such as Beta, Size, Value, Investment, and Momentum. The results show that profitability does not consistently or significantly predict stock returns once these factors are considered.

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Operating profitability exhibited a weak positive association with returns, especially in equal-weighted portfolios and up-market conditions, but the effect was statistically insignificant. Cash profitability showed even weaker and more unstable results, suggesting that cash-based earnings measures do not meaningfully explain return differences. Overall, the profitability anomaly, commonly observed in developed and some emerging markets, appears limited in the CSE, indicating that stock returns are influenced more by market dynamics, liquidity, and investor behavior than by firm fundamentals.

For investors and portfolio managers, these findings imply that profitability-based strategies alone are unlikely to generate consistent excess returns in the CSE. A multifactor approach that combines profitability with value, momentum, and macroeconomic indicators is recommended. Equal-weighted strategies may capture slightly stronger effects due to greater exposure to smaller firms. Policymakers can enhance market efficiency by improving financial disclosure and transparency, allowing firm fundamentals to be better reflected in prices.

For academics, the results highlight that the profitability effect is conditional and context-dependent, varying across time and market environments. Future research should explore time-varying and regime-switching models to capture changing profitability premiums to identify where profitability matters most. Incorporating liquidity, behavioral, or ownership variables may also clarify why profitability is weakly priced. Moreover, alternative profitability measures such as gross profitability or return on invested capital could provide deeper insights. Comparative studies across other frontier markets like Vietnam or Kenya would help determine whether the weak profitability premium observed in the CSE is market-specific or part of a broader regional pattern.

This study finds little evidence of a strong or consistent profitability premium in the CSE. Profitability remains an informative but secondary factor that should be interpreted within a broader multifactor and market-specific framework rather than as a standalone determinant of stock returns.

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INTEGRATING MEASUREMENT AND MEANING IN ORGANIZATIONAL CHANGE

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Abstract: *This paper addresses the central challenge in organizational transformation: integrating analytical measurement with human-centered meaning-making to drive sustainable change. Based on an empirical study of 147 senior managers across eight Georgian business organizations, the research initially identifies a critical disconnect. While quantitative awareness of the need for change exists, local management practices are hampered by core deficiencies, including organizational procrastination, managerial inertia, and the inconsistent application of standardized methodologies (PDCA, PESTEL, SWOT). To bridge this gap, the study introduces the Integrated Self-Diagnosis and Measurement Framework (ISDMF) first. This framework is designed to move beyond external compliance, aiming to internalize disciplined change by fostering self-accountability and continuous, systematic measurement. The core contribution lies in reframing change as a process where measurement informs meaning, and meaning activates measurement. This ensures that change is seen not merely as a procedural or metric-driven transformation, but as a lived process of alignment between objective organizational data and subjective, deeply-held individual awareness. By connecting quantitative rigor (Measurement) with a human-centered, symbolic perspective (Meaning), the study offers a novel lens for developing resilient leadership cultures and overcoming inertia in transitional economies.*

Keywords: *organizational change, measurement and meaning, leadership, change management, transformation, self-accountability, integrated framework.*

Introduction to Organizational Change Management

Change management, in its definition, emphasizes that the existing image is not relevant to the existing reality, and therefore, changes are inevitable. Every new stage requires a vision and analysis different from the old, already existing method, which should not only be a new standard acceptable to the company (Jones, 2004). Change management has always been an integral part of organizational management. Several change management models or processes are available. Most models have certain phases: preparing for the change, including analyzing, planning, and strategy development; managing change implementation; and consolidating and institutionalizing the change, including change review, feedback analysis, corrective action, stabilizing the implemented change (King, 1995).

Any change to be carried out or introduced in management should be the result of complex work, as it necessary for all those involved in the daily life of the company to participate in it. However, every rank of employee, starting from the CEO of the company, has their scope of responsibility and action (Lewin, 1947). This study is premised on the critical need to explore and conceptualize a comprehensive framework for managing organizational change, specifically tailored to the unique economic and operational landscape of *Georgian business organizations*. Focusing on this context provides a crucial, context-specific lens to evaluate the adaptability, challenges, and success factors of change practices within transitional economies (Rhodes, 2004)

Change Management Problematic in Georgian Business Organizations

Organizational change management in Georgia presents a unique set of challenges and opportunities. As a transitional economy, the country exhibits characteristics shaped by its post-Soviet

history, including hierarchical management structures, low institutional trust, and varying degrees of adaptability across public and private sectors. While Georgian organizations increasingly adopt international management frameworks, the practical implementation of these models often encounters structural, cultural, and procedural obstacles.

Recent surveys indicate that the understanding of change management principles remains limited among many mid-level managers, while senior executives tend to adopt a top-down approach that prioritizing formal compliance over participative engagement. This combination results in fragmented implementation and, in many cases, postponed or superficial changes (Babbie, 2017). A critical prerequisite for developing a locally relevant change framework is a deep understanding of the unique socio-economic and organizational constraints prevalent in the target region. This work establishes the contextual problematic that differentiates change management in Georgian business organizations, particularly as a transitional economy. The success rate of change initiatives in Georgia is often influenced by ingrained structural and cultural characteristics that deviate significantly from those found in developed Western economies. These include structural and cultural impediments (Cummings, 2015):

The implementation of successful organizational change in many contexts is profoundly hampered by deeply ingrained structural and cultural barriers. Structurally, the prevalence of rigid hierarchies and centralized authority concentrates decision-making at the top, effectively stifling bottom-up initiatives and significantly slowing the pace of necessary adaptation, particularly concerning technological change, while actively discouraging the broad participation essential for transitional success. This structural rigidity is often compounded by pervasive low-trust environments, both internal (management-employee relations) and external. Internally, this low trust fuels employee resistance, obstructs effective delegation, and renders the transparent communication required by robust change models (such as Kotter's 8-Step) nearly impossible to execute effectively. Furthermore, organizational cultural norms frequently prioritize adherence to tradition and the avoidance of risk over innovation and experimentation, creating a fundamental clash with the core requirement of transformational change—the willingness to embrace uncertainty (Bryman, 2018). These challenges are exacerbated by a limited managerial change leadership capacity, where a deficit in crucial soft skills such as emotional intelligence, conflict resolution, and the ability to articulate a compelling vision for change (Goleman)—hinders the ability to effectively address the "People" and "Process" dimensions. Finally, a persistent focus on content over culture leads to an over-reliance on tangible changes (e.g., new technology or policy) while critically neglecting the mindset and cultural imperatives necessary to sustain behavioral shifts, causing initiatives to fail in the long run due to a lack of genuine organizational adoption. (Nadler, 1980).

Research goal and Objectives

The main primary objective of this research is to examine the current state of change management practices in Georgia, encompassing the both public and private sectors. The study aims to determine the extent to which Georgian organizations comprehend the essence and necessity of change, and whether they perceive change implementation as a means of improving processes and achieving higher organizational performance. Furthermore, the research seeks to examine whether various types of changes—including organizational, structural, or digital—are viewed by managers as having a subjectively meaningful (Meaning) and positive impact on future operations. It also aims to precisely identify the specific criteria and metrics (Measurement) used to assess the effectiveness of change initiatives and to determine whether implemented changes achieve their intended, quantifiable goals. Finally, the study seeks to identify the key factors that determine success by linking measured outcomes (Measurement) with the perceived value and sustainability (Meaning) of the change. This process allows the extraction of lessons that can inform better planning and management of future change processes, promoting a stronger integration of analytical rigor and human-centered purpose in the Georgian context.

The primary goal of this research is to define the essence of organizational change and review associated change management models, in order to assess the level of understanding of change management concepts and the organizational perception of the necessity of change within Georgia's public and private sectors. The study explores the most common types of changes undertaken in Georgian organizations (organizational, structural, digital, etc.) and analyzes how organizations evaluate the effectiveness and impact of implemented changes (Measurement), determining whether they achieve their intended quantifiable outcomes and objectives. Building upon this, the paper seeks to identify the key success and failure factors (Meaning) influencing change management results, develop a tailored organizational change management framework with associated tools and measurement criteria, and ultimately formulate evidence-based recommendations for enhancing change management practices and ensuring more effective future implementation.

Respondent Involvement in the Study

The involvement of respondents from the eight selected organizations was critical to this study, as it enabled a comprehensive assessment of change management practices across diverse organizational types and sectors. The organizations—LTB, PSP, the National Agency of Public Registry, Georgian Railway, the audit firm Loyalty, Georgian State Electric System, the construction company Knauf, and the electrical retail chain Elite—differ in sectoral specificity and organizational scale, thereby providing a robust basis for a diverse and comprehensive analysis of change management practices. Data were collected using a five-point Likert-scale questionnaire comprising nine core questions, each with five response options, from which respondents selected one answer per question. Prior to distribution, verbal communication was conducted with respondents to clarify the research scope and objectives, ensure voluntary participation, and guarantee anonymity. The analysis of questions and responses facilitated the testing of six null hypotheses, which served as primary indicators for evaluating the effectiveness and perception of change management practices.

This methodology ensures empirical reliability, enables accurate data collection from decision-makers, and establishes a foundation for multi-level analysis of change management practices ultimately deriving robust conclusions. A total of 147 participants were included, all of whom held managerial or senior managerial positions, thereby ensuring that the data reflected informed, practical, and decision-relevant perspectives. The positions of respondents were diverse and included:

- Directors of operations and production;
- Heads of logistics, administration, and marketing departments;
- Directors of finance and sales;
- Heads of legal, analytical, and IT departments.

In each organization, participant selection was carefully aligned with the organizational structure, targeting individuals whose opinions and decisions significantly influence strategic and operational processes. In several organizations, HR directors were also included, underscoring the critical role of human resource management in facilitating successful organizational change.

This diversity of roles and alignment with organizational hierarchies lent significant analytical strength to the study. It enabled not only the evaluation of managerial perceptions and practices but also the examination of decision-making processes, organizational influence, and the strategic rationale behind the adoption of tools and methodologies. By capturing perspectives from multiple managerial levels and functional areas, the research offers a comprehensive understanding of how change is planned, executed, and institutionalized across diverse organizational contexts.

Respondent Inclusion and Analytical Implications The structured inclusion of respondents from both operational and strategic roles enhances the robustness and validity of the research findings, yielding insights that are both theoretically grounded and practically relevant. This methodological approach highlights the importance of engaging key decision-makers to capture an accurate representation of organizational change dynamics, thereby enhancing the study's contribution to the literature on change management in transitional economies, such as Georgia.

While the empirical data derive from general Georgian business organizations (N = 147), the prevalence of centralized control and bureaucratic inertia suggests distinct pathways of resistance across sectors:

- Private Sector Resistance Resistance primarily arises from low-trust environments, inadequate strategic communication, and an overemphasis on Content over Culture. Despite intense competitive pressures, the persistence of rigid, top-down decision-making structures often results in change initiatives that fail due to insufficient cultural adoption and employee buy-in.
- Public Sector Resistance (Inferred) In the public sector, resistance is likely amplified by entrenched bureaucratic structures and politicization, which foster a culture of inaction and prioritize status quo preservation over strategic transformation. Stringent legal and political constraints—while necessary—can institutionalize risk aversion, further stifling the innovation required for effective change (Likert, 1932)

The failure of Georgian organizations to implement change management effectively—as evidenced by the absence of structured planning (H6) and sustained process improvement (H4)—directly contributes to national economic underperformance. When organizations consistently neglect change management standards, the consequences are systemic:

- Reduced Competitiveness: Reliance on outdated “historical views” rather than proactive adaptation to environmental imperatives (e.g., rapid technological advancements) erodes international competitiveness.
- Resource Inefficiency: Failed change initiatives (H4) result in wasted resources, diminished productivity, and elevated turnover.

The core issue is not the absence of models but the lack of disciplined adoption. This research addresses this challenge directly through the development of a context-specific Integrated Strategic Disciplined Management Framework (ISDMF), which enforces internal accountability and bridges the gap between global theory and local practice.

Sector-Specific Dynamics

Recent surveys confirm that mid-level managers exhibit a limited understanding of change management principles, while senior executives tend to favor top-down approaches prioritizing formal compliance over participatory engagement. This dynamic leads to the implementation of fragmented, delayed, or superficial changes.

Georgian public institutions in the public sector are characterized by high bureaucratic rigidity and strict adherence to formal procedures, which significantly hinder change initiatives. Administrative inertia, political interference, and procedural complexity hinder strategic decision making and erode program effectiveness. Transparency International (2023) notes that accountability mechanisms remain weakly enforced, fostering an environment where reforms are symbolic rather than transformative.

Hierarchical decision-making further discourages initiative among lower-level staff and inhibits collaborative problem-solving. Fear of political or supervisory repercussions fosters risk aversion, thereby exacerbating resistance and hindering organizational agility.

In contrast, private organizations—particularly those exposed to international markets or foreign investment—demonstrate greater flexibility and are more likely to adopt modern frameworks, such as Lean, Agile, or Total Quality Management (TQM). However, challenges persist. Success hinges on organizational culture, leadership competency, and employee engagement.

Cultural dimensions—such as high uncertainty avoidance, collectivism, and hierarchical orientation—can generate resistance or slow down the adoption process. Leaders with high cultural intelligence (CQ) are better equipped to address employee concerns, articulate the rationale for change, and align staff with shared goals (Tichy, 1986)

This disconnect highlights the pressing need for contextually tailored frameworks that integrate global best practices with local constraints. Without such adaptation, change processes remain delayed, incomplete, or ineffective—limiting competitiveness, innovation, and sustainable growth.

Methodology, Research Hypotheses, and Empirical Testing Protocol

This section formalizes the study’s core assumptions through six null (H₀) and alternative (H₁) hypotheses, designed to empirically evaluate prevailing change management practices in Georgian organizations. The testing protocol, including data collection, validation criteria, and statistical method (Student’s t-test), is outlined below.

Formalized Research Hypotheses: The hypotheses are formulated as follows:

H₀₁: Risks are not assessed during organizational change initiatives. H₁: Risks are assessed during organizational change initiatives.

H₀₂: Employee expectations are not considered during organizational change. H₂: Employee expectations are considered during organizational change.

H₀₃: External environmental factors are not analyzed in the context of organizational change. H₃: External environmental factors are analyzed in the context of organizational change.

H₀₄: Organizational work processes are not improved as a result of change initiatives. H₄: Organizational work processes are improved as a result of change initiatives.

H₀₅: The role of a dedicated change manager is not recognized by organizations. H₅: The role of a dedicated change manager is recognized by organizations.

H₀₆: Standard change management methodologies (PDCA, PESTEL, SMART, SWOT) are not deployed; organizations rely primarily on historical experience rather than structured frameworks.

H₆: Standard change management methodologies (PDCA, PESTEL, SMART, SWOT) are deployed; organizations do not rely solely on historical experience.

Statistical Testing: Student’s t-test To test the hypotheses and assess statistical significance, the study employs the one-sample Student’s t-test. This method determines whether the mean response from the sample differs significantly from a neutral or theoretically expected value (typically 3.0 on a 5-point Likert scale, representing “neutral” or “no systematic practice”).

Each of the nine survey items corresponds to a specific hypothesis. For each item:

The mean (M) and standard deviation (SD) are computed.

The sample mean is compared against the reference value ($\mu_0 = 3.0$).

A significance level of $\alpha = 0.05$ is applied ($p < .05$ indicates rejection of H₀).

This approach ensures a reliable, interpretable, and replicable evaluation of whether observed practices deviate significantly from neutral or expected benchmarks.

Each organization employs more than 250 staff, with several public entities exceeding 1,500 employees. This variation in size and sectoral specificity enables a heterogeneous analysis of change management practices across operational and institutional contexts.

The inclusion of both public and private entities—spanning regulated monopolies, competitive markets, and administrative bureaucracies—strengthens the generalizability of findings and reveals cross-sectoral patterns in change adoption, resistance, and effectiveness.

Research Design and Data Collection

The study adopted a quantitative methodology to empirically assess change management practices across Georgian organizations. All 147 respondents held senior leadership roles (CEOs, board members, functional directors), ensuring that insights reflect strategic decision-making authority over the full change lifecycle: planning, execution, monitoring, and evaluation.

A nine-item, five-point Likert-scale questionnaire was administered (1 = Strongly Disagree, 5 = Strongly Agree). Each item is mapped to one of the six hypotheses. Respondents selected one response per item. Prior to distribution, verbal briefings were conducted to clarify objectives, secure informed voluntary consent, and guarantee anonymity.

Table 1. Results of hypotheses

	Hypothesis 1	Hypothesis 2	Hypothesis 3	Hypothesis 4	Hypothesis 5	Hypothesis 6
n	35	61	87	82	41	15

mean	3.828571429	3.704918033	3.862068966	3.012195122	2.731707317	3.266666667
s	0.984757787	1.295431232	1.339666861	1.094248741	1.140710091	1.387014608
t(n-1)	1.690924255	1.670648865	1.662765449	1.663883913	1.683851013	1.761310136
t	4.97776686	4.250002394	6.002122055	0.100919948	-1.506001739	0.744617651
Decision	Reject H ₀	Reject H ₀	Reject H ₀	Do not reject H ₀	Do not reject H ₀	Do not reject H ₀

Results and Research Novelty

The primary contribution of this study is the development of the Integrated Self-Diagnosis and Measurement Framework (ISDMF)—a multi-dimensional, internally driven change management system specifically tailored to the Georgian organizational context.

Designed as a sustainable countermeasure to organizational inertia, managerial procrastination, and over-reliance on external consultants, the ISDMF enables organizations to self-assess, self-correct, and institutionalize disciplined change practices without ongoing third-party intervention (Aiken, 2009).

Table 2. The Self-Diagnosis and Action (SDA) Cycle

Stage	Focus Area	Mandatory Action	Outcome/Procrastination Countermeasure
1. DIAGNOSE (The ‘Unfreeze’ Phase)	Confronting Reality & Risk	Internal teams must conduct PESTEL (External Factors), SWOT (Internal Resources), and Formal Risk Assessment (H1).	Forces the start; avoids delaying the unpleasant truth by mandating a structured analytical output (countering H6).
2. DESIGN (The ‘Plan’ Phase)	Expectation Alignment	Translate analysis into clear goals (SMART criteria) and create an Employee Expectation Survey (EES) to align goals with staff input (H2).	Creates buy-in; ensures planning is not top-down but integrated with main players’ motivations.
3. DEPLOY (The ‘Do’ Phase)	Execution & Oversight	Appoint a Change Champion (internal equivalent of H5) to manage communication and execution; break execution into small, ‘frog-eating’ tasks with non-negotiable deadlines.	Ensures momentum; tasks become manageable, directly fighting the Procrastination tendency.
4. DEVELOP (The ‘Check & Act’ Phase)	Internalization & Adaptation	Conduct mid-term feedback sessions and compare results to initial SMART goals; the Change Champion documents lessons learned and updates internal Standard Operating Procedures (SOPs).	Achieves sustainability; institutionalizes the learned experience, preventing the organization from being left ‘alone with problems’ after the cycle concludes.

The SDA Cycle is a closed-loop, self-reinforcing model that institutionalizes continuous cultural monitoring and corrective action, directly countering behavioral rigidity, toxic inertia, and resistance to change. By transforming the organization into its own primary agent of transformation, the cycle moves beyond episodic interventions to enable sustained, internally driven improvement.

The SDA Cycle represents the operational core of the ISDMF. It shifts Georgian organizations from awareness without action to disciplined, self-sustaining transformation — a locally grounded, globally informed mechanism for lasting change.

The Integrated Self-Diagnosis and Measurement Framework (ISDMF)

The primary contribution of this work is the development of the Integrated Self-Diagnosis and Measurement Framework (ISDMF)—a prescriptive, internally driven system that directly counters the systemic inertia, procrastination, and resource inefficiency revealed by the empirical findings (H₀₄–H₀₆). Unlike transient external interventions, the ISDMF institutionalizes change discipline by integrating proactive behavioral diagnosis with rigorous, data-informed measurement, thereby eliminating costly and unsustainable reliance on external consultants.

The Integrated Change Measurement Framework (ICMF)

The ICMF provides the comprehensive, multi-dimensional metrics required to rigorously evaluate ISDMF effectiveness. It transcends traditional financial KPIs by measuring emotional, behavioral, and cultural outcomes—ensuring that change success is holistic, sustainable, and internally validated. The ICMF is structured around four synergistic pillars, which converge into the Holistic Change Effectiveness Index (HCEI)—a composite score that quantifies overall transformation maturity.

Table 3. Holistic Change Effectiveness Index (HCEI)

CMF PILLAR	MEASUREMENT FOCUS	KEY INNOVATIVE METRIC
1. Behavioral Shift (BAS)	Actual adoption of new work habits and processes (Digital Traces of Change).	Collaboration Heatmaps: Measures the frequency of ‘cross-functional’ activity on digital platforms (countering H6 inertia).
2. Emotional & Cognitive Adaptation (EAI)	Employee readiness and emotional tone during transition (Acceptance vs. Fear).	Emotional Adaptation Index (EAI): Based on Micro-Pulse Surveys and sentiment analysis (countering H2 resistance).
3. Process & System Effectiveness (PEG)	The measured efficiency gains from the new system/process.	Process Efficiency Gain (PEG): Metrics like time saved, error reduction rates, and system utilization frequency (H4 proof point).
4. Strategic & Lagged Impact (ILI)	Long-term, sustainable impact on core business goals.	Impact-Lag Index (ILI): Measures the specific time required for the positive change impact to appear in hard KPIs (e.g., ROI, talent retention).

The empirical and theoretical synthesis of this work culminates in the Holistic Change Effectiveness Index (HCEI)—a unified, multidimensional diagnostic instrument that enables organizations to quantify the success of cultural transformation and assess underlying organizational resilience. Far from a mere academic construct, the HCEI is a practical management tool that translates complex change dynamics into a single, actionable composite score, empowering Georgian organizations to move from subjective impressions to evidence-based cultural governance.

The Unique Contribution of the ISDMF

The ISDMF represents a contextually grounded, next-generation change management system that explicitly embeds behavioral discipline into the operational fabric of Georgian organizations. Its three defining innovations are as follows.

First, mandatory internal accountability enforces standardized planning, diagnosis, and measurement through designated internal roles and transparent dashboards, thereby eliminating the need for external consultants. This mechanism directly counters the procrastination and ownership deficits revealed by H₀₆ and H₀₅.

Second, multimodal measurement via the Integrated Change Measurement Framework (ICMF) and Holistic Change Effectiveness Index (HCEI) integrates emotional (Psychological Safety Index), cognitive (Leadership Congruence Score), and operational (Organizational Adaptability Rate) data into a single composite index. By transcending conventional financial KPIs, it addresses the behavioral gaps identified in H₀₂ and H₀₄.

Third, the action-oriented closed-loop cycle (Self-Diagnosis and Action, SDA) structures change into diagnose-act-re-evaluate phases.

Practical Extensions of the ISDMF

- The Best Practices Journal of Organizational Change (Georgian Case) establishes a confidential, cross-organizational platform for anonymous submission of SDA Cycle outcomes, quarterly curated reports of anonymized case studies, and sector-specific working groups. By breaking down knowledge silos, it converts individual experiments into collective intelligence, enabling LTB’s process innovations to inform Elite and Public Registry risk protocols ultimately benefiting the Georgian Railway.
- The Guideline for Change Management in Georgia is a culturally calibrated playbook that adapts global models (Kotter, Lewin, PDCA) to Georgian hierarchical norms, respect

networks, and transitional realities. Key adaptations include framing urgency as a national duty and family legacy, leveraging informal elder advisors in coalition building, and celebrating short-term wins through public recognition rituals aligned with Georgian hospitality traditions. Delivered as a bilingual visual handbook with one-page SDA templates and an HCEI calculator, it is distributed free of charge through partnerships with the Georgian Chamber of Commerce, the Ministry of Economy, and universities.

The two initiatives operate in synergy to cultivate a sustainable culture of change in Georgia. The Guideline provides the strategic roadmap for culturally conscious transformation, while the Journal supplies the empirical learning loop and continuous refinement. Together they form a living national cycle: Guideline → Implementation → Measurement → Shared Learning → Continuous Improvement.

The integrated suite of instruments—the Integrated Self-Diagnosis and Measurement Framework (ISDMF), Self-Diagnosis and Action (SDA) Cycle, Holistic Change Effectiveness Index (HCEI), Best Practices Journal, and Georgian Change Management Guideline—creates a convergent ecosystem where knowledge, measurement, and culture reinforce one another. This constitutes the future of change management: success measured not only by outcomes, but by the depth of learning and evolution embedded in the process itself.

Final Conclusion

This work establishes that successful organizational change in Georgia hinges on transcending external dependency and internal procrastination through mandated discipline and measured self-accountability. The Integrated Self-Diagnosis and Measurement Framework (ISDMF)—with its Self-Diagnosis and Action (SDA) Cycle and Holistic Change Effectiveness Index (HCEI)—delivers a self-contained, replicable system that transforms change management from a reactive crisis response into a proactive, institutionalized competency (George, 2007). By integrating internal rigor, cultural calibration, and national learning, the ISDMF equips Georgian organizations not only to execute change, but to master its evolution.

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LEADING THE BORDERLESS TEAM: MANAGEMENT PRACTICES FOR A HYBRID AND GEOGRAPHICALLY DISPERSED INTERNATIONAL WORKFORCE

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Abstract: *The accelerated and permanent shift to hybrid and remote work models has fundamentally altered the operational reality of multinational corporations, giving rise to the "borderless team"—a geographically dispersed, culturally diverse, and digitally connected workforce. This paper explores the unique challenges inherent in leading these teams, including exacerbated communication gaps, a deficit of trust and cohesion, amplified cultural hurdles, and the paradox of performance management at a distance. Through a conceptual analysis of extant literature, the study synthesizes these challenges and proposes a comprehensive framework of management practices designed to foster effectiveness. This framework is structured around four critical domains: (1) Intentional Communication and Technology Stewardship, emphasizing structured rhythms and cloud-based infrastructure; (2) Deliberate Relationship and Trust Building; (3) Inclusive Leadership and Cultural Intelligence to mitigate proximity bias; and (4) Outcome-Oriented Performance Management. The study concludes that success in this new paradigm requires a deliberate evolution from informal, office-centric management to a structured, inclusive, and technology-facilitated leadership approach, redefining the international manager's role from supervisor to connector and strategic facilitator.*

Keywords: *borderless teams, hybrid work, global workforce management, international leadership, virtual collaboration*

1. INTRODUCTION: THE NEW GEOGRAPHY OF WORK

The landscape of international management has undergone one of the most significant transformations in decades. While virtual work was often an exception or a perk in the pre-pandemic era, it has now become a standard operating model for many multinational enterprises (MNEs). According to a report by McKinsey Global Institute (2021), remote work has stabilized at levels three to five times higher than before the pandemic, suggesting a permanent structural shift. This has given rise to the "borderless team", a hybrid, geographically dispersed international workforce that operates across time zones, national cultures, and digital platforms, largely unbounded by traditional physical offices. This new reality presents a fundamental challenge to established international management paradigms.

Models built on co-located teamwork, traditional expatriate assignments, and management by physical presence are increasingly obsolete (Neeley, 2015). Managers are now tasked with leading teams they may never meet in person, fostering collaboration across digital interfaces, and maintaining organizational culture in a fragmented environment.

The core problem is that the inherent complexities of international management-cultural differences, communication barriers, and geographic distance, are now amplified by the hybrid work model, creating a new set of managerial challenges that demand novel solutions.

Therefore, this paper aims to address the following research questions:

1. What are the primary challenges in leading hybrid, geographically dispersed international teams?
2. What management practices and frameworks are most effective in fostering collaboration, performance, trust, and inclusion within these borderless teams?

This paper will proceed by first reviewing the relevant literature on virtual and global teams to establish a theoretical foundation. It will then delineate the core challenges of the borderless hybrid team. Subsequently, it will propose a structured framework of effective management practices, supported by theoretical and empirical evidence.

Finally, the discussion will synthesize the implications for international management theory and practice, followed by a conclusion and suggestions for future research.

2. LITERATURE REVIEW: FROM INTERNATIONAL TEAMS TO BORDERLESS NETWORKS

The concept of working across distance is not new. The literature on "virtual teams" has existed for over two decades, defined as "groups of geographically and/or organizationally dispersed coworkers that are assembled using a combination of telecommunications and information technologies to accomplish an organizational task" (Townsend et al., 1998, p. 17).

This research stream identified early challenges, such as building trust without face-to-face interaction (Jarvenpaa & Leidner, 1999) and the limitations of communication technologies (Daft & Lengel, 1986). The evolution continued with the study of "global virtual teams" (GVTs), which added the critical dimension of cross-cultural complexity to the mix. Researchers like Gibson et al. (2014) explored how cultural values impact communication styles, conflict resolution, and perceptions of time in dispersed teams.

The work of Shachaf (2008) highlighted that cultural diversity, while a potential source of innovation, can also lead to misunderstandings and process losses if not managed effectively. However, a significant gap remains in the literature. Much of the earlier research on GVTs focused on temporary, project-based teams or scenarios where remote work was a supplement to a primarily co-located model. The current phenomenon of permanent, mainstream, and hybrid borderless teams represents a qualitative shift. The hybrid model, where some members are co-located in an office and others are fully remote, introduces new dynamics like "proximity bias" (Hinds, 2021), which was less prevalent in fully distributed teams.

The current challenge is not just managing distance, but managing a new, complex ecology of work where the lines between physical and digital, and local and global, are permanently blurred. This paper seeks to address this gap by synthesizing existing knowledge and applying it to this new, hybrid context.

3. LEADING BORDERLESS TEAMS: BEYOND TRADITIONAL MANAGEMENT

Leading a borderless team is not merely an extension of traditional management practice; it represents a qualitative transformation in how leadership is conceptualized, enacted, and sustained. The competencies that once defined effective leadership in co-located environments, physical visibility, direct supervision, and spontaneous communication, are insufficient in a context defined by dispersion, digital mediation, and temporal asynchronicity. The manager of a borderless team must navigate an intricate web of interconnected challenges that span communication, trust, culture, and performance evaluation. Each of these dimensions interacts dynamically, amplifying or mitigating the others, thereby demanding a holistic and adaptive leadership approach.

3.1. The Coordination and Communication Gap

Perhaps the most immediate and visible challenge in leading borderless teams concerns the coordination and communication gap that emerges when traditional communication channels are disrupted. In conventional, co-located teams, coordination is often facilitated by synchronous

communication, face-to-face meetings, hallway conversations, and spontaneous updates. In contrast, borderless teams depend heavily on asynchronous communication, which, as Maznevski and Chudoba (2000) note, can delay the exchange of information, elongate decision-making cycles, and create temporal fragmentation.

The loss of informal and spontaneous communication, such as the so-called “watercooler” conversations, has profound implications for team dynamics and knowledge sharing. These informal interactions serve as a cornerstone for organizational socialization, fostering a shared understanding of context and culture. When such interactions vanish, teams risk falling into what Gibbs et al. (2021) describe as “contextual fragmentation”, a condition where members operate based on incomplete or inconsistent understandings of goals, norms, and expectations. Moreover, as communication becomes increasingly formalized, scheduled, and mediated by technology, the free flow of ideas that fuels creativity and innovation may be stifled. Without visual cues or informal dialogue, managers also find it more difficult to gauge team sentiment, morale, or engagement, making emotional intelligence and proactive check-ins indispensable leadership practices.

3.2. The Trust and Cohesion Deficit

Trust remains the bedrock of effective teamwork, yet its construction within borderless teams poses distinctive challenges. In co-located settings, trust typically evolves through repeated, informal social interactions, shared lunches, casual exchanges, or collaborative problem-solving moments. In virtual or hybrid environments, however, these opportunities for spontaneous trust formation are limited or absent. Jarvenpaa and Leidner (1999) introduced the notion of “swift trust” to describe the fragile and situational trust that virtual teams must develop rapidly to function effectively. Such trust depends heavily on consistent communication, reliability, and perceived competence, rather than on interpersonal familiarity.

The challenge is further exacerbated by “proximity bias”, defined by Hinds (2021) as the unconscious inclination of leaders to favor employees who are physically closer to them. In hybrid contexts, where some employees work in the office while others remain remote, this bias can lead to the creation of a two-tier organizational system. The “in-group”, those in physical proximity to leadership, may enjoy greater access to informal networks, mentorship, and visibility, while the “out-group” of remote workers experiences isolation, exclusion, or limited career advancement opportunities. This phenomenon undermines both equity and team cohesion, eroding the very trust required for effective collaboration. To counteract this deficit, leaders must practice intentional inclusivity-actively seeking input from remote members, ensuring equal access to information, and modeling equitable communication behaviors.

3.3. The Amplified Cultural and Linguistic Hurdles

While cultural diversity has long been a defining characteristic of international management, the hybrid digital environment introduces new complexities that magnify traditional cross-cultural challenges. Communication in borderless teams is frequently mediated by text-based channels. emails, chat platforms, and collaborative documents, where tone, nuance, and contextual cues are easily lost. As Gibson et al. (2014) observe, communication styles that are direct or indirect may be misinterpreted in such media, leading to misunderstandings and interpersonal tension.

In particular, team members from high-context cultures, who rely on implicit cues and shared situational understanding, may struggle in low-context digital environments that demand explicit articulation of every detail. Conversely, members from low-context cultures may perceive such implicit communication as vague or inefficient. Similarly, differing attitudes toward hierarchy and authority can complicate virtual interactions, where turn-taking and deference norms are harder to interpret. For example, a junior employee from a hierarchical culture may hesitate to speak up during a video call, interpreting silence as respect, whereas colleagues from egalitarian cultures may perceive this as disengagement. The digital medium, far from being neutral, can thus act as an amplifier of

cross-cultural friction, exacerbating misunderstandings that might otherwise be resolved through informal or nonverbal cues in face-to-face settings.

Leaders of borderless teams must therefore develop heightened cultural intelligence (CQ), adapting their communication styles to accommodate diverse cultural expectations and ensuring that digital tools are used inclusively. Training in intercultural competence and the establishment of clear communication norms such as explicit feedback protocols or structured turn-taking in meetings, can help mitigate these challenges.

3.4. The Performance Management Paradox

The final major challenge in leading borderless teams lies in the performance management paradox. Traditional performance evaluation systems, grounded in visible indicators such as “face time,” attendance, or observable effort, become ineffective and inequitable in distributed settings. As Stanciu (2022) notes, managers in borderless environments face the paradoxical task of evaluating the contributions of individuals they rarely see. Without physical visibility, leaders may inadvertently rely on digital presence metrics, such as online activity, message frequency, or hours logged which often reflect “productivity theater” rather than genuine output or impact.

Conversely, in the absence of clear and consistent performance metrics, high-performing remote employees may remain invisible, their contributions undervalued compared to those who are physically present. This inequity not only undermines motivation but can also reinforce proximity bias and cultural misunderstanding. Overcoming this paradox requires a fundamental paradigm shift in managerial mindset from evaluating presence and activity to assessing outcomes and impact. Such a shift demands explicit goal-setting, transparent communication of expectations, and a foundation of mutual trust. Managers must also cultivate data-informed yet empathetic evaluation systems, using both qualitative feedback and quantitative outcomes to assess performance fairly. Moreover, organizational systems, particularly HR policies and reward structures, must be reconfigured to support this outcomes-based logic, ensuring that remote and hybrid employees are recognized equitably for their contributions.

3.5. Integrating the Challenges: Toward a New Leadership Model

The challenges of coordination, trust, culture, and performance do not exist in isolation; rather, they form an interdependent system that defines the lived reality of borderless leadership. Inefficient communication can erode trust; cultural misalignment can distort performance evaluations; and lack of clarity in goals can exacerbate both coordination failures and relational tensions. To lead effectively under these conditions, managers must move beyond reactive problem-solving and embrace a systems-oriented leadership model—one that recognizes the interconnectivity of these dynamics and responds through deliberate, holistic strategies.

Leadership in borderless teams thus requires a blend of technological fluency, cultural sensitivity, and emotional intelligence. It demands both strategic design to structure communication and workflow and human-centered empathy, to maintain inclusion and trust across distance. By reframing leadership as the art of building coherence amid dispersion, managers can transform these challenges into opportunities for innovation and inclusivity in global collaboration.

4. A FRAMEWORK OF EFFECTIVE MANAGEMENT PRACTICES

To navigate these challenges, international managers must adopt a deliberate and structured set of practices. The proposed framework is organized into four key domains.

4.1. Practice Area 1: Intentional Communication and Technology Stewardship

- Structured Communication Rhythms: Implement a cadence of meetings with clear purposes (e.g., daily 15-minute check-ins for alignment, weekly deep-dive syncs, monthly strategic reviews). This creates predictability and ensures regular contact (Munteanu, 2021).

Technology Stack Strategy: Curate a suite of tools for different purposes and ensure team proficiency. For example, use Slack/Teams for quick, asynchronous questions, Asana/Trello for project tracking, and Zoom for relationship-building meetings. The foundational infrastructure for these digital tools, often reliant on cloud computing, is critical, as it provides the scalable and accessible platform that makes borderless collaboration technically feasible (Dzitac et al., 2017). A key principle is to match the richness of the communication technology to the complexity of the task at hand.

Asynchronous-First Mindset: Encourage a culture where work does not require an immediate, real-time response. This empowers team members in different time zones and promotes deep work. This involves creating detailed documentation, using video updates, and leveraging collaborative documents.

4.2. Practice Area 2: Deliberate Relationship and Trust Building

Trust must be engineered, not left to chance.

- **Structured Social Interaction:** Schedule virtual coffee chats, online team-building games, and dedicated "virtual watercooler" channels. These interactions must be facilitated and not optional to ensure inclusion of all members, regardless of location.
- **Purposeful Onboarding and Offsites:** Invest significantly in the initial onboarding of remote members to integrate them into the culture. Furthermore, periodic face-to-face offsites, even if infrequent, are critical investments for building the foundational social capital and trust that sustains the team during long periods of virtual work (Neeley, 2015).
- **Creating Psychological Safety:** Leaders must actively model vulnerability, admit mistakes, and create forums where all team members feel safe to express ideas and concerns without fear of reprisal (Edmondson, 2018). This is especially crucial for members from cultures that are less assertive.

4.3. Practice Area 3: Inclusive Leadership and Cultural Intelligence

The manager's role shifts from a central commander to a facilitator of inclusion.

- **Mitigating Proximity Bias:** Managers must take conscious steps to ensure equity. This includes rotating meeting times to share the burden of odd hours, establishing rules that remote participants speak first, and mandating camera-on or camera-off flexibility to avoid singling out individuals (Hinds, 2021).
- **Explicit Cultural Norm-Setting:** Instead of assuming shared norms, the team should co-create "team working agreements." These explicit documents outline expectations for communication (response times, preferred channels), decision-making, and feedback, taking into account the diverse cultural backgrounds of team members (Meyer, 2014).
- **Leader as Connector:** The manager actively works to create direct connections between team members, reducing their role as a central hub and information bottleneck. This fosters a stronger, more resilient network within the team.

4.4. Practice Area 4: Outcome-Oriented Performance Management

Success must be defined by output, not input.

- **Clear Goals and Metrics:** Implement goal-setting frameworks like Objectives and Key Results (OKRs) to provide absolute clarity on what needs to be achieved and how success will be measured (Doran, 1981). This provides autonomy and empowers team members to manage their own work processes.
- **Regular, Forward-Looking Feedback:** Replace the annual performance review with a continuous process of coaching and development. Regular one-on-one conversations should focus on removing obstacles, providing resources, and discussing career growth, rather than solely on past performance (Stanciu, 2022).

5. DISCUSSION AND IMPLICATIONS

The emergence of the borderless team represents not merely a change in organizational design but a profound paradigm shift in the theory and practice of international management. As globalization and digitalization converge, the boundaries that once defined traditional work structures are dissolving. Technological advancement, the normalization of remote collaboration, and the growing emphasis on flexibility have collectively given rise to teams that exist and operate beyond geography. These teams function across borders, time zones, and cultures, relying on virtual platforms and asynchronous communication to achieve common goals. This transformation calls for a fundamental rethinking of how organizations coordinate, lead, and sustain performance in transnational environments.

In this context, the paper argues that the traditional managerial toolkit developed in an era when co-location and physical presence were the norm is increasingly inadequate for addressing the realities of the hybrid and fully virtual workplace. Classical leadership models tend to rely on visibility, proximity, and informal interaction as mechanisms for trust-building and control. However, in a world where collaboration occurs primarily through screens and digital interfaces, these assumptions no longer hold. The managerial role must, therefore, evolve from supervision to digital facilitation, from command to connection, and from control to coordination across dispersed and diverse networks.

The framework proposed in this study seeks to address these emerging challenges by synthesizing established theories of global leadership, cross-cultural management, and virtual team dynamics, and applying them to the novel context of permanent hybrid work. It proposes a structured approach for leading borderless teams that emphasizes intentionality, empathy, and inclusivity in digital interactions. The framework highlights the need for leaders to design communication patterns, foster psychological safety in virtual settings, and maintain team cohesion without relying on physical presence. In this sense, leadership in borderless teams becomes both more deliberate and more human-centered, as it must compensate for the absence of traditional social cues and spontaneous interaction.

The theoretical implications of this paradigm shift are considerable. Established models of global team effectiveness, such as those emphasizing cultural diversity, task interdependence, and shared identity, must now be revised to incorporate the hybrid dimension explicitly. Hybrid work introduces unique biases, such as proximity bias (favoring employees who are physically closer) and visibility bias (rewarding those more active online), that can distort performance evaluation and inclusion. Moreover, the very competencies of international managers must be reconceptualized. While cross-cultural sensitivity remains central, new competencies, digital literacy, virtual empathy, inclusive facilitation, and cultural intelligence in online contexts, become critical to sustaining trust and engagement in teams that never meet in person.

From a practical standpoint, the implications for organizations are equally far-reaching. Businesses must invest in developing leaders who can effectively navigate this new reality. Training programs should focus on strengthening communication skills in virtual environments, understanding intercultural nuances in digital interaction, and cultivating the ability to motivate and evaluate employees based on outcomes rather than presence. Furthermore, organizational systems and processes, including performance appraisal, promotion criteria, and talent management, must be redesigned to be location-agnostic and outcome-driven. Such adjustments ensure that fairness and inclusion are maintained even when employees operate from different regions or time zones.

Finally, the ability to build organizational culture, trust, and high performance in borderless teams will determine which organizations thrive in the future. Success in this environment depends on the capacity to foster belonging, align shared purpose, and maintain cohesion without the traditional anchors of physical proximity. The borderless team thus becomes a symbol of both the opportunities and challenges of global management in the twenty-first century. Those organizations that master the art of leading without borders, balancing technological efficiency with human connection, will define the next era of international management practice.

6. CONCLUSION AND FUTURE RESEARCH

LEADING THE BORDERLESS TEAM: MANAGEMENT PRACTICES FOR A HYBRID AND GEOGRAPHICALLY DISPERSED INTERNATIONAL WORKFORCE

The transition to borderless teams is increasingly recognized as a defining feature of contemporary international business. The traditional concept of teams as geographically bounded units has given way to a new organizational reality in which collaboration transcends spatial and temporal limitations. This transformation has been accelerated by advances in digital communication technologies, the normalization of hybrid work structures, and the strategic pursuit of global talent. The borderless team therefore represents both a response to and a driver of globalization, reflecting how technology and culture interact to redefine the nature of work and management.

At a structural level, borderless teams challenge many of the long-standing assumptions embedded in international management theory. Historically, global teams operated within clear geographic and cultural boundaries, and physical co-location was viewed as essential for cohesion, creativity, and trust. In contrast, borderless teams operate across multiple time zones and digital platforms, relying on asynchronous communication and virtual interaction as the foundation of coordination. This change compels managers and scholars alike to reconsider the very notion of presence, leadership, and collaboration in the international business environment.

Despite their potential advantages, such as enhanced flexibility, access to global expertise, and reduced operational costs, borderless teams also present a series of complex challenges. Chief among these are communication gaps, which arise when team members interpret messages differently due to linguistic, cultural, or technological barriers. The absence of nonverbal cues and spontaneous dialogue can lead to misinterpretation and disengagement. In addition, trust deficits often emerge in virtual environments where personal interaction is limited. Without deliberate effort, employees may perceive unequal access to information or opportunities, undermining psychological safety and team cohesion. Finally, the amplification of cultural hurdles, stemming from diverse communication styles, attitudes toward hierarchy, and varying expectations of time, can further complicate collaboration if not carefully managed.

Addressing these challenges requires a deliberate and theoretically grounded approach to leadership. The paper therefore proposes a comprehensive framework of management practices tailored to the borderless context. The first component, intentional communication, emphasizes structured dialogue, transparency, and empathy to ensure mutual understanding across digital platforms. The second, deliberate trust-building, involves consistent feedback, recognition of contributions, and equitable participation in decision-making. The third, inclusive leadership, calls for leaders to foster psychological safety and cultural awareness, creating a space where diverse perspectives are valued. The final element, outcome-oriented performance management, redefines productivity metrics by focusing on results rather than presence or visibility. Collectively, these principles provide a roadmap for leading distributed teams with clarity, fairness, and purpose.

The effectiveness of such a framework, however, depends on a broader organizational commitment to systemic change. It is insufficient for individual managers to adapt in isolation; organizations must embed the principles of borderless collaboration into their structures, policies, and reward systems. This entails redesigning human resource management (HRM) practices to ensure they are location-agnostic, equitable, and aligned with outcome-based evaluation. Performance appraisal systems, promotion criteria, and professional development programs must be recalibrated to account for the realities of hybrid and remote work. Additionally, organizations must invest in technological infrastructure that supports transparent communication, collaboration, and knowledge sharing across geographical divides.

From a scholarly perspective, the transition to borderless teams opens a wide range of research opportunities. Future studies should seek to empirically test the proposed management framework through both quantitative and qualitative methodologies. Large-scale surveys could examine correlations between leadership practices and performance outcomes in multinational enterprises (MNEs), while ethnographic and case-based approaches could provide nuanced insights into the lived experiences of managers and employees within borderless environments. Comparative analyses across

industries, regions, and organizational sizes would further illuminate how contextual factors mediate the success of borderless collaboration.

Beyond short-term outcomes, longitudinal research is essential to understanding the long-term consequences of hybrid and borderless work. Questions remain regarding the impact of sustained virtual collaboration on innovation, employee well-being, identity formation, and career progression. Remote workers may face challenges in gaining visibility, building informal networks, and accessing mentorship opportunities, which can in turn affect promotion and retention rates. Understanding these dynamics is crucial for designing inclusive and sustainable global organizations that balance flexibility with equity.

An emerging area of inquiry concerns the intersection between Artificial Intelligence (AI) and borderless teamwork. As AI becomes increasingly integrated into digital work platforms, it has the potential to transform the way teams communicate, coordinate, and make decisions. AI-powered tools can facilitate cross-cultural communication through real-time translation and sentiment analysis, provide data-driven insights into team health, and mitigate human biases by offering objective assessments of contribution and engagement. However, the reliance on algorithmic systems also raises new ethical and managerial questions concerning privacy, transparency, and the risk of over-automation. Future research should thus explore how AI can be harnessed not only as a technological enabler but also as a catalyst for inclusive and equitable global collaboration.

Ultimately, the transition to borderless teams underscores the need for an ongoing rethinking of leadership and organizational design in international business. The future of work will be defined not by physical presence but by the ability to connect, communicate, and collaborate effectively across distance and difference. As organizations continue to navigate this evolving landscape, success will belong to those that master the art of cultivating trust, culture, and shared purpose in a world without borders. This transformation calls for a synthesis of technological capability and human-centered leadership, an approach that integrates efficiency with empathy, structure with flexibility, and global reach with local understanding.

In conclusion, the study of borderless teams invites scholars and practitioners to engage in a deeper dialogue about the meaning of leadership in the digital age. The challenges are significant, but so too are the opportunities for innovation, inclusion, and sustainable growth. As technology continues to blur the boundaries of work, the true test of international management will lie in its capacity to build cohesive, high-performing, and culturally intelligent teams that thrive beyond geography.

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THE IMPACT OF INFLUENCER MARKETING ON THE CONSUMER BEHAVIOUR OF GENERATION Z AND MILLENNIALS

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Abstract: *The paper focuses on the impact of influencer marketing on the consumer behaviour of younger generations, that is, Generation Z and Generation Y (Millennials), emphasizing how influencers shape their perception, attitude, behaviour towards a brand. Using literature review methodology, the study highlights the results of recent research papers, which clearly indicate that there is a strong positive correlation between the influencer's credibility and customers' attitude towards the brand. The paper provides a substantial contribution to the existing body of literature by presenting insights into the consumer behaviour of younger generations. Similarly, potential negative long-term impacts of relying on influencers for endorsing products are also briefly discussed. In conclusion, influencer marketing could be proven advantageous for businesses, however, potential risks such as greenwashing and misalignment of brand-influencer values must be taken into consideration. Therefore, for the effectiveness of social media influencing, business owners should ensure and maintain consumer trust and prevent potential reputational as well as ethical risks.*

Keywords: *Influencer marketing, consumer behaviour, social media influencers, consumer trust, greenwashing*

1 Introduction

The existing literature (Pascalau & Urziceanu, 2020; Kaur, 2023) clearly states that traditional ways of marketing are slowly disappearing. In the present-day context, where the usage of social media platforms is on rise, especially among younger generations such as Generation Z (Gen Z) and Generation Y/Millennials (Gen Y), it is natural that businesses are shifting their marketing strategy and advertising approach. The main motive behind this is that they want to increase their visibility online, where youngsters are now spending majority of their time. In this context, it is essential for the companies to make such adjustments from time to time as per the evolving lifestyle of young consumers because this will help them to survive on the marketplace over a longer period of time and have a competitive advantage (Kaur et al., 2023). As a result, there is a surge in the number of businesses that indulge in social media and adopt influencer marketing as their marketing strategy (Statista, 2025).

Since Gen Z and Gen Y are the primary users of social media platforms, it is essential to know the impact of influencer marketing on their buying behaviour. There are numerous studies that have been done on this subject. On one side, the previous scholars argue that influencer marketing can have a positive impact on the consumer behaviour of younger generations. On the other side, there are researchers that warn business owners of potential long-term risks such as compromising brand credibility by associating with influencers who promote greenwashing claims or were part of controversies. Hence, there is no strong consensus among the scholars regarding this subject. Consequently, currently, there is a literature gap that prevails concerning the effectiveness of influencer marketing on the consumer behaviour of members from Gen Z and Gen Y. Moreover, the research topic is of utmost importance due to its practical implications in business industry. For instance, if an organization aims to target younger generation, should it rely on influencers to endorse

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the products and services? The present paper attempts to answer such questions with the help of literature review methodology by presenting various perspectives of recent researchers.

Hence, the aim of this study is to discuss the concept of influencer marketing in the current context by summarizing what recent researchers claim regarding its impact on young consumers' perception, attitude and behaviour. Therefore, the present article attempts to close the existing literature gap by providing more clarity on the given subject and answering the following Research Questions (RQs):

RQ 1: What is the impact of influencer marketing on consumer behaviour of Generation Z?

RQ 2: What is the impact of influencer marketing on consumer behaviour of Generation Y (Millennials)?

RQ 3: How do influencers lure members of younger generation to change their perception regarding a brand and impact their buying intention?

RQ 4: What are the most popular social media channels where Gen Zs and Millennials commonly come across content shared by influencers?

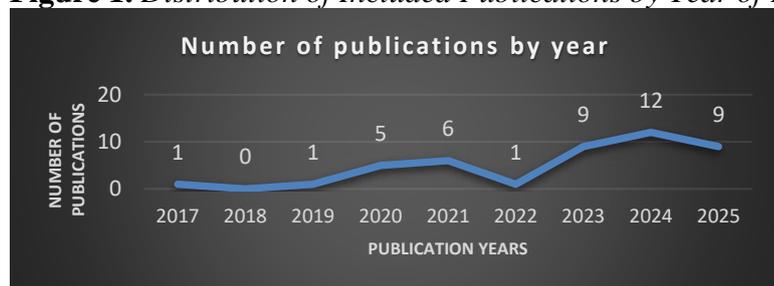
RQ 5: What are the potential long-term risks of relying on influencers for endorsing products or services of a company?

Responding to the above RQs with the help of relevant research papers on the existing subject provides the business managers, start-up owners as well as scholars of this field a comprehensive understanding regarding the impact of influencer marketing on the younger generations. This, in turn, can help them to strategize and plan accordingly while attracting potential customers from the youth.

2 Methodology

In order to answer the 5 RQs mentioned previously, a structured literature review methodology is employed for presenting relevant but different perspectives of scholars that studied this subject. In the first phase, relevant keywords were introduced in various search engines such as Google Scholar, Web of Science, Scopus and ScienceDirect. In the second phase, the irrelevant papers were filtered and screened for only including the paper which focused on Gen Zs and Millennials. Similarly, inclusion criteria also took into consideration papers that were of superior quality, well-written and had more citations, that is, are more impactful. Moreover, a preference was given to more recently published papers for capturing the highly dynamic nature of this field as well as the recent trends that are emerging as a result of increasing screen time of young audience. As a result, in total 44 records were selected for this paper and their distribution by year of publication can be observed in Figure 1.

Figure 1. *Distribution of Included Publications by Year of Publication (2017–2025)*

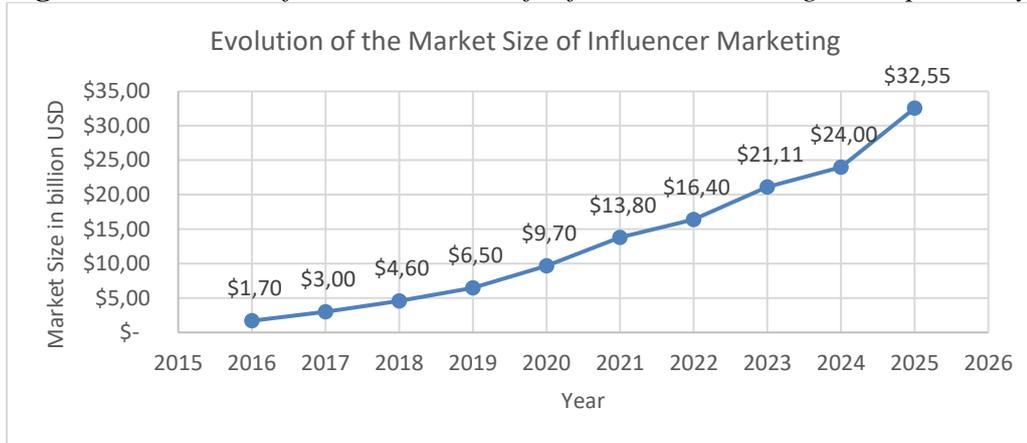


Therefore, the present study attempts to highlight some of the findings of the recent research works about the impact of influencer marketing on consumer behaviour of younger generations (more precisely, Gen Z and Y). Besides, conference articles, journal papers, studies and reports that emphasized the latest market trends were also selected for this paper to offer a more updated perspective regarding the concept. Therefore, this study presents the concept through a fresh perspective by critically analysing the latest studies.

3 Literature Review

3.1 Impact of influencer marketing on consumer behaviour

Figure 2. Evolution of the Market Size of Influencer Marketing in the past ten years (in billion USD)



Source: Statista, 2025

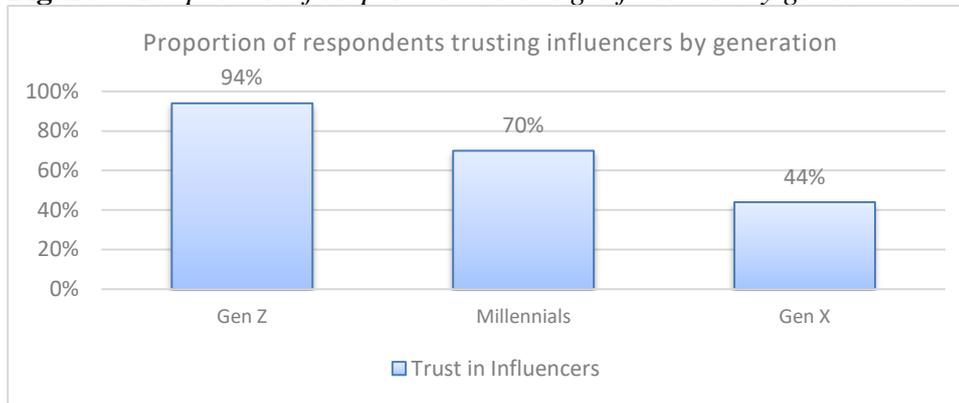
Firstly, as per the existing data (Figure 2), it is clear that the market size of influencer marketing is expanding over time. Figure 2 clearly indicates that in the past ten years, there has been a continuous increase in the market value of global influencer marketing and as of last year, this value reached 32.55 billion US dollars. This suggests that managers worldwide are recognizing the significance of influencer marketing and the organizations are adopting this marketing strategy for gaining a competitive advantage. Secondly, due to its increasing popularity, influencer marketing is an actively researched topic by scholars and a substantial amount of literature body suggests that it has a crucial impact on the consumer behaviour. Therefore, based on the aforementioned arguments, one may conclude that analysing the different perspectives of researchers and academics can provide a comprehensive understanding about what do they believe regarding this subject. Additionally, this can also allow one to extract essential insights regarding the preferences of consumers, such as the most popular social media platforms and so on. Besides, it is a well-known fact that the use of digital media tools such as social media is more common among consumers belonging to younger generation. Consequently, it is more relevant and meaningful to analyse only the studies that primarily focus on the change in consumer behaviour of younger generation as a result of influencer marketing. Therefore, Chen et al. (2024) claim that it is a subject of practical implications as the business owners can use the insights resulting from this literature analysis for decision-making in their own companies.

While there is no doubt that influencers have a huge following due to various reasons (such as making engaging content) and not just because they promote products, it is essential to mention that according to a report published by Morning Consult (2019), most of the respondents from Gen Z and Millennials choose to follow certain influencers primarily due to their authenticity and trustworthiness, engaging personalities as well as more knowledge about something that the followers genuinely care about. This shows that influencers already have well-established relationship of trust with their followers. Using this trust factor, business owners can approach such influencers for getting known among young consumers and eventually, increase their popularity. If in case a brand succeeds in gaining immense fame among online community and capture word-of-mouth, this can significantly reflect in their sales volume and overall financial performance, which is the ultimate objective of all companies. Present research indicates that perceived influencer authenticity and credibility is a major factor of the followers' perception towards a brand and buying intention. When the followers of an influencer believe that the shared content is authentic and trustworthy, persuasion amplifies via both central as well as peripheral pathways. Consequently, investigating the function of persuasive

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knowledge in influencer marketing may yield additional research insights (Breves et al., 2021; Liu & Zheng, 2024). However, based on the presented arguments, it is clear that when a brand collaborates with not only a famous, but a trustworthy as well as reputable influencer, this can help the company in improving brand credibility and eventually, their perception towards the brand. This positive impact on the brand perception also affects buying intention on a long-term.

Figure 3. Proportion of respondents trusting influencers by generation



Source: Market.us. Scoop, 2025

As shown in the figure above, during a survey, a significantly high percentage of respondents from Gen Z (94%) affirmed that they trust influencers, followed by Millennials/ Gen Y (70%) and Gen X (44%). This clearly indicates that there is a stronger relationship between influencers and followers from younger generations (more precisely Gen Z and Gen Y). As a result, one may conclude that it is more efficient for business owners to use influencer marketing, especially if they intend to target people from younger generation. Similarly, this explains why that there are increasing research papers that study the impact of influencers on the consumer behaviour of this particular age group.

According to a survey (Radwan et al., 2021) conducted among youngsters from the United Arab Emirates (UAE), influencers attract the attention of young people by luring them to look for more information regarding the products and to visit sellers' websites. This may result in grabbing the attention of youngsters and keeping them engaged. Increased engagement rates have a significant impact on consumer trust and loyalty, thereby positively influencing the consumer behaviour (Al-Haraizah et al., 2025).

Nadanyiova and Sujanska (2023) explain that a purchaser's attitude towards advertising is significantly influenced by his perception of the influencer's credibility. This indicates that if a person associated with a lot of controversies is endorsing some products, this may result in potential consumers forming a negative viewpoint regarding the promoted items and the business in general. Therefore, it is advisable to only choose well-reputed influencers, whose values are also aligned with those of the company. A company may make the mistake of preferring a more well-known influencer for promoting their products. Nevertheless, it is essential to note that fame is not the only attribute that the business owners should prioritize while selecting an influencer. While an influencer with higher number of followers may double the reach of the product, a nano-influencer with relatable audience can make a more meaningful difference by bringing the right kind of audience to the business owners. For instance, if a mega fashion influencer promotes products for a food retail company, the likelihood of conversion will be lower. In contrast, if a nano fashion influencer promotes products of a fast fashion clothing, the probability of conversion is higher due to the like-minded audience. However, relying only on social media influencing and strategically choosing an adequate influencer is not a practical solution for capturing a word-of-mouth or growing a business.

According to a study (Moodley & Ntobaki, 2024), influencers have a significant impact on how consumers behave, and their perceived relatability and authenticity serve as key factors in this process. The findings, nevertheless, also highlight the potential risks of negative reviews, emphasizing the necessity for firms to properly monitor their relation with influencers. This implies that as much as choosing the correct marketing channel is important for reaching the target audience, it is also a prerequisite to have a good product quality, which genuinely satisfies the consumers. Relying solely on social media influencing will not result in long-term success. In other words, influencer marketing is a powerful weapon that can be used by a company for further enhancing the chances of success.

Additionally, according to Radwan et al. (2021), it is proven that interest, demand, buying intention, attitude, perception as well as behaviour are also highly impacted by an influencer’s social media activities. All this indicates that social media has transformed the way one perceives, interacts and communicates, thereby pushing sellers to adjust to the market dynamics and recent shifts. On top of this, as mentioned by previous research (Kaur, 2023), the traditional ways of marketing are slowly disappearing. This is an indication for the businesses to not rely anymore on conventional methods for reaching their audience, thereby further emphasizing the relevance and significance of influencer marketing in the present market. Moreover, a growing online presence of the new generations as well as an annual increase in the number of hours spent by them on social media channels further necessitates the companies to reorient their marketing strategies toward more personalized and digitalized approaches such as influencer marketing. Furthermore, due to a reduced attention span of youngsters because of high consumption of short-form video content (Asif & Kazi, 2024), it is even more challenging currently for the businesses to increase their conversion and influence consumer behaviour. Only engaging content shared on the adequate channel by an influencer whose values align with the business has the potential to make a meaningful difference in the buying decision.

The above arguments justify that since the last two decades; social media platforms have become a marketing communication hub for organizations. Brands attempt to reshape consumers’ perception towards them as this can ultimately impact their buying decision. In this context, influencer marketing acts as a weapon for those marketers who want to change the perception of young customers by directly communicating to them through influencers.

3.2 Impact of influencer marketing on consumer behaviour of Generation Z

According to present researchers (Nadanyiova & Sujanska, 2023), Generation Z or Gen Z represent the largest segment for influencer marketing since they are the most active on social media platforms. This is the audience which was born between 1997 and 2012 and since they started growing up in a digital age, they have never experienced a period without internet (Trifan & Pantea, 2024).

Gen Z is considered to be dynamic, flexible, fast-paced, and, social media platforms like Instagram provide intriguing, tempting, captivating material in smaller portions, which not only grabs their attention but also maintain their engagement rate (Bhatt, Vyas & Vohra, 2025). Nevertheless, the most surprising fact is that although influencer marketing has gained recognition as a marketing communication instrument, there is still a lack of research that concentrates on its impact on Generation Z (Nadanyiova & Sujanska, 2023). Therefore, future scholars and researchers must focus on the younger generations while studying this concept due to its increased practical implications (Chen et al., 2024). Being a tech-savvy (Trifan & Pantea, 2024), Gen Zs are relatively more digitally literate, smarter and even more active than the older generations. Moreover, Gen Zs are considered to be one of the most socially conscious generations, which is the reason why brands that promote sustainability, diversity, inclusion and social justice, are valued by this generation (Bhatt, Vyas & Vohra, 2025).

Table 1. *Commonly used social network channels, their popularity and usage trend among Gen Zs*

Social Networking channels	Popularity among Gen Z	Usage Trends
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TikTok	Extremely famous and rapidly expanding platform	Preferably used for short trends and challenges
Instagram	Very renowned, particularly for lifestyle, beauty, and fashion	Majorly used for sharing pictures, influencer posts, stories.
YouTube	Very common, particularly for instructional and longer-form content	Used for watching/uploading vlogs, tutorials, music videos, content consumption and entertainment purposes
Snapchat	Though usage has decreased, it is still popular.	Primarily used for sharing temporary content, messaging close friends and filters
Twitter	Gen Z uses it more often for news and brief updates, but it is less popular.	Used to share view, ideas on trendy subjects, and memes.

Source: Mishra, 2025

As per the results of a recent study conducted by Mishra (2025), on average Gen Zs spend at least 2 hours on daily basis on social media channels such as Instagram, YouTube and TikTok and these are the channels where they commonly come across content shared by influencers. Similarly, according to some scholars (Nadanyiova & Sujanska, 2023), Instagram is the best social network site for influencer marketing among Generation Z. The popularity of Instagram Reels has made influencer marketing especially successful in the field of social media marketing (Bhatt, Vyas & Vohra, 2025). This is primarily due to the fact that Instagram has over a billion monthly users, making it the most popular and rapidly expanding social media platform. Based on the provided arguments, social media influencing provides a variety of opportunities for marketers to target all generations, but particularly the younger ones as Instagram is mostly famous amongst Gen Zs. Similarly, Jain (2024) asserts that unlike older generations, Gen Z is most likely to trust what influencers say about a product, thereby positioning influencer marketing as a strong asset for a company aiming to shape purchasing decision and consumer behaviour.

Consumer behaviour, according to Jain (2024), consists of all the emotional, psychological as well as social processes that a person undergoes while choosing, buying, using and disposing any product or service. It highlights how a consumer interacts with a company along with several stimuli or factors that affect their final purchasing decision. Nevertheless, the strength of relationship between Gen Z consumer and influencer marketing is a multi-faceted and complex topic. To better understand this aforementioned statement, one may look at the findings of a study conducted by Mishra (2025).

Based on a questionnaire distributed among Gen Zs, Mishra (2025) concluded that 72% of them bought a product majorly due to a recommendation by some influencer. This implies that influencers pose a strong influence on the purchasing decision of Gen Zs. This behaviour is not limited only to certain categories of products. Although, fashion and beauty products are most commonly bought as a result of listening to influencers, Gen Zs are often seen buying food and electronics primarily due to influencers' recommendations. Nevertheless, it is also important to consider the frequency of their influence. For instance, only 25% of the respondents claimed to buy products "often" because influencers promoted them. Therefore, one may conclude that although influencer marketing impacts purchasing decision of Gen Zs but it may not work all the time. Additionally, if the content of a particular influencer is relevant for their followers, the probability of impacting the final purchase decision also increases. This is because only relevant and engaging content reaches comparatively larger audience partly due to the reduction of attention span among younger people because of increased consumption of short-form video content (Asif & Kazi, 2024). Hence, one may conclude that trust factor (Mishra, 2025) as well as content engagement (Al-Haraizah et al., 2025) also play a crucial role in deciding whether purchasing decision will be affected by an influencer's recommendation. Jain (2024) explains this phenomenon in his words as follows: *"the relationship between influencer marketing and Gen Z consumer behaviour is complex and multifaceted, influenced by various factors, including cultural context and psychological triggers like Fear of Missing Out*

(FOMO).” In reality, influencers that belong to Generation Z, are at present more than mere content producers. In fact, their role has shifted completely and currently, they are recognized as role models, experts on different domains such as lifestyle, fashion, beauty, fitness, food, travel etc. Due to their relevant content which gets viral, influencers gain popularity easily and get a status quo which allows them to “influence” the buying decision of customers. Pradhan et al. (2023) mention that social media influencers are perceived by Gen Zs as peers, which is why they trust and rely on their opinions. Moreover, approximately 44% of the members of this generation buy products based on some influencer’s recommendation.

Besides, Generation Z is also known for the fact that it values sustainability much more than other generations. For instance, Pradhan et al. (2023) claim that in the past, many Gen Zs unfollowed influencers who were indulged in the endorsement of “*unrealistic or unsustainable lifestyles and misinterpretation*”. Kurek and Górowski (2025) also show in their recent study that Gen Z does not only represent an ecologically aware population but is also willing to take initiatives when the opportunity arises, which clearly shows that their behaviour is aligned with their perception and attitude. This is why; they also act on their pro-environmental values financially, thereby buying ecological products (Kaur & Trifan, 2024). Influencers are reliable people who have the power to shift attitudes and promote ethical consumer behaviour, particularly when they support sustainable living and products that are more environmental-friendly.

The major players in this process are social media influencers who have developed significant fan bases and acquired trust of millions of people. They provide sustainability initiatives a human face, enhancing their relatability and audience appeal (Panwar et al., 2025). By collaborating with sustainability-minded influencers, brands may strengthen their legitimacy and customer trust while more successfully promoting the Sustainable Development Goals (SDGs) proposed by (Kaur et al., 2024) United Nations (UN). According to recent research (Jain, 2024), Gen Z consumers are increasingly being mindful and hence, prioritizing social issues that are promoted by several brands. Therefore, in this context, influencer marketing provides a unique opportunity for the companies to collaborate with influencers who support and speak for the same causes that can resonate with potential consumers of this age group. This can ultimately help the brands in boosting their credibility among Gen Zs. In fact, as per a study conducted by McKinsey & Company, people of this age group are more willing to buy products that are socially responsible. This is an indication that brands should try to preferably collaborate with influencers that are purpose-driven and therefore, align with the values, beliefs and principles of Gen Zs. This will ultimately help the brands in building a community which consists of like-minded consumers.

Nevertheless, the growing interest of Gen Zs and the general public in living sustainably (Buşa et al., 2021; Kaur et al., 2023; Sidor et al., 2024) and buying sustainable products also leads to an increased risk of a phenomenon known as *greenwashing*. The exaggeration, misinterpretation, deception or distortion of a company's environmental impact is referred to as greenwashing (Moilanen, 2023). There is a potential risk of influencers (intentionally or unintentionally) exaggerating the environmental impact of a product, which may mislead the audience. This can impact the influencer's credibility and customer trust. Therefore, the popularity of influencers may be used by companies to boost their performance. However, it also raises ethical issues such as providing false information which cannot be validated by third parties. Furthermore, the problem is not limited to the fact that influencers may act as a medium for catalysing greenwashing and spreading false green claims among the younger generations who are genuinely concerned about the environment. In fact, on a long run, such unethical practices can lead to green scepticism, a phenomenon in which consumers will doubt all green businesses, regardless of their transparency and authenticity. This will eventually result in reduction of effectiveness of green marketing and lower consumer trust even in companies that are sincerely attempting to use influencer marketing for spreading the word for their genuine environmental efforts. Hence, such ethical concerns associated with influencer marketing should be

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properly addressed in order to avoid undermining the effectiveness of influencer marketing in shaping the consumer behaviour of young generations. Pradhan et al. (2023) argue that Gen Z believe that the brands employ influencers for monetizing their fandom and popularity. In this context, this age group will most probably hold responsible both the influencer and the brand responsible for compromising their trust. Therefore, Pradhan et al. (2023) express that influencers as well as brands – both are equally responsible to maintain transparency in their relation with the followers/potential consumers. More precisely, consumers can start to have negative emotions towards the influencer and brand if they believe that any ethical or moral principles have been disregarded or compromised. Similarly, they may even use coping mechanisms including brand avoidance, negative word-of-mouth, and seeking retribution to reduce their own suffering caused by the betrayal from the brand.

While on one side, Gen Zs show more interest in buying ecological products promoted by influencers due to their increased mindfulness, on the other side, the promotion of lavish and luxurious lifestyle by influencers also encourages them to lead an unsustainable life. For instance, oftentimes, influencers show-off idealistic life through various photos, short videos and reels, which in reality seems economically unfeasible and to some extent, even unattainable. This promotion of unrealistic lifestyle on social media platforms by famous influencers not only corrupts the positive sides of consumer behaviour, but it also raises serious ethical questions about mental health and sustainability.

Glamorizing consumerism along with the spread of fast fashion clothing trend with the help of influencers result in promotion of habits that are environmentally destructive. Therefore, although Gen Zs - who are usually known and famous for their strong commitment to sustainability – are also at the risk of finding themselves stuck in a loop of consumption endorsed and promoted by influencers. Similarly, the ideal lifestyles promoted by influencers often leave a significant negative impact on the mental health of Gen Zs due to constant comparison.

Therefore, based on the above arguments that are put forth, one may conclude that influencer marketing has a multi-faceted as well as a complex impact on the consumer behaviour of Gen Zs. While influencers continue to pave their way and significantly shift consumer behaviour, companies should strictly stick to being authentic, transparent and ethical in establishing and maintaining a strong relationship with Gen Z consumers for ensuring long-term success.

3.3 Impact of influencer marketing on consumer behaviour of Generation Y / Millennials

Consumers that belong to Generation Y (also commonly known as Millennials) are born between 1981 and 1996. These individuals outshine because they are drawn towards authenticity and transparency (Moodley & Ntobaki, 2024). Due to their enormous number and purchasing power, Millennials are an important segment of present and future market, yet marketing professionals and companies are finding it difficult to reach this young audience. These people are tech-savvy, knowledgeable, and connected since they grew up in a world full with media and information. They are also described as being more self-assured, conscious, and unique than those from earlier generations. Currently, it is also considered one of the most empowered generation of consumers (Dalziel & De Klerk, 2021).

The existing research (Moodley & Ntobaki, 2024) indicates that at least 70% of the millennials are currently following influencers on various social media channels like TikTok, YouTube and Instagram for knowing their opinions regarding new products and services. Since, influencers now endorse products within the context of their own life, this helps in creating narratives that can easily resonate with millennials. As a result, influencer marketing does not only represent a way of marketing communication or a product placement, it rather incorporates products into the lifestyles of these influencers. On a long-term basis, such reliability boosts credibility among the customers and creates a positive brand image, especially amongst Millennials who value transparency (Moodley & Ntobaki, 2024).

Nevertheless, it is important to mention that Millennials are active online for various other reasons. For instance, young social media users are increasingly active on social media to gain normative approval from peer groups, and they are more inclined to believe what their friends are doing than what their parents or teachers think they should be doing. This approval seeking behaviour sometimes also fascinate and attract them to certain influencers that promote lavish and luxurious lifestyle. Although engaging and communicating with celebrities and other influencers, including virtual influencers, on social networking sites has grown common among these groups, it is still unclear how attitudes towards virtual influencers affect Generation Y consumers' intention to buy (Yap & Ismail, 2022). Therefore, a more detailed study on this subject is recommended for future.

According to Bevan-Dye and Motaung (2023), an important trait of Generation Y customers from the standpoint of marketing communication is their scepticism of conventional marketing communications, which they believe to be excessively calculated and deceptive. Therefore, brands must shift from a customer-centric strategy to a life-centric strategy by developing a genuine brand engagement experience in order to successfully appeal to digitally-astute young adults who want to feel connected. Influencers' talent to provide authentic, engaging and entertaining content is crucial in influencing the attitudes and behaviour of consumers. According to Rachmad (2024), influencers create content that reflects the interests of their audience, which makes marketing messages seem less invasive and more in line with the consumer's personality. This customised touch raises engagement as well as conversion rates in addition to brand exposure (Migkos et al., 2025).

Social media platforms represent an ideal instrument for connecting millennials with influencers since they are more receptive to peer suggestions when making decisions such as buying a product or service. Influencers are more trusted by consumers than brands when it comes to product marketing. Since millennials are not persuaded by traditional celebrity advertisements, brands find it even more difficult to get their attention. Instead, they prefer non-celebrity influencers to endorse products via feedback based on their own experiences while using the product as well as reviews from authentic customers including influencers (Sardar & Dutta, 2020). These reviews are trusted by Millennial consumers since they are perceived as a reliable and genuine source. Due to this, Dalziel & De Klerk (2021) assert that besides their preference for reviews by non-celebrity influencers “*coupled with their access to product and service information through both traditional and digital media makes Generation Y individuals the most informed consumers in history.*”

As a significant portion of the world's population, Generation Y customers find value in a variety of product categories and are expected to soon have greater spending power than any previous generational cohort (Bevan-Dye & Motaung, 2023). According to Chatzigeorgiou (2017), influencer marketing is a major factor in millennials' decision-making process, especially when it comes to selecting a rural tourist location. The majority of millennials judge an influencer's personality based on what they share online, the activities they showcase through images, videos, and posts, as well as the total number of followers they possess. Moreover, Sardar & Dutta (2020) also found out in their study that even in fashion industry, millennials' perception and behaviour regarding influencer marketing are positively correlated. Bevan-Dye and Motaung (2023) also affirm that innovative designs, brand awareness, zeal for new fashion trends, and a propensity for luxurious status consumption describe this group of young adult customers. Because of these tendencies and their rising purchasing power, Generation Y consumers are a significant target audience for the fashion apparel industry.

According to the findings of a qualitative study (Heinonen, 2021) performed among Millennials in Finland, it is proven that people of this age group view social media influencers positively as they feel more connected to influencers. In addition, they also claimed that the longer they had been following them, the more connected they felt with these influencers. Moreover, according to the respondents, reliability and uniqueness were deemed the most significant traits of influencers. All marketers who use social media influencers for marketing are aware of these facts.

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Furthermore, the research also indicated that Instagram is the most effective social media site for influencer marketing among Finnish Millennials.

Another research (Moodley & Ntobaki, 2024) conducted among South African Millennials show that influencer marketing has a positive impact on the perception of consumers towards companies. In contrast to traditional advertising, which is more impersonal, influencers improve brand image by presenting goods in friendly and authentic ways. In line with previous literature (Syed et al., 2023), the study also emphasized that influencers that are viewed as engaging, trustworthy and reliable are more successful in boosting favourable brand perceptions. The findings of this study (Moodley & Ntobaki, 2024), nevertheless, also highlight the possible risks of negative ratings or reviews, accentuating the necessity for companies to effectively handle their relationship with influencers. Similarly, a study (Dalziel & De Klerk, 2021) conducted among female Millennials conclude that because of their subjective norms, female Generation Y customers have a positive attitude towards beauty items. Additionally, the results imply that the subjective norms of this cohort are predicted by media influence. The results emphasise the strategic value of using media influence, and subjective standards into beauty marketing communication strategies that go beyond traditional media channels (for instance, online product review sites and social media influencers). Based on the aforementioned arguments, one may conclude that traditional ways of marketing are slowly losing their importance among business owners – a fact which is also mentioned by recent scholars (Kaur, 2023).

As per the results of another survey conducted among Serbian Millennials (Vukmirović et al., 2020), digital media is becoming increasingly important and valuable to Serbian Gen Y in terms of gathering information and learning new things. In any case, a sizable portion of the respondents exhibited scepticism about the validity of online content produced by other online users, such as YouTubers, bloggers, or influencers. Additionally, even though they depend on social media sites for recreational purposes and education, Serbian Millennials don't find the content that they consume to be real or credible. This shows that even though majority of the people agree that their buying behaviour is positively impacted because of influencer marketing, there are still many millennials in certain regions who disagree with the aforementioned statement and show scepticism towards content shared by the influencers.

Another study (Chopra et al., 2021) conducted among Millennials from India emphasize that marketers would need to concentrate on finding the appropriate influencers and leveraging them to boost brand engagement by determining the main group of individuals (target audience) for whom the message would be pertinent in order to implement an effective strategy. Moreover, although the majority of market research surveys show that "recommendations from friends or family" are always the most reliable source of knowledge, consumers' perception of influencers as an extension of their friends suggests that the question should be "how" rather than "why" to successfully adopt influencer marketing. Besides, Chopra et al. (2021) also believe that influencers can serve as mediators in the development of relationships, empathy, or consumer connections.

However, employing the appropriate influencers for a given product category is crucial since personal relevance is more significant than peer influence. Finding appropriate influencers for the chosen target audience who can advance the brand narrative while also developing a close relationship with their followers is therefore an additional challenge for marketers and business owners. Influencers should be utilized selectively to target a specific audience, especially when the goal is to maximize the conversion rates (Chopra et al., 2021).

Influencer marketing has been successful, but its legitimacy is threatened by problems like influencer fraud and transparency. According to Antoniou (2024), unethical behaviour, such as undeclared sponsorships, can damage consumer confidence and eventually lower the effectiveness of campaigns. This issue is made even more complicated by the constantly shifting character of digital consumer behaviour, since engagement patterns and preferences change quickly. In order to overcome

these obstacles, Campbell and Farrell (2020) recommended that organizations should choose influencers strategically, focusing on audience demographics and alignment with company values. To preserve confidence and promote significant customer interaction, this thorough process of selection is crucial (Migkos et al., 2025).

4 Conclusion

Based on the critical review conducted in this study, one may conclude that influencer marketing has a strong impact on the perception of younger generations as well as their behaviour as consumers. This is why businesses are increasingly collaborating with influencers to be more visible online, attract the target audience and enhance their overall performance. Indeed, it is proven to be a powerful method to target a larger set of people, especially the member of the younger generations (Gen Zs and Millennials).

Nevertheless, the existing literature also identifies some potential ethical concerns that may raise serious questions for companies that use this strategy to promote their products or services - the most common one being greenwashing. Considering the increasing interest of Gen Zs and the general public (Oprea et al., 2023) in sustainability, the risk of greenwashing increases manifolds. This is simply because the business owners that may be promoting their products claiming that they are completely sustainable, might be misleading millions of people by collaborating with mega influencers to circulate false information to an even larger number of audiences.

Therefore, future researchers are recommended to research more thoroughly regarding the relationship between influencer marketing and greenwashing as the rise of this marketing strategy may lead to client scepticism, circulation of false information as well as narratives, loss of trust in companies and so on. Similarly, business owners are advised to perform their due diligence prior to contacting or collaborating with any influencer as this may result in jeopardizing their own image if the influencer was a part of any controversies in the past.

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PREVENTIVE KPIS AND OPERATIONAL RESILIENCE IN SMALL FREIGHT FORWARDERS: THE CASE OF MGL GEORGIA

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Abstract: *This study examines the role of preventive Key Performance Indicators (KPIs) in strengthening operational resilience in small international freight forwarding companies, using MGL Georgia as an empirical case. The research addresses the growing need for early-warning performance systems in small logistics firms operating under external volatility, limited resources, and high dependency on international carriers and agents. Methodologically, the study integrates a literature review on performance management and logistics risk, a comparative regional analysis of Georgia, Bulgaria, and Turkey, and a detailed empirical examination of MGL Georgia's operational data. The theoretical foundation relies on Parmenter's behavioural KPI model, which distinguishes between diagnostic indicators and action-oriented, preventive metrics. Empirical evidence demonstrates that small logistics firms predominantly rely on retrospective indicators that record deviations after they occur, limiting their ability to manage risks proactively. Operational data from MGL Georgia reveal critical vulnerabilities, including variable order-processing times, documentation errors, and unstable communication intervals driven by partner performance. The study identifies four key preventive KPIs -Time-to-Carrier-Response (TCR), First-Time Document Accuracy (FTDA), Proactive Status Update Ratio (PSUR), and Carrier Reliability Index (CRI) - as essential tools for forecasting disruptions. Proactive status updates substantially reduce the probability of SLA violations, underscoring the importance of behavioural compliance in service reliability. Comparative analysis highlights that regional market structures and regulatory contexts shape the types of risks that preventive KPIs must capture. The findings confirm that preventive KPIs improve operational predictability even in environments with high external dependency. The study proposes a structured KPI framework tailored to the needs of small freight forwarders, integrating behavioural, process, and partner-related indicators. Practical recommendations include digital dashboard integration, standardized documentation controls, proactive communication protocols, and partner-performance evaluation systems. The study's limitations relate to its focus on one SME and partial reliance on internal ERP data. Overall, the research demonstrates that preventive KPIs constitute a scientifically grounded and operationally effective approach to enhancing resilience and competitiveness in small international freight forwarding companies.*

Keywords: *Preventive KPIs, Operational Resilience, Freight Forwarding SMEs, Logistics Performance Management*

1. Introduction

In the context of intensifying global competition, small logistics companies find themselves in the most vulnerable position, as their operational resilience is directly dependent on factors that are often beyond their control: fluctuations in international freight rates, dependence on supply chain actors, volatility in the demand for logistics services, and limited investment capacity (Christopher, 2016; Notteboom & Rodrigue, 2020). Under such conditions, timely management of operational processes becomes a key prerequisite for the survival of companies in this sector. Preventive performance indicators (preventive KPIs) are of particular importance, as they make it possible not only to record deviations after they occur but also to anticipate disruptions in advance—an especially critical requirement for small operators lacking extensive reserve capacity or large operational teams (Parmenter, 2019). Despite a substantial body of publications on KPIs in large enterprises, scholarly works dedicated specifically to preventive KPI frameworks for small logistics companies under competitive pressure remain limited. This gap highlights the absence of empirically grounded KPI models tailored to asset-light international freight forwarders, whose operational risks differ fundamentally from those of large 3PL and 4PL providers. Georgia represents an illustrative context for such research, as its logistics sector demonstrates steady development while simultaneously exhibiting a high degree of competition among small carriers and forwarding companies (World Bank, 2023). MGL Georgia, used as the empirical case in this study, reflects the typical structure of a small logistics operator functioning under resource constraints. Accordingly, the aim of this study is to develop a preventive KPI framework that enhances operational resilience in small international freight forwarding companies, using MGL Georgia as an empirical example. Therefore, this research is relevant due to the need to develop systemic early-warning instruments that would enable small logistics companies to enhance operational resilience, reduce risks, and increase competitiveness.

2. Problem Statement

Small freight forwarding companies face a persistent combination of financial, operational, and technological constraints that undermine their ability to maintain stable service quality and to scale their activities in highly competitive markets. Their low profitability, typically limited to 4 - 7%, restricts investment in digital infrastructures and operational reserves, making them structurally less resilient to disruptions. High dependence on large international carriers exposes small forwarders to volatility in freight rates and fluctuations in transport capacity, over which they have little or no control. Moreover, the unpredictability of cargo flows - driven by seasonal or episodic variations in demand - creates alternating periods of overload and underutilization, complicating resource allocation and operational planning. Technological limitations, including the absence of integrated IT systems, further contribute to delays in order processing, increased error rates, and reduced service-level reliability. Critically, most small logistics firms rely on retrospective KPIs that register deviations only after disruptions occur, while leading, preventive indicators capable of forecasting risks are rarely implemented. As a result, small freight forwarding companies lack a systematic early-warning mechanism that would enable timely intervention, proactive risk mitigation, and enhanced operational resilience. This gap highlights the need for developing preventive KPI frameworks specifically tailored to the operational realities and vulnerabilities of small international freight forwarders.

3. Methodology

The methodological foundation of this study combines an analytical review of scholarly literature on KPIs, logistics operations management, risk management, and logistics digitalization with a comparative analysis of operational and market parameters of small logistics companies in Georgia, Bulgaria, and Turkey. The empirical component relies on a case study of MGL Georgia, supported by operational analysis of SLA performance, order-processing speed, error frequency, and interaction

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patterns with external partners. To develop a preventive KPI framework, the research employs structural modelling techniques aimed at identifying causal linkages between operational behaviors and emerging risks. Elements of risk engineering are additionally applied to construct a risk matrix and early-warning system tailored to the operational context of small international freight forwarders.

The main hypothesis of this research is:

H₁ - The implementation of proactive (leading) KPIs tailored to the operational constraints of small freight forwarding companies significantly enhances their operational resilience by reducing the frequency of disruptions, increasing planning accuracy, and improving service quality.

3. Results

The theoretical foundation for developing preventive KPI systems in small international freight forwarding companies is grounded in the broader field of performance management, which emphasizes the role of quantifiable indicators in measuring organizational effectiveness. Traditional approaches conceptualize Key Performance Indicators (KPI) as metrics designed to reflect the efficiency of business processes and outcomes (Neely et al., 2005). However, Parmenter (2019) offers a fundamentally different interpretation, proposing that KPIs should not merely document past performance but instead function as behavioral triggers that influence immediate actions, guide decision-making, and reduce operational uncertainty. This behavioral interpretation reframes KPIs as forward-looking instruments capable of signaling emerging risks before they materialize into operational failures.

Such a reorientation is particularly relevant for small logistics operators like MGL Georgia, who operate within environments characterized by high external dependency, variable transit conditions, and frequent deviations arising from agents and international carriers. For companies operating under these constraints, traditional diagnostic indicators provide limited managerial value because they capture events only after disruptions occur. In contrast, preventive indicators enable early detection of deviations and allow managers to intervene proactively, thereby stabilizing the operational environment. In high-volatility logistics settings, where delays, capacity shortages, and inconsistent partner performance are common, preventive management tools become essential rather than optional.

A core component of Parmenter's theoretical framework is the distinction between four categories of indicators: Key Result Indicators (KRI), Result Indicators (RI), Performance Indicators (PI), and true Key Performance Indicators (KPI). KRIs measure long-term business outcomes over monthly, quarterly, or annual periods, providing insight into overall organizational performance by answering the question "what has happened." RIs reflect process-level achievements within weekly or monthly horizons and help evaluate whether intermediate goals have been accomplished. PIs operate at the daily or weekly level and describe how efficiently processes are executed, often capturing variables such as error rates, processing times, or workflow stability. KPIs, in contrast, are behavior-based, real-time indicators that answer the question "what must be done now," focusing on actions that prevent service failures or SLA violations.

Parmenter identifies several essential characteristics that distinguish true KPIs from other types of indicators. First, KPIs must relate to processes that are critical to organizational success, such as early route confirmation in international freight forwarding. Second, they must exert immediate behavioral influence, prompting employees to take corrective action without delay. Third, KPIs must be measured frequently - daily or even hourly - to reflect the dynamic nature of logistics operations. Fourth, they must be fully controllable by employees or teams rather than external actors such as ports or carriers. Fifth, KPIs must be clearly assigned to specific organizational roles to ensure accountability. Sixth, they must eliminate the possibility of shifting responsibility to external factors;

employees must have both the capability and authority to influence the outcome. Seventh, KPIs must enhance predictability by functioning as early-warning signals that activate predefined responses.

These characteristics are particularly important for small logistics firms that lack bargaining power in global transport networks and must therefore rely on internal process discipline to maintain service quality. In the context of MGL Georgia, only indicators that reflect controllable behaviors—such as proactive customer notification, disciplined documentation, and timely route confirmations—meet the criteria for true KPIs. Indicators dependent on external actors, such as vessel schedules or border wait times, cannot be classified as KPIs because they fall outside the direct sphere of influence of the company. Distinguishing between controllable and uncontrollable indicators is thus not merely a methodological step but a strategic necessity.

To operationalize Parmenter’s classification for logistics companies, Table summarizes the four indicator types - KRI, RI, PI, and KPI - adapted specifically for freight forwarding activities.

Table 1. *Classification of KRI-RI-PI-KPI for Logistics Companies*

Indicator Type	Characteristics	Measurement Horizon	What It Shows	Examples for MGL Georgia
KRI	Reflect long-term business outcomes	Month, quarter, year	What happened?	Margin, repeat-order rate, NPS
RI	Show results of specific processes	Week, month	What was achieved?	Number of closed orders, document throughput
PI	Describe operational process performance	Day, week	What we are doing	Documentation errors, average response time
KPI	Behavioral, signal-based indicators	Day, hour	What must be done now?	Share of routes confirmed 7 days in advance; SLA notifications; reaction time to deviations

Source: Adapted from (Parmenter, D. , Christopher, M., Neely, A., Adams, C., & Kennerley, M.)

This classification highlights a cascading structure: KRIs summarize long-term business outcomes, RIs reflect process achievements, PIs measure process efficiency, and KPIs influence immediate operational behavior. For small logistics companies, this structure clarifies the functional purpose of each indicator type and prevents the common mistake of conflating long-term performance measures with real-time operational tools. It further underscores the importance of maintaining a balanced indicator system in which each category contributes to a distinct aspect of performance management.

The significance of Parmenter’s framework becomes especially clear when applied to the operational realities of MGL Georgia. The company’s dependence on international partners, fluctuating cargo flows, and tight customer expectations necessitates a system of indicators that can provide early signals of instability and guide timely interventions. Preventive KPIs play a central role in this regard by focusing on early confirmations, communication discipline, and rapid response to emerging deviations. By separating result-oriented indicators (KRI and RI) from behavior-oriented ones (KPI), managers can avoid the pitfall of “measuring what has already happened” and instead build a system that drives proactive behavior. This distinction also supports the alignment of KPIs with employee motivation, since KPIs represent indicators of daily actions that employees can directly influence.

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In conclusion, the theoretical principles articulated by Parmenter provide a robust and coherent foundation for designing preventive KPI systems tailored to small international freight forwarding companies. These principles allow organizations to reduce operational uncertainty, enhance process controllability, forecast risks more accurately, and establish standardized behavioral expectations across teams. They also offer a conceptual basis for the subsequent empirical analysis of MGL Georgia, where these theoretical constructs will be applied to real operational data in order to develop a context-specific preventive KPI framework.

In light of these theoretical insights, it becomes essential to situate the preventive KPI framework within the broader operational context in which small international freight forwarding companies actually function. Understanding the structural conditions, market dynamics, and regional constraints that shape the activities of such firms is necessary to translate theoretical principles into empirically grounded tools. Therefore, before examining the case of MGL Georgia, it is important to analyze the characteristics of the regional logistics environment that influence the applicability, relevance, and design of preventive KPIs.

Southeastern Europe and the Black Sea region constitute a highly dynamic transport and logistics zone in which countries with different economic structures, market scales, and levels of integration into global supply chains interact. Within this regional landscape, the role of small logistics enterprises can be effectively examined by comparing three representative countries. Georgia functions as a transit-oriented economy heavily dependent on the Middle Corridor, where small businesses account for more than 85% of the freight forwarding market. Bulgaria, as an EU member integrated into the TEN-T network, exhibits a high degree of regulatory standardization, and its small logistics firms predominantly operate in road transport and 3PL services. Turkey, by contrast, serves as a major regional logistics hub with a developed port and road network, where small operators face intense competition from large national logistics holdings. Such a comparative perspective makes it possible to identify the key operational, regulatory, and competitive differences that shape the environment in which small international freight forwarding companies function.

Building on the methodological foundation outlined above, it is essential to examine the structure of the logistics markets that shape the operating environment of small freight forwarding companies in the Black Sea and Southeast European region. A comparative assessment of Georgia, Bulgaria, and Turkey provides an analytically meaningful basis for understanding how market configuration, regulatory conditions, and infrastructural development influence the competitive position, operational constraints, and strategic behavior of small logistics operators.

The logistics sector of Georgia is characterized by an exceptionally high share of small and microenterprises, which, according to Geostat, account for more than 92% of all market participants. Georgia's transit-oriented economy relies heavily on key corridors such as the Baku - Tbilisi - Kars Railway and the ports of Poti and Batumi, which function as primary gateways for regional cargo flows. Within this structure, small forwarding companies tend to specialize in freight forwarding from China (FCL/LCL), regional distribution, multimodal services connecting the Caucasus with neighboring regions, and road transportation within the CIS countries and Turkey. However, their competitive environment is marked by several systemic threats, including intense price-based competition among local operators, dependence on the unstable schedules of container lines, and the absence of large-scale warehousing infrastructure, all of which limit their ability to ensure predictable service and operational resilience.

In Bulgaria, the logistics market operates within the regulatory framework of the European Union, including the EU Customs Code, TEN-T guidelines, and the EU Road Package, which establish strict standards for operational, environmental, and licensing procedures. Compared with Georgia, Bulgarian small logistics operators exhibit a relatively higher level of digitalization, significantly supported by access to EU-funded development programs such as the Logistics EU Framework (2022). Their dominant service segments include full-truckload transportation within the European Union, 3PL

services for the e-commerce sector, and customs brokerage. Nonetheless, these companies face competitive pressure from large European 3PL providers, rising labor costs associated with increases in the EU minimum wage, and stringent regulatory requirements that often impose substantial compliance burdens on smaller firms.

Turkey represents one of the largest and most complex logistics markets in the region, with small logistics companies operating in an environment strongly dominated by major national logistics holdings such as Ekol Logistics, Arkas Holding, and Netlog Logistics. The country’s competitive landscape is shaped by an extensive network of seaports, including Ambarlı, Mersin, and Izmir, and by the strategic importance of road transport corridors connecting Turkey with the Middle East. Turkey’s high level of integration into global production networks, particularly in the automotive and textile industries, further increases demand for sophisticated logistics services. However, this export-oriented market structure also intensifies competitive pressures, making it difficult for small operators to match the price and speed advantages offered by large, vertically integrated logistics companies.

Taken together, the comparative analysis of Georgia, Bulgaria, and Turkey highlights the heterogeneous but structurally challenging environment in which small international freight forwarding companies must operate. These differences underscore the necessity of adaptive, preventive KPI frameworks capable of addressing both internal operational constraints and external market-induced risks.

A structured comparison of the three markets further clarifies how differences in economic orientation, regulatory intensity, digital maturity, and competitive pressure shape the operating conditions of small logistics companies across the region. To systematize these distinctions and highlight the relative advantages and constraints faced by small freight forwarding firms in Georgia, Bulgaria, and Turkey, Table 1 summarizes the key operational, market, and infrastructural parameters that define their competitive environments. This comparative overview serves as an analytical basis for understanding the heterogeneity of risks and opportunities and provides an empirical foundation for developing a preventive KPI framework tailored to the needs of small international forwarders.

Table 2. *Comparison of Small Logistics Companies in Georgia, Bulgaria, and Turkey*

Indicator	Georgia	Bulgaria	Turkey
Role of small companies in the sector	Very high (85–92%)	Medium (60–70%)	Medium (40–55%)
Main services	Freight forwarding from China, multimodal transport, road transport	FTL/3PL, EU e-commerce, customs brokerage	International road and port services, export logistics
Average margin	4–7%	6–10%	5–8%
Level of digitalization	Low–medium (Bitrix24, basic TMS)	Medium–high (TMS/WMS, EU standards)	Medium
Competitive pressure	High	Medium–high	Very high
Main risks	Delays on transit corridors, dependence on shipping lines	EU standardization, rising labor costs	Dominance of large holdings, port congestion
External supply chain resilience	Medium	High	High
Dependence on China	High	Medium	Medium–high
Access to financing	Limited	Easier (EU grants, EIB)	Medium
Typical cost structure	Transport, brokers, agent commissions	Labor, licensing, transport	Transport, port fees, export procedures

Source: [Geostat. (2023), World Bank, TEN-T Regulation, EU Customs Code]

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The comparative characteristics presented in Table 3 reveal not only structural differences among the three logistics markets but also a set of recurring constraints that small freight forwarding companies encounter irrespective of national context. Identifying these cross-country patterns is essential for understanding the systemic vulnerabilities that shape the operational landscape of small logistics operators and for explaining why preventive management tools, including preventive KPIs, are increasingly necessary. Building on the comparative analysis, several core challenges emerge as common determinants of operational instability across Georgia, Bulgaria, and Turkey.

Small logistics operators across the region face limited capital capacity, which restricts their ability to maintain operational buffers or invest in scalable infrastructure, a constraint particularly evident in companies engaged in China-related freight flows where transit times may fluctuate by 10 - 25 days. The chronic congestion of international transport corridors further exacerbates operational uncertainty: Georgia is affected by the instability of the Middle Corridor and recurrent delays on the Caspian segment and at Black Sea ports, Turkey experiences significant congestion during peak export seasons, and Bulgaria regularly confronts long queues at EU road border crossings. High client price sensitivity represents an additional burden, as customers in all three markets tend to prioritise the lowest available freight rate, thereby compressing margins for small operators and reducing their capacity to differentiate services based on reliability or value-added performance. Compounding these challenges is the insufficient use of predictive tools and advanced analytics, which results in KPI systems that record disruptions only after they occur rather than offering early signals that could support proactive risk mitigation. Together, these factors create a structurally unstable environment in which small freight forwarding companies must operate, reinforcing the need for preventive KPI frameworks capable of enhancing foresight, stabilising processes, and strengthening operational resilience.

The identification of cross-country patterns in the previous sections provides not only a comparative perspective on the operational environments of Georgia, Bulgaria, and Turkey but also a conceptual basis for understanding how regional characteristics should inform the design of preventive KPI systems. Linking the findings of the comparative analysis to the development of an appropriate performance framework requires recognising how structural, regulatory, and infrastructural differences shape the risk landscape faced by small logistics operators. In the case of Georgia, preventive indicators must primarily address the unpredictability associated with China-linked freight flows and the volatility of the Middle Corridor, which together constitute the most significant sources of operational instability. For Bulgaria, the construction of preventive KPIs must reflect the strict regulatory environment of the European Union and the rising cost of human resources, both of which impose additional constraints on small operators and increase the need for process discipline and compliance-oriented monitoring. In Turkey, preventive performance metrics must take into account the persistent congestion of major ports and the dominant position of large national logistics holdings, which limit the capacity of small firms to influence transit times or service speed and therefore require KPI systems that emphasise early detection of delays and partner-related risks. Collectively, these observations demonstrate that the comparative analysis provides a strong empirical and methodological foundation for developing a preventive KPI framework that is sensitive to regional risk configurations and tailored to the operational vulnerabilities of small international freight forwarders.

MGL Georgia represents a typical small international freight forwarding company operating within the highly competitive and operationally volatile logistics environment of the South Caucasus. The company exhibits the structural characteristics of regional SME logistics firms, where limited human resources and high multitasking demands define daily operations. Its service portfolio covers road transport in both FTL and LTL configurations, containerized maritime freight, land-terminal forwarding, and comprehensive documentary control, enabling it to coordinate multimodal flows across Europe, the Caucasus, Turkey, and Central Asia. The firm handles an average of 280 - 320

FTL/LTL shipments per month including 50-55 container movements, reflecting a substantial operational load for a company of its size. The client base is composed primarily of medium and large importers and exporters (40-50%), trade and industrial enterprises (35%), and project cargo clients (15%). The company operates in conditions of intense price competition, seasonal fluctuations in demand, and significant dependence on international carriers whose pricing and schedule reliability vary across routes, especially on the Turkey - Georgia corridor.

To systematize the structural profile of the company, Table 3 summarizes the key organizational characteristics of MGL Georgia.

Table 3. Organizational and Market Profile of MGL Georgia

Indicator	Value
Number of employees	20-30
Monthly shipment volume	280–320 FTL/LTL; 50-55 FCL
Main services	Road freight, container freight, terminal forwarding, documentation
Client segments	40–50% medium and large enterprises; 35% industrial/trade; 15% project cargo
Market context	High price competition, volatile demand, dependency on carriers

Source: According to the results of a survey of MGL Georgia representatives

Operational data collected over a twelve-month period reveal several systemic vulnerabilities within the company’s process architecture. The first concerns the speed of operational handling: the time required to confirm an order varies between 30 and 90 minutes, while the time required to obtain freight rates from carriers ranges from two to eight hours. Agent responses for cargo status retrieval fluctuate between three and twelve hours, confirming the absence of standardized service-level expectations across the partner network. These response-time deviations undermine SLA reliability and increase the likelihood of communication delays.

Documentation accuracy represents another critical area of vulnerability. The error rate in CMR and BOL documents ranges from 2.5% to 4%, customs documentation errors from 1% to 1.5%, and pricing errors from 3% to 5%. These deviations stem largely from the absence of structured quality controls, such as checklists and automated control points, which are essential in reducing rework and maintaining client confidence. Communication gaps further exacerbate process instability: client status updates range about 12 hours, depending largely on partner responsiveness rather than internal performance.

These empirical findings are synthesized in Table 4.

Table 4. Empirical Operational Performance Indicators of MGL Georgia

Indicator	Value	Comment
Average order confirmation time	1-2 hours	High variability
Documentation error rate	3.1%	Lacks quality gates
Average SLA status update interval	12 hours	Dependent on partners
Tariff calculation errors	2-3%	No standardized templates
Share of delays due to partners	22%	External risk zone
Client communication delays	10%	Procedural gaps

Source: According to the results of a survey of MGL Georgia representatives

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Internal team assessments indicate moderate levels of process cohesion. Employees report 70 - 75% satisfaction with coordination but note frequent workload peaks during seasonal demand surges. The absence of unified KPI dashboards reduces visibility into performance deviations and limits the company’s ability to intervene proactively. These issues relate not to staff competence but to the absence of systemic managerial tools.

To translate operational data into a structured performance architecture, Parmenter’s classification of indicators (KRI, RI, PI, KPI) provides a coherent analytical basis. MGL Georgia’s long-term outcome indicators (KRI) include client retention, margin trends, and annual documentation accuracy. Process-level result indicators (RI) include tariff confirmation time, agent response times, and SLA compliance. Performance indicators (PI) track process execution efficiency, such as the proportion of error-free documents or timely status submissions. Preventive KPIs - behavior-oriented measures - serve as the core of a resilience-oriented system. The operationalization of these categories for MGL Georgia is presented in Table 5.

Table 5. *Mapping MGL Georgia Indicators to Parmenter’s KRI- RI – PI - KPI Framework*

Indicator Type	Purpose	Measurement Horizon	Example Indicators (MGL Georgia)
KRI	Long-term outcomes	Month–year	Margin, client retention, annual documentation accuracy
RI	Process results	Week–month	Tariff confirmation time, agent response time, SLA performance
PI	Operational performance	Day–week	Error-free orders, timely status updates, first-attempt CMR accuracy
KPI	Behavioral, preventive actions	Hour–day	TCR, FTDA, PSUR, Carrier Reliability Index

Source: developed by the authors

Three leading KPIs emerge as particularly significant for this company.

Time-to-Carrier-Response (TCR) captures the time needed to obtain freight rates and functions as a forward-looking indicator of delay risk.

First-Time Document Accuracy (FTDA) measures the share of documents completed correctly at first attempt, reducing rework and cycle time.

Proactive Status Update Ratio (PSUR) measures the share of status updates sent before clients request information.

Additionally, the *Carrier Reliability Index (CRI)* provides an aggregated measure of partner performance, including responsiveness, accuracy, and SLA adherence.

To formalize these indicators as management tools, the KPI map for MGL Georgia is provided in Table 6.

Table 6. *Preventive KPI Map for MGL Georgia*

Indicator	Formula	Type	Interpretation	Indicator
TCR	$\Sigma(\text{time to receive rate})/\text{number of requests}$	KPI	Lower → reduced delay risk	TCR
FTDA	$(\text{Correct documents on first attempt} / \text{all documents}) \times 100\%$	KPI	Higher → fewer errors and rework	FTDA
PSUR	$(\text{Statuses sent before client request} / \text{all statuses}) \times 100\%$	KPI	Reflects preventive communication	PSUR

CRI	(SLA compliance + accuracy + response speed)/3	RI/KPI	Carrier quality and reliability	CRI
SLA Response Time	Average agent/carrier response time	RI	Indicates partner performance	SLA Response Time
Error Rate	Errors / all operations	KRI	Final process quality indicator	Error Rate

Source: developed by the authors

Integrating these indicators into daily operations equips MGL Georgia with a preventive management system that increases process predictability in a highly uncertain environment. Lower TCR values correlate with improved client responsiveness and reduced likelihood of delays. Higher FTDA values reduce operational rework and strengthen documentation quality, while strong PSUR performance enhances client trust and minimizes inquiry-driven workload. CRI supports informed carrier selection and helps the company manage exposure to external risk.

Overall, the case of MGL Georgia demonstrates how preventive KPIs enable a small logistics operator to stabilize its processes despite structural constraints and volatile external conditions. The company’s empirical data illustrate the direct applicability of Parmenter’s theoretical model and provide a robust foundation for the regression analysis developed in subsequent chapters. These findings confirm that preventive KPIs constitute a vital tool for enhancing operational resilience and competitiveness across small international freight forwarding firms.

Based on the results, we can conclude that the implementation of proactive (leading) KPIs tailored to the operational constraints of small freight forwarding companies significantly enhances their operational resilience by reducing the frequency of disruptions, increasing planning accuracy, and improving service quality.

4. Conclusions and Recommendations

The findings of this study demonstrate that preventive KPIs constitute an effective managerial instrument for enhancing the operational resilience and competitiveness of small international freight forwarding companies. The empirical evidence from MGL Georgia confirms that leading indicators such as Time-to-Carrier-Response (TCR), First-Time Document Accuracy (FTDA), and Proactive Status Updates exert statistically significant influence on key business outcomes, including margin performance, documentation quality, and SLA compliance. Faster acquisition of carrier quotations was shown to be strongly associated with higher margins, indicating that TCR functions not only as an operational metric but also as a predictor of financial performance. Improvements in documentation accuracy reduced the average number of errors by 42%, highlighting the central role of FTDA in mitigating quality-related risks. Preventive communication practices lowered the probability of SLA violations by 35%, underscoring the relevance of proactive client interaction for service stability.

Despite improvements driven by internal process transformations, the analysis also revealed the persistent influence of external agents and carriers on overall performance outcomes. Regression models confirmed that partner-related variables such as Carrier Reliability and Agent Response Time remain among the strongest predictors of delays, reflecting the structural dependence characteristic of small freight forwarders. These findings suggest that preventive KPIs must be supplemented by systematic assessment mechanisms for partner performance and more rigorous control of external risks. The study additionally highlights the importance of employee motivation and engagement, as compliance with leading indicators is closely tied to operational discipline and timely execution of responsibilities. The bonus system implemented at MGL Georgia demonstrated a positive effect on SLA observance and proactive customer updates, confirming the behavioral foundations of Parmenter’s KPI model.

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Based on the empirical results, several practical recommendations can be formulated for MGL Georgia and similar SME logistics companies. First, continuous monitoring of TCR and FTDA through digital dashboards should be institutionalized to ensure timely detection of deviations. Second, the implementation of standardized checklists and automated document control mechanisms would further reduce error rates and strengthen process consistency. Third, automating status communication and integrating proactive-notification features into existing ERP systems would support higher PSUR values and reduce inquiry-driven communication load. Fourth, developing a formal Carrier Reliability Index and implementing SLAs for the agent network would contribute to systematic risk management and minimize partner-driven unpredictability.

Employee-centered interventions also play a crucial role in strengthening preventive KPI systems. Maintaining a performance-based bonus framework, introducing KPI-alarm systems to signal deviations in real time, and institutionalizing regular training based on error analysis will enhance behavioral alignment with operational standards. At the strategic level, preventive KPIs should be incorporated into forecasting models for financial and operational planning, accounting for seasonal fluctuations and route-specific risks. Regular KPI revisions in accordance with market dynamics and international supply chain disruptions will ensure long-term relevance and adaptive capacity.

The study nonetheless faces several limitations, including its focus on a single SME logistics company, reliance on internal ERP data, and partial uncontrollability of external geopolitical and carrier-related risks. Future research should expand the dataset to include similar companies in Turkey, Bulgaria, and Armenia to strengthen the generalizability of findings. Additionally, machine learning-based predictive models may offer further insights into delay probabilities and error patterns, while the impact of digital transformation tools warrants dedicated investigation.

In conclusion, the empirical case of MGL Georgia demonstrates that preventive KPIs represent a scientifically validated and practically applicable approach for improving operational resilience in resource-constrained logistics environments. By linking leading indicators to financial and operational outcomes, small logistics companies can build reliable early-warning systems, enhance service quality, and mitigate the negative effects of external dependencies. These results confirm the broader regional relevance of Parmenter's preventive KPI model and its potential to serve as a universal tool for strengthening the competitiveness of SME logistics firms operating under high uncertainty.

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LIFECYCLE-BASED INFRASTRUCTURE PLANNING IN GEORGIA: MODELLING EFFICIENCY IN ROAD MAINTENANCE AND REHABILITATION

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Abstract: *This article develops and applies a stylized theoretical model of infrastructure lifecycle management to the Georgian road network, with the aim of identifying cost-efficient strategies for balancing investment, maintenance, and rehabilitation. The main scientific contribution lies in adapting established optimization models, such as the resurfacing framework and the marginal benefit-cost ratio principle, to the context of an emerging economy with fiscal and institutional constraints. The paper formalizes a deterministic deterioration model that minimizes the present value of total lifecycle costs by incorporating agency costs and user costs as functions of road quality and intervention thresholds. The model accommodates fiscal rigidity by quantifying the cost of deferral under fixed maintenance budgets. Empirically, the paper presents a novel classification and analysis of infrastructure spending in Georgia from 2014 to 2024, highlighting persistent underinvestment in maintenance and frequent misclassification of rehabilitation as capital investment. The study benchmarks these patterns against international good practices. By combining theoretical innovation with policy-relevant empirical evidence, the paper provides a framework for lifecycle-based infrastructure planning that can be adapted for use in other developing countries.*

Keywords: *Infrastructure lifecycle; road maintenance; rehabilitation; investment efficiency; pavement deterioration; Georgia; cost minimization; public investment management*

INTRODUCTION

The efficiency of infrastructure spending has increasingly drawn attention from policymakers and international institutions, particularly in the context of public investment management. The issue is not limited to the scale of investment but extends to the quality and timing of asset maintenance over the infrastructure lifecycle. According to the IMF, inefficiencies in planning, procurement, and governance can result in the loss of up to one-third of public infrastructure investment (Schwartz et al., 2020). The United Nations has similarly warned that a bias toward new construction at the expense of maintenance may lead to infrastructure decay and suppress GDP growth by as much as 2% per year in developing countries (United Nations, 2021).

This problem is especially pronounced in countries like Georgia, which aspires to function as a regional transit and logistics hub. Despite receiving significant donor funding for road infrastructure, Georgia lacks a comprehensive framework for managing assets across their full lifecycle. The IMF's Public Investment Management Assessment (PIMA) notes that investment decisions in Georgia are often guided by visibility and short-term considerations, while maintenance and rehabilitation receive insufficient attention (IMF, 2018). The treatment of maintenance as current expenditure under standard public accounting frameworks further discourages timely intervention, as it reduces measured savings, unlike capital expenditures which enhance reported investment (Babych & Leruth, 2021).

Economic models of infrastructure lifecycle management consistently emphasize the value of timely maintenance. Deterministic frameworks such as those developed by Harvey (2012) and Li and

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Madanat (2002) demonstrate that deferring maintenance increases user costs disproportionately, while periodic interventions can reduce total lifecycle costs. More complex formulations explore the interaction between infrastructure quality and road user behavior under network competition (De Palma, Kilani & Lindsey, 2007). However, these models are primarily tailored to high-income settings and do not account for the fiscal and institutional constraints typical for low- and middle-income countries. This study addresses this gap by applying a stylized theoretical model to the Georgian road network. It assumes fixed traffic flows, deterministic deterioration, and maintenance triggered by pavement roughness thresholds (e.g., International Roughness Index (IRI)). The model aims to minimize the present value of both agency and user costs. The empirical analysis uses budget data and project records from 2014-2024 to assess spending patterns across construction, rehabilitation, and maintenance. International practices are used as benchmarks. The paper concludes with reform proposals for budgeting and asset management to improve cost-efficiency and transparency.

THEORETICAL FOUNDATIONS

A large body of literature addresses the optimization of infrastructure maintenance, rehabilitation, and investment. While most models were developed for high-income countries with stable institutions and robust data systems, their insights remain relevant for emerging economies, particularly regarding lifecycle cost trade-offs.

A key concept in this field is infrastructure deterioration over time due to usage, climate, and material wear. For roads, this is measured as progressive surface roughness, affecting comfort, safety, and vehicle operation. Paterson and Attoh-Okine's framework models deterioration as a function of structural deformation, surface defects, and environmental stress (Paterson & Attoh-Okine, 1992). Their work underpins systems like the World Bank's HDM-4, widely used for road asset management.

Economic models built on such deterioration laws aim to minimise total costs - agency costs (e.g., resurfacing) and user costs (e.g., travel time, vehicle wear). Harvey presents a deterministic model where the optimal timing of maintenance balances the cost of intervention against rising user costs from deferred works. This approach introduces the marginal benefit-cost ratio as a decision rule (Harvey, 2012). Li and Madanat (2002) advance this by modelling continuous deterioration under a Markov process. Their resurfacing policy defines intervention thresholds to maintain pavement within acceptable roughness bounds. The model remains effective even under stochastic variation in road conditions (Li & Madanat, 2002).

Newbery's (1988) contribution focuses on road damage externalities. He shows that when roads are resurfaced at a defined threshold, the average maintenance cost equals the marginal social cost of road use. This supports using average maintenance cost as a basis for road user charges (Newbery, 1988). De Palma, Kilani, and Lindsey (2007) examine competing roads in a duopoly setting. Their model links maintenance and service quality to user utility. They find that in unregulated competition, maintenance may be underprovided, especially on higher-quality routes - highlighting the importance of public oversight (De Palma, Kilani & Lindsey, 2007).

Though calibrated in high-income contexts, these models can be adapted to resource-constrained settings. Their core insight is that timely, cost-effective maintenance reduces long-term expenditure remains applicable and will guide the analysis in subsequent sections.

EMPIRICAL AND POLICY STUDIES

Translating theoretical models into practice requires empirical validation and alignment with budgetary and institutional realities. In many developing and transition economies, maintenance remains underfunded, resulting in inefficient use of infrastructure investment.

A global review by Schwartz et al. found that up to one-third of public infrastructure investment is lost to inefficiencies, mainly due to inadequate asset management and neglected maintenance. Their analysis of over 2,000 projects shows that countries with stronger investment management systems achieve better returns not by spending more, but by managing assets more effectively (Schwartz et al.,

2020). The 2021 United Nations Handbook reinforces this view, warning that prioritizing visible new projects over maintenance may cost low- and middle-income countries up to 2% of GDP annually. The report recommends institutionalizing asset management, adopting lifecycle-based budgeting, and ensuring stable funding for maintenance (United Nations, 2021). Georgia's 2018 PIMA report identified several weaknesses: fragmented maintenance responsibilities, limited project appraisal, and the absence of lifecycle cost analysis. Despite increased investment in roads, maintenance and rehabilitation remain poorly prioritized, threatening the durability of past capital works (IMF, 2018).

Babych and Leruth argue that standard budget classifications contribute to this problem. Maintenance is recorded as current expenditure, while construction and major rehabilitation are treated as investment. This skews incentives against preventive spending and distorts fiscal planning. They propose a separate classification for rehabilitation to enhance transparency and efficiency (Babych & Leruth, 2021). Although focused on buildings, a literature review by Le et al. (2018) offers relevant insights. They find both under- and over-spending on maintenance can be inefficient and stress the need for empirical benchmarks and better data on asset condition, usage, and costs - needs that are equally pressing in transport infrastructure (Le et al., 2018). These studies highlight the importance of adapting theoretical frameworks to local institutional and fiscal contexts. Without improved data systems and classification standards, countries risk misallocating resources across the asset lifecycle.

INTERNATIONAL BENCHMARKS AND PRACTICES

International experience shows that efficient allocation between new construction, rehabilitation, and maintenance depends on the alignment of budgeting systems, expenditure classifications, and investment planning frameworks. High-performing systems apply lifecycle cost principles, supported by data and clear institutional rules.

Estonia provides a strong example. According to the IMF's 2019 PIMA, the country separates maintenance, rehabilitation, and construction in both budgeting and accounting. Medium-term ceilings are set specifically for maintenance, and asset registers are routinely updated using physical condition indicators (IMF, 2019).

Chile uses performance-based contracts to enforce road maintenance standards. Under its National Infrastructure Fund, contracts include measurable criteria such as pavement roughness thresholds, with penalties for non-compliance. A robust inspection regime supports long-term asset quality. This model has influenced PPP frameworks across Latin America (Guasch et al., 2014).

Mexico links investment and maintenance funding to performance indicators. Transport agencies apply multi-year asset management plans and conduct regular audits. A 2017 OECD report highlights efforts to harmonize expenditure definitions between federal and local governments to reduce classification inconsistencies (OECD, 2017).

Poland's General Directorate for National Roads and Motorways operates a pavement management system based on the HDM-4 platform. Projects are prioritized using indicators like the IRI and evaluated through net present value (NPV) and internal rate of return (IRR) calculations. This supports transparent, cost-effective programming (Pieriegud & Archutowska, 2012).

Despite institutional differences, these systems share key features: clear classification standards, condition-based planning, medium-term expenditure frameworks, and performance-linked funding. For Georgia, where maintenance is underfunded and rehabilitation is often misclassified, these cases offer valuable lessons. Aligning national practice with international benchmarks would require better asset data, revised budget coding, and strengthened institutional accountability.

CONCEPTUAL FRAMEWORK

Efficient infrastructure management requires a lifecycle perspective that captures trade-offs between investment, maintenance, and rehabilitation. This is especially important in fiscally constrained settings, where new construction often overshadows the need for preserving existing assets. Effective infrastructure management requires a structured approach to evaluating the long-term

cost implications of alternative spending strategies. This is especially relevant in contexts where fiscal space is constrained, and public attention remains focused on new construction rather than asset preservation.

A lifecycle-based framework allows for balancing investment, maintenance, and rehabilitation by accounting for the progressive deterioration of infrastructure. For road networks, condition is typically assessed using metrics such as the IRI or Pavement Condition Index (PCI) (Haas, Hudson & Zaniewski, 1994). Infrastructure quality declines with age, traffic volume, and environmental exposure. As conditions deteriorate, user costs (including travel delays, increased vehicle operating expenses, and safety risks) tend to rise non-linearly. Agency costs vary depending on the type and timing of intervention: routine maintenance is relatively inexpensive but requires regular application, while delayed interventions may result in costly rehabilitation or full reconstruction (Burningham & Stankevich, 2005).

The deterioration process is well illustrated in Paterson's foundational model, incorporated into the HDM-4 platform, which shows that roughness initially increases slowly but accelerates after a critical threshold (e.g., IRI > 5). Beyond this point, user costs escalate rapidly, and major rehabilitation becomes unavoidable (Paterson, 1987). Delayed maintenance not only increases long-term costs but also raises fiscal risk and the likelihood of structural failure, particularly for high-risk assets such as bridges and mountain roads (NCHRP, 2011).

The lifecycle optimization objective can be formally expressed as minimizing the present value of total costs over a defined time horizon T :

$$\min \int_0^T [C_m(t) + C_u(q(t))] e^{-rt} dt \quad (1)$$

where $C_m(t)$ is the agency (maintenance or rehabilitation) cost at time t , $C_u(q(t))$ is the user cost as a function of road quality $q(t)$, and r is the discount rate. The system evolves under a known deterioration function $dq/dt = -\delta(q)$, which reflects roughness progression or structural degradation. This model captures the essential trade-off: frequent interventions reduce user costs but require higher annual budgets, while infrequent or delayed interventions defer costs but result in greater long-term liabilities.

Translating this into policy requires setting quality thresholds, identifying intervention types, and applying cost parameters. In low-data environments, engineering assumptions and unit price catalogues, such as those in HDM-4, enable approximate lifecycle estimates (PIARC, 2023).

Institutional factors also matter. As IMF and World Bank reports show, treating maintenance as current expenditure and rehabilitation as capital investment creates bias toward new construction (Haas, Hudson & Zaniewski, 1994; Burningham & Stankevich, 2005). This model provides a basis to assess such misalignments and supports reforms for lifecycle-based budgeting in Georgia.

THEORETICAL MODEL STRUCTURE

Building on the framework outlined above, this section sets out a stylized theoretical model to guide maintenance and investment planning for road infrastructure in settings where fiscal and institutional constraints are binding. The model reflects principles established in the resurfacing optimisation literature, particularly the deterministic, steady-state formulation by Li and Madanat (2002).

Infrastructure quality over time is represented by the differential equation:

$$dq(t) / dt = -\delta(q(t)) \quad (2)$$

where $q(t)$ is the infrastructure quality (e.g., inverse of IRI or PCI) at time t , and $\delta(q)$ is the deterioration rate, which may be constant or dependent on factors such as traffic load, climate, and construction quality. In most practical applications, a linear or exponential form of deterioration is assumed for computational tractability (Prozzi & Madanat, 2004).

The model assumes that once the infrastructure quality falls below a predetermined threshold q_{min} , a resurfacing action is applied, restoring the asset to a higher quality level q_{max} . This cyclical intervention structure reflects common maintenance planning logic in pavement management systems.

The optimal resurfacing policy involves choosing the threshold q_{min} and restoration intensity Δq to minimize the present value of total costs over an infinite time horizon:

$$\min \sum_{n=1}^{\infty} \left[C_m(q_n) + \int_{t_n}^{n+1} C_u(q(t)) e^{-r(t-t_0)} dt \right] \quad (3)$$

where $C_m(q_n)$ is the agency cost of resurfacing at time t_n , $C_u(q(t))$ is the user cost as a function of road quality, and r is the social discount rate. A key insight from this model is that the optimal intervention cycle is not fixed but depends on the cost elasticity of quality and the deterioration dynamics of the asset.

The model accommodates extensions: multiple intervention types, stochastic deterioration, and variable traffic. Even in reduced form, it shows that resurfacing at higher thresholds may lower user costs, despite increased agency spending - a finding supported by HDM-4 applications.

In Georgia's context, the model can be calibrated using unit cost catalogues and traffic data. Thresholds such as IRI = 3 for overlays or IRI = 5 for rehabilitation are consistent with national and World Bank practice (Burningham, S. & Stankevich, 2005).

Importantly, the model also enables quantifying the costs of deferred maintenance under budget constraints - conditions often present in rigid, line-item budgeting systems. It can be used to assess the efficiency losses from delayed interventions and support arguments for reforming budget classification and expenditure rules. Sensitivity analysis further enhances its policy relevance. Parameters such as the discount rate, traffic growth, or cost inflation can be varied to test the robustness of maintenance strategies. In doing so, the model becomes a tool not only for planning but also for fiscal risk assessment and institutional reform in infrastructure management.

GEORGIA'S ROAD NETWORK: COVERAGE, QUALITY INDICATORS, AND GAPS

According to the latest available data from 2023, Georgia's road network comprises 34,043.9 km of *local roads*, 5,460.3 km of *secondary roads*, and 1,593.4 km of *international roads*. In total, this corresponds to a road density of 589.6 km per 1,000 km² (Department of Roads and Municipal Administration, 2024) (Local roads exclude those within self-governing cities, in line with the 2021 amendment to the Law of Georgia "On Motorways."). While comprehensive data on road quality remain limited, available indicators provide some insight into the state of the network. Based on the World Economic Forum's Global Competitiveness Index, which reflects perceptions of road quality (GCI 4.0: Quality of roads (1-7) based on survey), Georgia ranked between 80th and 81st globally during 2017–2019. Over this period, its score improved from 45.9 in 2017 to 46.6 in 2019 (WEF, 2019). Georgia outperformed other South Caucasus countries and several Eastern European economies, including Latvia (95th), Serbia (98th), Bulgaria (102nd), North Macedonia (105th), Ukraine (114th), Romania (119th), Bosnia and Herzegovina (121st), and Moldova (129th) (WEF, 2019). Nonetheless, Georgia still lags behind the leading performers in both Eastern and Western Europe in terms of perceived road quality.

In addition to international benchmarks, domestic data provided by the Roads Department of Georgia offer a more detailed picture of road surface quality based on the International Roughness Index (IRI). As of 2020, 89% of *international roads* were assessed to be in good or fair condition (IRI < 6), while 7% were categorized as poor (IRI between 6 and 8) and 4% as bad (IRI > 8). The Department aims to improve these figures further, targeting an increase in the share of roads in good or fair condition to 95% by the end of 2025 and 97% by 2030, while reducing the share of roads in bad condition to 1% and 0%, respectively (Transport Community, 2023). While the overall condition of international roads shows a positive trend, a considerable number of road sections still require rehabilitation and periodic maintenance to preserve service quality and prevent accelerated deterioration.

The condition of *secondary roads* remains more challenging. In 2020, only 67% of secondary roads were classified as being in good or fair condition, while 9% were in poor condition and 24% in bad condition. The planned targets anticipate a gradual improvement, with the share of roads in good

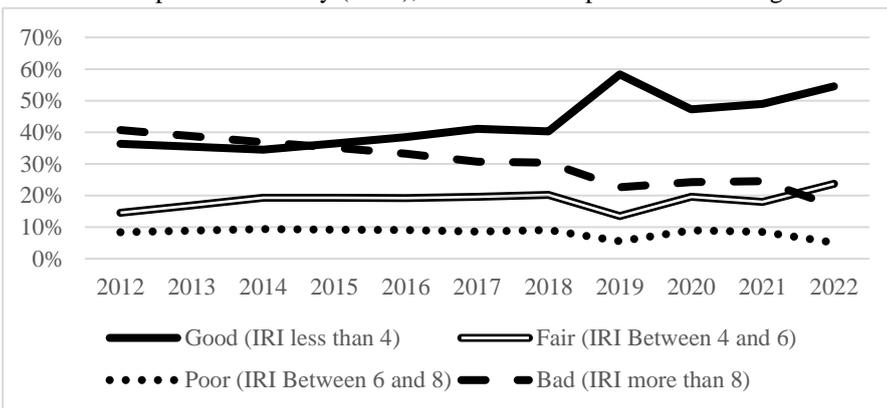
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and fair condition expected to rise to 79% by 2025 and 93% by 2030. Correspondingly, the proportion of roads in bad condition (IRI > 8) is projected to fall to 14% in 2025 and further to just 4% by 2030 (Transport Community, 2023).

Notably, the share of secondary roads in good condition (IRI < 4) has shown consistent growth, surpassing the share of roads in bad condition in 2015 and accelerating markedly since 2018. Meanwhile, the proportion of secondary roads in fair condition (IRI between 4 and 6) and poor condition has remained relatively stable over time (see Figure 1). Nevertheless, even by 2022, only slightly more than half of the road network was in good condition, while more than 16% of secondary roads remained in bad condition (Transport Community, 2023).

Figure 1. *Secondary Road Network Condition 2012–2022 (GEL Million)*

Source: Transport Community (2023), SSA Roads Department of Georgia



Note: Data for 2022 are based on estimates and may be subject to revision.

There is currently no publicly available data on the condition of *local roads* in Georgia beyond 2010. The most recent assessment, conducted by the World Bank that year, offers important historical context. At the time, only 5% of local roads were classified as being in good condition, 10% in fair condition, another 10% in poor condition, and the remaining 75% in bad condition. This extremely poor state of the local road network was largely the result of prolonged neglect following independence, during which many roads received little to no maintenance for over a decade.

Although local maintenance practices have improved in recent years, the legacy of underinvestment continues to weigh heavily on the system. As of the latest available qualitative assessments, only a small share of local roads—mainly those rehabilitated under the World Bank’s Secondary and Local Roads Project (SLRP) and similar programs—is considered to be in good condition. Approximately three-quarters of the local road network remains in bad condition, underscoring a significant disparity compared to the relatively better-maintained international and secondary road networks (World Bank, 2010).

RESILIENCE AT RISK: RISING PRESSURE ON GEORGIA’S ROAD INFRASTRUCTURE FROM MOBILITY AND CLIMATE CHANGE

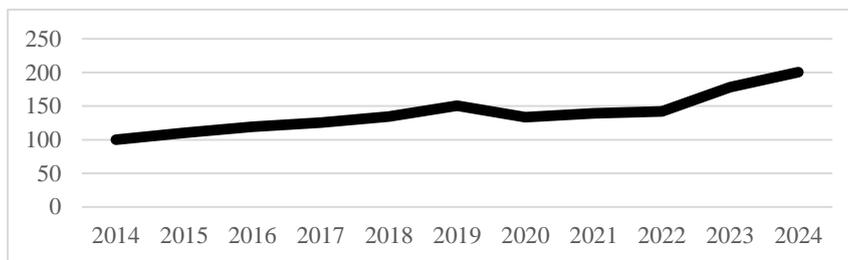
In addition to the notable improvements in the overall condition of Georgia’s road network—particularly on international roads—significant challenges persist with regard to secondary and, more acutely, local roads. These challenges are likely to intensify in the coming years due to a combination of environmental factors and increased traffic volumes, both of which heighten the importance of timely and adequate road maintenance. According to the Ministry of Internal Affairs, the number of registered vehicles in Georgia has risen sharply over the past seven years, increasing from approximately 1.2 million in 2017 (around 330 per 1000 persons) to nearly 1.8 million in 2024 (around 480 per 1000 persons) (Geostat, 2024). The increase was heavily concentrated in Tbilisi, which accounted for 22.2 percentage points of the total growth, followed by Imereti (4.5 ppts), Kakheti (4.0 ppts), Kvemo Kartli (3.7 ppts), Adjara (2.7 ppts), and Shida Kartli (2.3 ppts) (Geostat, 2024).

This growth in the vehicle fleet has translated into higher usage intensity on major transport corridors, particularly international roads. To assess infrastructure stress over time, a Road Pressure Index (RPI) was constructed, weighting vehicles by their estimated impact on road wear. The index is defined as:

$$RPI_t = \frac{\sum_i (V_{i,t} * W_i)}{L_t} \quad (4)$$

where $V_{i,t}$ - number of registered vehicles of type i in year t (e.g., cars, minibus, bus and truck, trailer and 3 axles or more vehicle), W_i - weight factor for vehicle type i , capturing its relative road pressure/damage, L_t - total road length in year t (in km). The weights reflect the relative impact of each vehicle type on road deterioration based on axle load and wear intensity. The resulting index measures the weighted vehicle load per kilometer of road and is normalized using base-year indexing (e.g., 2010 = 100) to facilitate trend analysis. The RPI shows a clear upward trajectory since 2014, with the only decline observed in 2020 during the COVID-19 pandemic. Notably, road pressure has intensified since 2022, reflecting increased cargo flows through the Middle Corridor and a surge in economic activity. This trend underscores the urgent need for enhanced and proactive road maintenance planning (Roads Department of Georgia, 2024).

Figure 2. Road Pressure Index (RPI) 2014–2024 (2014 as a Base Year)



Source: Authors' Calculations, Statistics Office of Georgia, Road Department of Georgia

Furthermore, Georgia's road network has faced increasingly frequent damage from climate-related hazards over the past decade. Intensifying extreme rainfall has led to floods and mudflows that wash out bridges and road foundations, especially in mountainous areas (Government of Georgia, 2017). For example, the June 2015 Tbilisi floods caused over \$20 million in damages, destroying sections of at least 40 roads in the capital (World Bank, 2017). In Georgia's highlands, heavier precipitation has triggered more landslides and debris flows. In 2014, massive landslides in the Dariali Gorge repeatedly blocked the only highway to Russia for weeks, wrecking road infrastructure and even severing a transnational gas pipeline (Civil Georgia, 2014). Such events are not isolated. National statistics indicate that landslide incidence has risen by roughly 63% since the late 1980s, a trend attributed to changing climate patterns (PPIAF, 2020). Meanwhile, heatwaves and rising average temperatures have begun to degrade pavement integrity, with higher summer heat accelerating asphalt deterioration (GIZ, 2020). These physical impacts underscore the growing vulnerability of Georgia's roads to climate change and associated environmental shifts. The rising number of vehicles and the associated increase in road pressure as well as environmental damages underscore the growing importance of routine maintenance to preserve road quality over time. Ensuring adequate and timely maintenance reduces the risk of premature deterioration, thereby lowering the need for costly rehabilitation works or the early reconstruction of road segments.

TRENDS IN ROAD INFRASTRUCTURE SPENDING IN GEORGIA: CONSTRUCTION VS. MAINTENANCE (2014–2024)

Over the past decade, Georgia has experienced a substantial expansion in investment activity, with Gross Fixed Capital Formation (GFCF) increasing by 1.7 times in real terms between 2014 and 2024 (Geostat, 2024). Although private sector investment has remained the dominant force, public investment has played a strategically important role, consistently contributing around one-third of total

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capital formation. Capital project expenditures financed through the state budget quadrupled over the same period—rising from 12% to 16.6% of total budgetary outlays and reaching nearly 4.3 billion GEL by 2024 (Geostat, 2024; Ministry of Finance, 2024). When measured as a share of GDP, public capital spending grew from just under 4% to 4.7%, highlighting a sustained policy orientation toward infrastructure-led development (Ministry of Finance, 2024). At the same time, the composition of investment financing shifted markedly, with the share of domestic sources increasing from 40.8% in 2014 to 70.9% in 2024—signaling improved domestic revenue mobilization and declining reliance on foreign grants (Ministry of Finance, 2024). Within this evolving public investment landscape, road infrastructure has emerged as a central priority, absorbing an increasing share of public resources and anchoring Georgia’s ambitions to strengthen its role as a regional transit and connectivity hub. In 2024, 70.9% of capital project expenditures were financed through domestic budget funds, 28.5% through external loans, and only 0.6% through grants (Ministry of Finance, 2024).

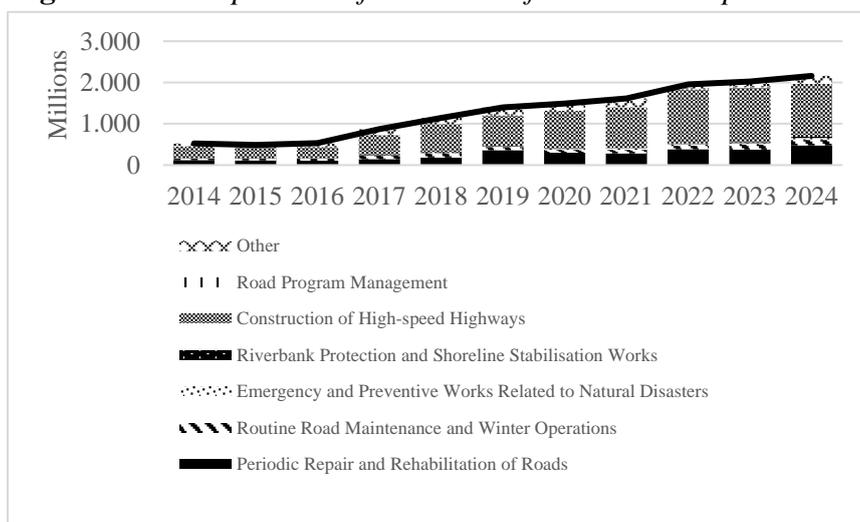
Between 2014 and 2024, the Roads Department of Georgia expanded its spending from 0.5 billion GEL to over 2.1 billion GEL on road infrastructure improvement measures (Roads Department of Georgia, 2024). This extraordinary increase reflects a compound average growth rate of 16.6% per year. The expansion was not smooth; it featured pronounced spikes in budget expenditures – notably 64.9% growth in 2017, followed by 31.0% in 2018, 21.9% in 2019, and 21.2% in 2022 (Roads Department of Georgia, 2024). These surges correspond to periods of accelerated project implementation (e.g. the scaling up of major highway construction programs), highlighting the volatility and project-driven nature of Georgia’s road investment cycle. In terms of the broader economy, annual road infrastructure expenditure has fluctuated between 1.4% and 3% of GDP over the decade (Roads Department of Georgia, 2024; Geostat, 2024). This elevated spending aligns with Georgia’s strategic emphasis on developing transport corridors – an ambition to serve as a regional transit hub that attracted substantial donor financing for new highways. Crucially, however, the rising expenditure has not translated into a proportional increase in upkeep of existing assets. As the IMF’s Public Investment Management Assessment (PIMA) observed, maintenance and rehabilitation remain poorly prioritized despite greater outlays, posing risks to the durability of past investments. This suggests that spending quality – the balance between building new infrastructure and preserving old – may be as important as spending quantity in Georgia’s road sector (IMF, 2018).

Georgia’s road infrastructure budget is officially divided into three programmatic components: (1) *Road Program Management* (administration and planning), (2) *Construction and Maintenance of Roads*, and (3) *Construction of High-Speed Highways*. In practice, the lion’s share of resources has been absorbed by new construction, especially highways, while maintenance activities constitute a relatively small portion of the total. In 2014, for example, the construction of high-speed highways program accounted for 283 million GEL, or 53.8% of total road infrastructure spending (Roads Department of Georgia, 2024). By 2024, this category had grown to over 1.2 billion GEL, representing 58.9% of the road budget (Roads Department of Georgia, 2024). The predominance of high-speed highway projects reflects Georgia’s focus on expanding its main transit corridors, often with external funding support. This prioritization of new highway construction is further evidenced by the budget’s evolution: the highway program consistently grew faster than other components, increasing not only in absolute terms but also as a share of an expanding pie.

Correspondingly, the resources devoted to road maintenance and rehabilitation have risen in absolute terms yet lag behind in relative growth. Under the *Construction and Maintenance of Roads* umbrella, two key line-items are *Periodic Repair and Rehabilitation* (i.e. major scheduled renewals of road pavement) and *Routine Maintenance and Winter Operations* (everyday upkeep such as pothole patching, cleaning, and snow removal). The Construction and Maintenance of Roads budget category encompasses a range of activities, including Periodic Repair and Rehabilitation, Routine Maintenance and Winter Operations, as well as Emergency and Preventive Works related to natural disasters, riverbank protection, and shoreline stabilization. Among these, Periodic Repair and Rehabilitation and Routine Maintenance and Winter Operations represent the largest subcomponents.

In 2014, periodic repair and rehabilitation received slightly more than 119 million GEL, which was 22.7% of total road infrastructure expenditure (approximately 0.4% of GDP) and 50.4% of expenditures on construction and maintenance of roads (Roads Department of Georgia, 2024; Geostat, 2024). Routine maintenance and winter operations in 2014 was funded at just under 37 million GEL (about 7% of the road infrastructure improvement budget, 15.5% of the expenditures on construction and maintenance of roads, and 0.1% of GDP) (Roads Department of Georgia, 2024; Geostat, 2024). By 2024, these allocations had increased to over 481 million GEL for periodic rehabilitation (about 22.3% of the total road infrastructure improvement budget, 54.9% of the expenditures on construction and maintenance of roads, and 0.5% of GDP) and around 125 million GEL for routine maintenance (about 5.8% of the total road infrastructure improvement budget, 14.4% of the expenditures on construction and maintenance of roads, 0.1% of GDP) (Roads Department of Georgia, 2024; Geostat, 2024). Thus, over the decade the nominal spending on maintenance nearly quadrupled, yet its share of both the road budget and GDP barely changed. In fact, routine maintenance saw a slight decline in budget share (from 7.0% to 5.8%), while periodic rehabilitation held roughly constant around 22–23% (Roads Department of Georgia, 2024). This indicates that new capital works have outpaced maintenance even as overall funding grew. The composition of spending therefore reinforces a construction-heavy pattern: roughly 60% of funds go to new highways by 2024, whereas the combined outlay on periodic rehabilitation and routine maintenance hovers near 28% (with the remainder going to program management and other minor works) (Roads Department of Georgia, 2024). The evidence clearly points to a persistent imbalance: Georgia’s road investment strategy has heavily favored building new infrastructure over adequately maintaining the existing network (see Figure 3).

Figure 3. *Decomposition of the Road Infrastructure Improvement Measures 2014–2024 (GEL Mil.)*



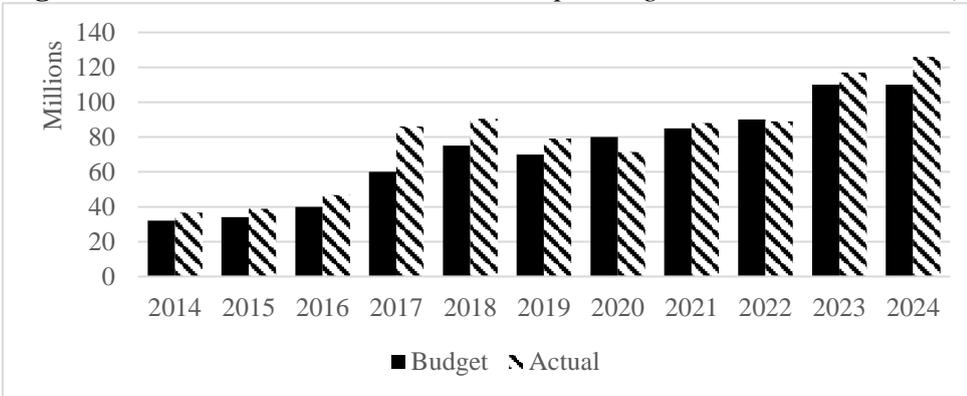
Source: SSA Roads Department of Georgia

In the road sector, both current and capital maintenance are budgeted through specifically designated programs and sub-programs. The Roads Department employs its own methodology to estimate physical maintenance needs, using a multi-criteria analysis based on maintaining defined road condition standards, typically measured by the International Roughness Index (IRI) (World Bank, 2010). However, there is no unified or standardized approach for calculating either routine or capital maintenance requirements and their corresponding budgetary implications. In practice, funding levels are determined largely through incremental adjustments, reflecting the availability of fiscal resources rather than a needs-based assessment. The analysis of maintenance-related expenditures—both planned and actual—is further complicated by limited budgetary disaggregation. While routine maintenance appears under road project and equipment classifications, spending on capital

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maintenance is not consistently identified or separately reported in budget execution documents (World Bank, 2010). Available data indicate that actual maintenance expenditures have generally exceeded approved allocations—except in 2020, when spending was temporarily constrained by the COVID-19 pandemic (Roads Department of Georgia, 2024) (see Figure 4).

Figure 4. Routine/Periodic Maintenance Spending on Roads 2014–2024 (GEL Million)

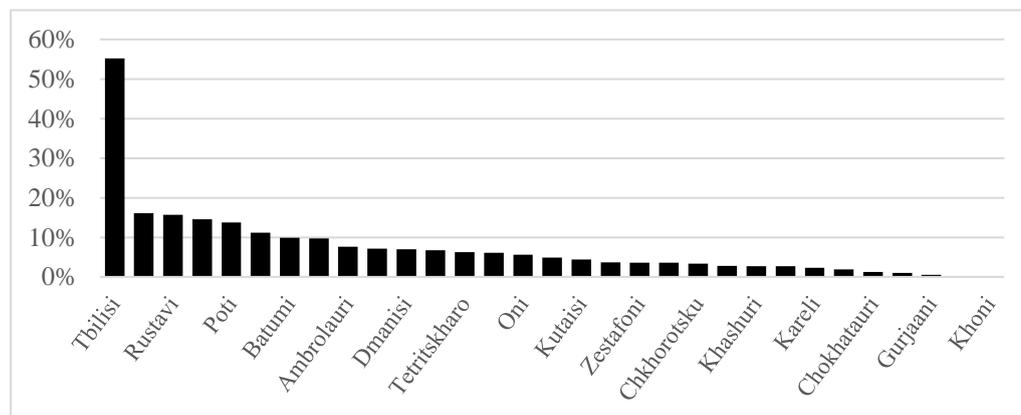


Source: SSA Roads Department of Georgia

In 2007, responsibility for local road maintenance in Georgia was transferred from the Roads Department to municipalities, introducing a decentralized framework. However, many municipalities continue to face institutional and financial constraints, with limited experience in managing maintenance operations. As a result, they rely heavily on private contractors not only for implementation but also for drafting contracts and workplans (World Bank, 2010). Most contractors are former Roads Department units privatized in the late 1990s. While some have acquired new equipment for rehabilitation, most rely on aging machinery. Routine maintenance plays a minor role in their business—typically 5–10% of turnover—but is valued for its stability, particularly during off-peak seasons. Contractor turnover remains low, and contracts are often awarded to the same firms due to weak municipal procurement capacity (World Bank, 2010).

Routine maintenance is funded exclusively from municipal revenues, as no earmarked transfers are provided by the central government. Although periodic rehabilitation may receive co-financing, routine maintenance allocations vary widely across municipalities. In 2022, only Tbilisi allocated more than 50% of its road infrastructure budget to maintenance—up from 34.9% in 2018. A few others, including Ozurgeti, Rustavi, Dusheti, Poti, and Akhalkalaki, allocated slightly more than 10%, while Batumi was close to that level. Several municipalities reported no maintenance expenditure at all, prioritizing construction and rehabilitation. For some, data remains unavailable (Ministry of Finance, 2024) (see Figure 5).

Figure 5. The Share of Road Infrastructure Maintenance Expenditures Within Total Road Infrastructure Development Spending 2022 (%)



Source: Authors’ Calculations Based on Municipal Budget Documents

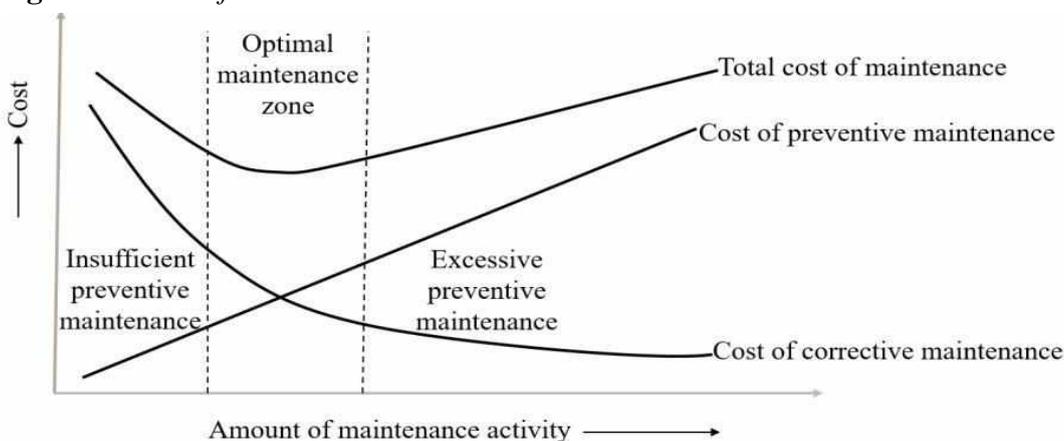
Routine road maintenance plays a critical role in preserving infrastructure quality and managing long-term costs. According to a World Bank assessment from 2010—the most recent available detailed breakdown—routine maintenance expenditures for international and secondary roads were primarily directed toward winter road maintenance (51.9%), followed by roadway maintenance (32.6%), technical means of traffic regulation (9.3%), and road structure maintenance (3.5%) (World Bank, 2010). The distribution differs markedly in the case of local roads, where the emphasis shifts toward basic upkeep: roadway maintenance accounts for 66.5%, structural maintenance 21.2%, and traffic regulation measures just 5.7%. Winter road maintenance comprises only 3.3%, largely due to limited municipal budgets and prioritization of pavement repairs. Over 65% of the local road maintenance budget is allocated to road surface improvements—most notably, patching and sealing of asphalt roads (40%), graveling of non-paved or severely deteriorated roads (15–20%), and base repairs (5–10%) (World Bank, 2010).

Municipal maintenance contracts for local roads are typically input-based, meaning contractors are compensated based on the quantity of work or materials used. While this approach provides flexibility, it places most of the financial risk and administrative burden on contracting agencies. Each contract includes a detailed bill of quantities covering 109 distinct activities, and monthly workplans must be developed and evaluated. Given the limited staffing and capacity of local inspectorates, contract supervision and quality assurance remain significant challenges (World Bank, 2010). Moreover, maintenance strategies often favour reactive repair of degraded roads, while recently rehabilitated roads—despite being in good condition—are neglected under the rationale that maintenance funds should target problem areas. This short-term logic risks accelerating the deterioration of otherwise sound infrastructure, ultimately raising overall maintenance costs and leading to a gradual decline in average road conditions across the network (World Bank, 2010).

LIFECYCLE IMPLICATIONS OF UNDERFUNDING MAINTENANCE

Georgia’s bias toward new infrastructure investment over maintenance poses significant lifecycle cost risks. As discussed earlier with Paterson’s model (1987), the total present value of road costs is minimized when maintenance is performed at optimal intervals to prevent severe deterioration (Paterson, 1987) (see figure 6). In Georgia, however, maintenance has been persistently underfunded relative to new construction. Only about one-quarter of the road budget is allocated to routine maintenance and periodic rehabilitation – roughly 0.6% of GDP – while nearly 60% goes to new highway projects. Routine maintenance funding has remained around 0.1% of GDP for a decade. This imbalance means many road assets may deteriorate to poor condition before intervention, undermining their intended lifespan. Indeed, without increased upkeep, new highways built today could require premature rehabilitation just a few years later, negating the development benefits of those investments.

Figure 6. *Total of Maintenance Cost*



Source: Douglas, C (2017)

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Insufficient maintenance leads to cost inefficiencies across the asset lifecycle. Road pavements follow a deterioration curve: without timely upkeep, pavement roughness worsens at an accelerating rate, causing sharply rising user costs (vehicle wear, extra fuel, travel delays) and eventually requiring extensive – and expensive – rehabilitation. Deferring routine repairs may save money in the very short term, but each GEL “saved” by skimping on maintenance can impose several GEL of costs in the future through higher rehabilitation bills or losses from poor transport quality.

International evidence echoes this pattern. For example, a U.S. study found that every \$1 of road maintenance deferred can incur over \$4 in future repair costs, and the World Bank estimated that \$12 billion of timely road maintenance in Africa during the 1980s would have averted \$45 billion in reconstruction costs the following decade (IMF, 2018). Neglecting maintenance also drives up indirect costs: vehicle operating costs can increase dramatically on poorly maintained roads, and safety risks grow as infrastructure deteriorates (IMF, 2018). In short, under-funding routine and periodic maintenance is a false economy – it trades modest upfront savings for much larger costs down the line, raising the total cost of infrastructure ownership. Georgia’s own spending pattern – heavily weighted to new builds and reactive fixes – thus risks higher lifecycle expenditures and diminishing returns on investment, as roads deteriorate faster than they can be repaired.

In addition to increasing overall maintenance spending, it is crucial to prioritize the upkeep of roads that are still in good or fair condition (this section is particularly important for international and secondary roads, where a substantial share of the network remains in good or fair condition, yet the allocated maintenance budget remains relatively limited). Empirical evidence from Georgia’s road network indicates that preventive maintenance at this stage yields the highest economic returns, helping to avoid costly deterioration and extend asset life efficiently. An HDM-IV simulation from a 2010 World Bank study illustrates that for a typical local paved road starting in good condition (International Roughness Index ≈ 3 , AADT ~ 500), implementing regular routine maintenance dramatically lowers life-cycle costs (World Bank, 2010). Over a 20-year span, total transport costs (agency + user costs) drop from about \$1,008,600 per km with a “do-nothing until rebuild” approach to roughly \$960,700 per km with timely maintenance – a net present saving of \sim \$47,900 per km (World Bank, 2010). These savings are split almost evenly between reduced future rehabilitation expenses and lower road user costs (fuel, vehicle wear, travel time) due to smoother pavement. In cost-benefit terms, each \$1 spent on routine upkeep of a road in good condition can avert about \$8 in overall costs, thanks to both deferred major repairs and user cost reductions. By contrast, adding routine maintenance an expensive asphalt overlay mid-way (when the road is in fair condition IRI=5.5) yields only marginal extra benefit – total costs fall only another $\sim 3\%$ (to \$959,300 per km) – because maintenance expenditures quadruple with the overlay. The marginal benefit-cost ratio drops to around 2.6:1 in that enhanced scenario (the benefits are purely the result of lower user cost), indicating diminishing returns (World Bank, 2010). Thus, basic routine maintenance of good roads offers the highest payoff, whereas more intensive interventions (overlays or late reconstruction) deliver smaller incremental gains.

The return on maintenance investment plummets once a road reaches poor condition (This section is particularly important for local roads, where the share of poor-quality infrastructure is especially high, rehabilitation progresses slowly, and maintenance spending remains low— with some municipalities allocating virtually no resources to road upkeep). HDM-IV simulations for a deteriorated asphalt road (initial IRI ~ 8) show that simply patching potholes on a very rough road without early rehabilitation not only fails to substantially improve ride quality, but can increase total costs by deferring the inevitable reconstruction. In one scenario, routine patching delayed the rebuild by 7 years (from 2020 to 2027) but kept the pavement in poor shape, so vehicle operating costs remained high; as a result, the present value of total costs was actually higher with routine maintenance than with none at all. Every extra dollar spent on patching such a road had negative returns (NPV $\approx -$ \$66,000 per km) because the prolonged roughness imposed steep costs on users (World Bank, 2010). The optimal strategy in this case was to combine routine maintenance with a timely reconstruction (or

overlay) at a lower roughness threshold – for example, rebuilding at IRI 10 instead of 16 yielded the lowest total cost. This combined approach produced a modest net gain (benefit-cost ratio ~1.5) by significantly cutting user costs in the later years (World Bank, 2010). The implication is that once pavements become badly degraded, only substantial capital repair (overlay or full rehabilitation) can reset the cost curve; routine maintenance alone offers brief respite but no lasting economic benefit in such cases. Put simply, “fix-it-later” is far costlier than “fix-it-early.”

These efficiency dynamics vary across Georgia’s road network categories and inform critical policy choices. Georgia’s international highways (which carry heavy traffic) are relatively well-maintained – about 80% are in good condition – whereas only 5% of local roads are good and a staggering 75% of the local network is classified as *very poor* (World Bank, 2010). This disparity reflects past funding biases: major roads received resources for timely upkeep, while local roads were largely neglected post-independence. Crucially, the highest marginal returns on maintenance are achieved by preserving the roads that are already in good (or fair) condition, regardless of category. Even roads in fair condition offer strong returns to preventive repairs (by sealing cracks and potholes before they undermine the base), albeit slightly lower than for pristine roads due to higher repair costs. Therefore, after securing all good-condition sections, it is still economically efficient to maintain fair-condition roads as a second priority – their upkeep yields far greater benefit per dollar than funneling resources into severely dilapidated segments. However, current policy and public pressure often push the opposite approach. Municipalities tend to pour scarce funds into visibly poor roads in response to community complaints about bad access, while recently rehabilitated or decent roads receive little to no maintenance. This “worst-first” tendency may be politically understandable, but it carries heavy long-term costs. As the World Bank study warns, it creates a vicious cycle: roads in poor condition absorb most of the budget for only short-lived improvements, while good roads are left untended and deteriorate prematurely, eventually requiring costly repairs themselves. The outcome is a perpetually underperforming network and an excessive burden on limited maintenance funds, which are essentially spent inefficiently to chase ever-worsening conditions (World Bank, 2010).

INTERNATIONAL COMPARISONS AND BEST PRACTICES

A growing body of international evidence highlights the strategic importance of preventive and routine maintenance as a cost-effective alternative to rehabilitation and reconstruction of road infrastructure. While capital investments often dominate political and public attention—largely because they are classified as fixed capital formation and look favourable in public accounting systems—maintenance spending is treated as current expenditure under international standards such as the Government Finance Statistics Manual (IMF, 2014). This classification disincentivizes governments from allocating sufficient resources to maintenance, as increased spending in this area may appear to reduce government savings. In this context, many countries have struggled to strike the right balance between expanding infrastructure and sustaining its quality over time.

Despite this global challenge, several countries have implemented notable practices that provide valuable lessons for Georgia. Estonia has developed a relatively advanced public investment management framework that emphasizes lifecycle costing and performance-based contracting. The country maintains a comprehensive asset register and integrates road maintenance needs into medium-term budget frameworks, helping ensure that infrastructure assets are managed proactively rather than reactively. Although some institutional fragmentation persists, Estonia’s systematic approach to road asset management contributes to more timely and cost-effective maintenance interventions (IMF, 2019). Poland has introduced mechanisms to secure predictable maintenance funding, most notably through the National Road Fund, which is financed by fuel charges and tolls. This fund supports both capital investment and maintenance and enables forward-looking planning. Road condition data are systematically collected and used to justify budget allocations, helping to maintain a balance between building new roads and preserving existing ones. Furthermore, technical assessments and cost-benefit analyses are embedded in investment planning, reinforcing the long-term cost-effectiveness of maintenance over reconstruction (IMF, 2019a).

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Mexico has embedded maintenance obligations in its legal and regulatory frameworks. Multi-year maintenance budgets are required alongside capital investment plans, and maintenance costs are explicitly considered in the lifecycle assessment of infrastructure projects. Dedicated maintenance funds are also established, including for public-private partnerships (PPPs), ensuring that financial resources are reserved for asset upkeep. While implementation challenges remain—especially in terms of regional equity and execution capacity—the legal requirement to integrate maintenance into infrastructure management has yielded important benefits (IMF, 2019b).

Another instructive model comes from Chile, which has been a pioneer in performance-based maintenance contracting for roads. Through its National Infrastructure Fund and related programs, Chile uses long-term maintenance contracts that include explicit performance indicators – for example, requirements that road roughness (IRI) or pavement condition remain below a certain threshold on contracted sections. Contractors are paid not just for inputs but for outcomes, with penalties for non-compliance if road quality targets are not met (Mansilla & Vassallo, 2020). A robust government inspection regime underpins these contracts to ensure standards are maintained. This performance-based approach creates clear accountability and incentives for timely maintenance, as the private operators’ profits depend on meeting maintenance outcomes. The Chilean model has influenced public-private partnership (PPP) maintenance frameworks across Latin America and offers a mechanism to depoliticize and guarantee maintenance activities. For Georgia, adopting elements of performance-based maintenance (even within traditional public works contracts) could help ensure that once roads are built, they are kept in good condition via enforceable standards, rather than waiting for periodic government-driven rehabilitation (Mansilla & Vassallo, 2020).

In comparison, Georgia has made significant progress in road rehabilitation, but institutional and budgetary shortcomings continue to hamper the sustainability of these achievements. According to the World Bank, Georgia’s Public Investment Management Assessment (PIMA) revealed that maintenance is generally underfunded and poorly integrated into the investment cycle. Budget allocations disproportionately focus on rehabilitating roads in poor condition, while roads in good condition are often neglected. This leads to a vicious cycle in which previously rehabilitated assets deteriorate prematurely due to the lack of preventive maintenance, ultimately requiring costlier interventions in the future (IMF, 2018). These international cases underscore a key insight: investing in routine maintenance when roads are still in good or fair condition offers significantly higher returns than investing in reactive maintenance or full-scale rehabilitation once roads deteriorate. Performance-based contracting, dedicated maintenance funds linked to road use (such as fuel levies), and medium-term planning frameworks emerge as critical enablers of more effective road maintenance systems. Embedding maintenance into infrastructure appraisals and budget frameworks ensures that it is no longer treated as a discretionary expense but as a vital component of sustainable infrastructure policy.

Across these examples – Estonia, Chile, Poland (and others such as Mexico) – certain common principles emerge. High-performing road infrastructure systems establish clear expenditure classifications, enforce maintenance through dedicated funding or contracts, and build robust data-driven decision frameworks. They institutionalize the idea that maintenance is not discretionary but rather a fixed cost of asset ownership, to be planned for just as capital investments are. In Estonia, this meant changing budgeting rules; in Chile, changing contract incentives; in Poland, changing the planning toolkit. For Georgia, closing the maintenance gap will likely require a combination of all these approaches. As noted, aligning Georgia’s practices with international benchmarks would involve improving asset data, revising budget coding, and strengthening institutional accountability for maintenance outcomes. In practical terms, reforms could include introducing performance-based maintenance contracts on heavily trafficked routes, carving out a protected maintenance fund or multi-year appropriation, and upgrading the road asset management database to track pavement conditions in real time. By learning from these international experiences, Georgia can move toward a more lifecycle-balanced infrastructure strategy – one that protects and maximizes the value of existing road assets while still allowing for strategic expansion.

CONCLUSION

Georgia's road infrastructure story, as examined in this paper, highlights that the country's foremost challenge is not a lack of new roads, but rather the upkeep of those already built. Decades of heavy investment in new highways and local roads have not been matched by a commensurate focus on maintenance, leading to visible quality issues despite high spending. Only a small fraction of local roads are currently in good condition, and even recently rehabilitated segments are deteriorating faster than expected due to insufficient routine maintenance. This gap between expansion and upkeep has created a vicious cycle: limited maintenance funds get thinly spread to address the most deteriorated roads, which in turn forces neglect of roads still in fair condition – hastening their decline and perpetuating the cycle. The analysis makes clear that breaking out of this “*build-neglect-rebuild*” pattern will require a fundamental reorientation of Georgia's road policy, essentially adopting a “maintenance-first” mindset going forward.

Looking ahead, Georgia has a significant opportunity to leverage international best practices and leapfrog towards more sustainable infrastructure management. The experiences of peer countries make one thing clear: nations that excel in infrastructure outcomes balance ambitious new investments with diligent maintenance, supported by strong institutions and planning frameworks. This lesson is highly relevant for Georgia. By decisively embedding maintenance into its fiscal and infrastructure planning frameworks – for instance, adopting formal maintenance planning standards, lifecycle cost analysis, and dedicated funding mechanisms – Georgia can greatly enhance the longevity and quality of its roads. Without prescribing one-size-fits-all solutions, the analysis signals a strategic direction for policymakers: prioritize maintenance as a cornerstone of road infrastructure policy. In essence, the findings encourage Georgia to institutionalize a policy ethos of “*maintain to enable, rehabilitate when needed, and only build anew when necessary,*” shifting the national infrastructure paradigm toward proactive asset care. Embracing this forward-looking, maintenance-first approach – and treating maintenance expenditure as an investment in the country's future – will align Georgia's practices with international norms and yield substantial economic and social returns in the long run. In conclusion, a sustained commitment to road maintenance is not merely a technical necessity but a strategic imperative for Georgia's development, ensuring that the roads built today will continue to support growth and connectivity well into the future.

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JOB SATISFACTION MANAGEMENT AND ITS IMPACT ON BURNOUT AND TURNOVER AMONG AUDITORS

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Abstract: *The paper examines managerial viewpoints related to job satisfaction, burnout, and turnover in auditing companies. Based on in-depth analysis using managerial viewpoints obtained through human resources managers' or audit managers' participation in face-to-face or online interviewing sessions for gathering data. Stressors identified using the analysis include workload and deadline issues. Other identified stressors are complex requirements presented by clients. Besides these stressors identified to risking or fostering burnout among auditors include satisfaction survey analysis conducted by firms to evaluate employee satisfaction. Other identified viewpoints or organizational characteristics attended to or considered in organizational decision-making include exit questionnaires. Compensation or monetary value represents an identified factor considered or prioritized in organizational decision-making. Organizational viewpoints or managerial decisions identified to mitigate burnout considered in organizational decision-making include development or improved training. Other organizational viewpoints or managerial decisions considered to improve or prevent burnout involve acknowledging or recognizing organizational members.*

Keywords: *auditing profession, job satisfaction, burnout, turnover, qualitative research.*

1. Introduction

The contemporary world that is rapidly developing continues its rhythm of development with massive investments in projects related to developing existing knowledge or creating new products/services. In a dynamic setting like this one, the auditing profession stands out. The financial statements checked and disclosed to investors by auditors are crucial to creating a transparent environment that fosters a reliable climate for investments (Khudhair et al., 2018).

In the course of carrying out an audit, practitioners in financial standardization assess not only the accuracy of a firm's financial processes throughout a year—January 1 to December 31—that are reported to go into the statements but also whether these are in line with global financial reporting standards. Based on completion of these proceedings, an audit team presents a report conveying its opinion concerning how accurate or fair these disclosures presented in financial statements are (International Auditing Practice Notes, 2021). These financial statements obtained after undergoing audit procedures are used to make financial analyses based upon which investors' decisions are made.

Considering its immense value to society, auditors must conduct their task in working conditions that enable them to scrutinize business activities, review accounting systems, and check compliance with international requirements. Unfortunately, however, these conditions are not quite so favorable. The task environment for auditors is largely linked to stressful working conditions (Rodrigues et al., 2022). One major concern would undoubtedly be the issue related to working hours. This task environment exposes auditors to long hours, especially when there are peaks related to increased workload related to multiple audits to be done before filing requirements. Such conditions make them less amenable to maintaining a good work/life balance.

Other sources of stress are related to the nature of audit work itself. Some financial statements are necessarily estimate-based because they are contingent upon future uncertainties. These estimates

are more challenging for inexperienced auditors to make because using professional judgment in unfamiliar or complicated business settings can be quite stressful. Moreover, auditors face challenges due to global changes in auditing standards. Inclusion of these changes into audit processes increases further stresses.

These cumulative stressors are bound to create long-term effects. Stress exposure over a period of time can cause professional burnout. Professional burnout not just impacts the well-being of the auditor but can also affect audit opinions. The widely quoted framework related to burnout used in this scenario is that of “audit burnout model,” which illustrates the elements of role conflict, role overload, and role ambiguity to cause burnout. As per this model, burnout has three consequences: “decreased job satisfaction, reduced job performance, and increased intention to leave” (Knight et al., 2021).

Again, however, this model does not represent completely the underlying dynamic concerning job satisfaction. The fact that burnout exists already tends to indicate that these auditors are working under conditions in which there exists a preponderance of unfavorable attitudes toward working compared to both expectations and in which these unfavorable investments—be they financial or cognitive—exceed benefits. In these conditions, job satisfaction becomes not merely a consequence but seemingly a precursor to burnout.

Based on past studies, the aim of this study is to explore which elements within job satisfaction are associated with burnout in auditors. Utilizing a qualitative approach to its study, this paper will shed light into the relationship between job satisfaction, burnout, and employee turnover.

2. Burnout and job satisfaction

2.1. Burnout: Definition and Scientific Development

In contemporary studies, burnout has become an area of interest to scholars across different disciplines like economics, healthcare, or auditing. The consequences of burnout are identified in jobs which seemingly belong to different domains but are associated with high stress conditions like healthcare or auditing (Rodrigues et al., 2022; Degheili et al., 2019).

In its essence, burnout syndrome encompasses a combination of psychologic and behavioral reactions aimed at countering work-related stresses (Wulantika, Ayusari, & Wittine, 2023). More specifically, these reactions are so demanding in terms of cognitive resources that in the end cause dysfunction either in an occupational or a personal context. More importantly, burnout syndrome cannot be viewed in terms of a personal problem but occurs due to specific working conditions arising because of organizational settings (Edú-Valsania, Laguía, & Moriano, 2022).

Burnout was first defined in 1974 by Freudenberger. He observed hospital staff to conclude that burnout occurs when there is a negatively colored psychological state that occurs because of occupation-related stress (Aksoy & Yalçınsoy, 2018). He found there are three major symptoms associated with burnout. These are feeling exhausted, feeling depersonalized towards other people, and feeling less productive.

Building on Freudenberger’s pioneering efforts, burnout rapidly became a focus of academic interest, yielding a large amount of published studies. The most influential conceptualization was largely developed by Maslach (1982). It describes burnout in terms of three components:

- **Exhaustion.** It represents a feeling of depletion that occurs due to prolonged exposure to occupational stress. Weakness and lack of energy are linked to increased negative reactions to one’s occupation. These reactions can result in cognitive or emotive detachment.
- **X Depersonalization.** It refers to a defensive mechanism wherein there is a distant, cynical, or indifferent attitude amidst staff members toward their job or toward those related to the occupation.
- **Poorer personal accomplishments.** Refers to a condition wherein employees become overly self-critical to the point that they doubt their competence. Characterized by ineffectiveness, lack of confidence to face upcoming challenges in the future, and lower self-esteem.

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These three characteristics are considered to co-exist simultaneously. However, there has been debate concerning the nature of these characteristics' inter-relationships. One example would include theories suggesting that feeling emotionally drained can cause both depersonalization and a sense of lower personal accomplishments. Although there has been abundant research in burnout characteristics, there has been no consensus attained concerning these inter-relationships.

2.2. Job Satisfaction: Definition and Scientific Development

Job satisfaction refers to a mental state that occurs after people evaluate both actual outcomes related to their job experience and compare them with individual expectations. In other words, job satisfaction represents a general attitude toward the job itself. In organizational psychology, job satisfaction is considered one of the constructs that has attracted immense attention because job satisfaction impacts organizational performance due to its effects on employee attitudes toward the organization (Khavis et al., 2020).

Job satisfaction dynamics can be very well understood using Maslow's Need Hierarchy. In the initial phases, people tend to focus more on fulfilling basic needs like eating, sleeping, or feeling secure. But subsequent to these needs are self-actualization or esteem needs. More importantly, job satisfaction does not linger or remain constant. As people acquire more experience or skills in their professional lives, they tend to set new benchmarks for satisfaction (Syrou & Adamopoulos, 2022).

There are divergent scholarly views regarding the emergence and construction of job satisfaction. According to some scholars, job satisfaction is an emotionally founded construct made up of feelings that are both favorable or unfavorable in nature in relation to one's occupation (Narotama & Sintaasih, 2022; Ramona, Blanca, & Delia, 2022). Other scholars believe that job satisfaction derives from cognitive processing or evaluations made by employees concerning their working environment (Syrou & Adamopoulos, 2022). The third view perceives job satisfaction as a behavior-linked construct. In other words, both cognitive and emotional processes mediating job satisfaction are acknowledged (Syrou & Adamopoulos, 2022).

Although there are varying theoretical perspectives on the issue, there appears to be a general consensus that there are a number of major determining factors which directly influence employee perceptions of job satisfaction. These are:

- Salary and financial incentives. Salary provided to employees not only includes remuneration to meet expenditures but is also considered a badge of acknowledgment for services delivered. Adequate salary structures tied to incentives emphasize to the employee that his or her efforts are appreciated. As a result, satisfaction increases (Syrou & Adamopoulos, 2022).
- Work environment and conditions. These are considered to play an important role in satisfaction. Auditors are expected to be satisfied if computers used for data processing are of high quality. But there are other areas like fair working hours, a clear understanding of responsibilities, and fair pay for other duties. Improved internal communications are other areas that increase satisfaction (Nguyen, 2019; Ramona, Blanca, & Delia, 2022).
- Opportunities for development. Workers who are ambitious and development-oriented appreciate opportunities for training or sharing knowledge. Besides training or sharing knowledge, other development-related opportunities that are helpful in employee retention involve inter-departmental shifts or promotion. In auditing companies, for example, inter-departmental shifts or promotions are fundamental elements driving job satisfaction (Nguyen, 2019; Narotama & Sintaasih, 2022).
- Achievement and Recognition. Workers need to feel a sense of purpose in what they are doing. Feeling that sense of purpose comes when there's a sense of personal or professional achievement. As an auditor, professional satisfaction could come from verifying financial data reliability or checking internal controls. Moreover, professional or organizational acknowledgment adds to that satisfaction (Syrou & Adamopoulos, 2022).

In conclusion, job satisfaction represents a complex construct which results from both emotional and cognitive elements, with a crucial role being held by financial, environmental, developmental, and recognition-related features. Knowledge concerning interrelation between these elements represents a fundamental principle to judge these factors' influence upon burnout and withdrawal intentions within challenging occupational sectors like auditing.

2.3. Linking Job Satisfaction and Burnout

Job satisfaction and burnout are frequently considered to be two ends of one spectrum, which define an employee's psychoemotional condition in his/her professional environment. Job satisfaction stands for a worker's favorable attitude toward his/her professional responsibilities and the enterprise he/she works for. Burnout represents his/her condition of chronic exhaustion, depersonalization, and decrease in professional accomplishments because of his/her chronic exposure to stressful circumstances (Maslach & Leiter, 2016). Satisfaction should thus be treated as a protective factor that increases resilience to stress. Meanwhile, burnout is considered to signal a depletion of cognitive-mental reserves (Lee & Ashforth, 1996). They are not directly related to one another. High job satisfaction does not allow burnout to happen. But dissatisfaction precedes burnout. Again, this phenomenon becomes apparent in jobs with high stakes in terms of accuracy, responsibility, effort inputs. Auditing belongs to these jobs.

Salary or financial rewards represents the first factor underlying job satisfaction. It not only represents a monetary incentive but shows appreciation for one's contribution to the organization (Sirou & Adamopoulos, 2022). In auditing, compensation does not always measure up to workload, especially when there are high volumes due to an average working week between 65-80 hours (Persellin et al., 2019). As a result, inequity in reward or return against investment occurs. Lack of satisfaction emanating from mental inequity contributes to burnout. Eventually, an individual develops apathy against the profession.

The second factor that plays an equally crucial role is working environment and conditions. A favorable environment that provides good equipment and channels for smooth communication will enable employees to address stress-related issues and sustain satisfaction (Nguyen, 2019). Unfortunately, in the case of audits, due to the nature of work involving late hours, a lack of supervision, and technological requirements, none of these conditions favoring efficient employee performance are met. As a result, not only does it cause a drop in job satisfaction but directly impacts elements like depersonalization and burnout. Additionally, a lack of favorable organizational culture with poor communication between supervisors and subordinates increases stress levels due to auditors feeling alone in solving organizational issues (Ramona et al., 2022).

The third important element in burnout is development or growth. It refers to how much the staff members see professional development in terms of training or promotion. In other words, training or advancement increases job satisfaction because professional development occurs not only in the workplace but in one's entire life (Narotama & Sintaasih, 2022). In the field involving auditing firms, though, there are too many responsibilities that prevent staff members from dedicating much time to training or sitting for professional certification. Lack of professional development leads to staff members feeling like there is a standstill in their professional development. As a result, there are no feelings of professional success, which constitute one third of burnout.

The fourth determinant is that of achievement and recognition. The need for individual acknowledgment to promote increased self-esteem cannot be ignored. In a field like auditing, its complex nature consisting of details that are not visible to the clients makes individual acknowledgement crucial to stay motivated (Sirou & Adamopoulos, 2022). Lack of motivation makes them question the value of what they are doing. This leads to feelings that everything doesn't count or amounts to nothing. Caught in these thoughts, one ends up feeling detached. Detachment is one of the major dimensions in burnout. Based on these dimensions, burnout continues to reduce motivation.

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In combination, these elements make it clear that job satisfaction and burnout are interrelated constructs according to both emotional and cognitive processes. From an emotional point of view, satisfaction leads to feelings of happiness, which are generally protective against burnout (Ramona, Blanca, & Delia, 2022). From a cognitive point of view, there are continuous comparisons between reward fairness, resource adequacy, or between expectations/outcomes (Syrou & Adamopoulos, 2022). In both these comparisons, if there's a continuous lack of fit between what's expected or received against resources or rewards, there's bound to be increased employee dissatisfaction and burnout. In this sense, job satisfaction isn't merely a result of a favorable working environment but can itself serve as a mediating factor that shields against burnout.

In the field of auditing, for instance, this theoretical relationship assumes particular significance because of pressure. Fluctuations in workload due to seasonality as well as various requirements presented by different clients mean that auditors are subjected to continuous pressure. These directly counteract conditions that create opportunities for satisfaction to happen. These include inadequate remuneration related to workload, development prospects that are hampered due to time constraints, organizational conditions that are typified by long working hours and lack of assistance, and lack of appreciation. These conditions create conditions ripe for burnout to happen.

As a result, job satisfaction and burnout need to be explored not in isolation but together with each other because these two are interdependent. In the case of auditors, not only would increasing satisfaction in terms of fair pay, environment, development opportunities, and recognition serve to improve conditions but it would also serve to reduce burnout. In fact, to explore these intersections between satisfaction and burnout specifically amongst auditors due to its salience to this study's concepts laid further in subsequent chapters.

3. Qualitative Research: Managerial Perspectives on Job Satisfaction, Burnout, and Turnover in Auditing

3.1. Research Design

A qualitative study design was used to explore job satisfaction, burnout, and turnover dynamics within the auditing profession. Distinguishing qualitative approaches from survey methods that focus on establishing frequencies for specific variables, a qualitative approach allows a more in-depth assessment of how managers perceive stressors related to burnout or view antecedents to job satisfaction or burnout-related turnover. As managers are pivotal to organizational or individual workplace experiences, a study based upon manager perceptions can provide vital information related to organizational or workplace dynamics.

Thus, this study aimed to interpret the thoughts, stories, and frameworks used by audit managers and human resource managers in their discourse with regard to stress, satisfaction, and decisions concerning careers. In so doing, not only does the study determine how managerial staff think about these issues but also to what extent these thoughts correspond to or deviate from those in theories concerning burnout and job satisfaction.

3.2. Data Collection

The participants for the study were three representatives belonging to one audit firm. Two members belonged to an HR manager position, while one belonged to an audit department manager position. Semi-structured in-depth interviews were used to get data. Two of these interviews happened face-to-face at a head office. The third interview happened online. Every interview was between 25 to 30 minutes.

As a result of participants' reluctance to participate in audio-recorded conversations, note-taking was employed to record participants' responses. In note-taking, major statements or concepts are recorded using words or phrases to represent those statements. These statements are later expanded in written transcripts shortly after interviewing. Although note-taking could result in less accuracy in terms of participants' utterances, it helped to record participants' major concepts.

The guide consisted of eight open-ended questions that focused on the association between auditing stress, managerial views concerning role overload, role ambiguity, incompatible responsibilities, methods used to manage time allocation, association between stress or satisfaction related to jobs, mechanisms used to evaluate satisfaction, managerial viewpoints concerning burnout syndrome, and reasons related to auditors' decisions to withdraw from professional responsibilities. These areas provided a methodical approach to address issues identified in the objectives.

3.3. Data Analysis and Findings

The data obtained from conducting the interview sessions was processed using thematic analysis. In this study, inductive coding was used. The results are presented in the following sections.

While there was consensus that auditing was stressful in itself, there was variation in interpretation. One manager suggested that stress was a normal condition common to all professions and was not specific to a concern in auditing. The other managers pointed to a range of specific factors. These included "the public interest involved in issuing audit reports," "the difficulty involved in handling large audit clients," "delays in receiving data from clients," "pressure to finalize reports within tight schedules," and "turnover in personnel." In combination, these indicate that managers are aware both of general stresses associated with professional occupations in general and specific stresses related to auditing. These specific stresses are related to role overload due to tight schedules.

As for role ambiguity and conflicting role requirements, managers generally pointed to their companies' efforts to communicate clear job descriptions to auditors to reduce the problem. Two managers clearly stated the problem was not common due to strict hierarchies in which clear workflows are identified. The third manager admitted to overlaps but stated these are managed effectively due to internal monitoring systems. These statements tend to counter statements generally found in academic literature suggesting role conflict and ambiguity are major contributors to burnout. Although these managers suggested these are not major problems in their companies, using hierarchies to manage ambiguity suggests that these are not necessarily absent but instead managed within an organization.

One issue that was evident in these interviews was the extent to which overtime was common to these firms, in spite of the fact that there was a system in place to manage the use of time. Two of these managers acknowledged that workload was managed based on job description, timesheets, and experience, but both managers acknowledged that auditors are forced to work overtime to complete tasks. The third manager was forthcoming in stating that his organization did not establish specific parameters against which the amount of time to allot to specific tasks was judged. One person interviewed observed that there was a difference between generations. Younger auditors are less willing to go along with requirements to go overtime.

The participants held varying perspectives concerning the relationship between stress and job satisfaction. Two managers suggested that stress did not greatly impact job satisfaction since auditors anticipated working in those conditions or because firms did not set responsibilities beyond what was expected. On the other hand, another manager was adamant that stress contributed to reducing job satisfaction since working extra hours beyond expected working hours could lower motivation to levels where a pay rise would not improve one's attitude. These varying perspectives show there seems to be a gap between what managers believe concerning stress and its impacts and what actually occurs for employees. The normalization of stress shown in these managers can result in firms failing to detect dissatisfaction in auditors.

In response to questions concerning mechanisms employed to measure job satisfaction, not surprisingly, all three managers confirmed that there was some mechanism for data gathering in place within their companies. These methods included yearly or bi-yearly survey efforts, use of anonymous box suggestions, or manager-employee reviews. Nevertheless, given the existence of lingering complaints, especially those concerning work hours, there are potentially serious underlying issues regarding its functionality. Based upon analysis, three possible reasons for these observations include

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auditors' reluctance to truthfully answer potentially sensitive questions, survey design that does not allow for true feelings to surface, or managers' ineffectiveness to address complaints even if there was data obtained.

In relation to burnout, yet another pattern was found to be common among managers. Not a single organization performed a study related to burnout. They did not see burnout's relevance to them because of the relatively young age composition of their staff. Others considered burnout an occupational hazard that was bound to happen but could somehow be mitigated in the short term. One manager merely admitted its existence but did not see it as something negative but rather something normal. Again, there seems to be a lack of understanding of its effects if burnout continues to happen.

Beugrüngung

Turning to another topic, there was a focus on staff turnover. Every individual was asked to describe how exit questionnaires or exit interviews are used to establish a reason for leaving amongst auditors. In three firms, salary was identified firstly or prominent in statements concerning staff turnover. Other reasons would encompass professional burnout or exhaustion, a lack of satisfaction with methods used to judge performance or wanting to pursue another occupation after acquiring experience in that position, or an opportunity to move to another country. Secondary concerns differed but focused upon inequity between remuneration schemes and workload.

4. Dsicussion

The results of this particular qualitative study are highly informative with regard to understanding managers' perceptions and approaches to the challenges concerning job satisfaction, burnout, and employee turnover in the auditing field. While these specific interviews afford confirmation concerning managers' understanding about the stressful environment associated with auditing work, there are some specific elements to note.

In regard to the first point, there are indications that stress remains a normal phenomenon within managerial discourse. Indeed, managers generally tended to identify stress in terms of its universality in connection with other professions to reduce its specificity. Thus, according to managerial discourse, stress appears less specific to auditing. In fact, unlike Maslach's (2003) model concerning burnout, which considers chronic occupational stress as one of its precursors to emotional exhaustion and disengagement, managers tend to consider stress as something that cannot really be eliminated. Accordingly, managers seem to lack concern regarding organizational changes that are envisioned to reduce role overload. In other words, managers tend to focus more on responsibilities rather than pay attention to possible role overload.

Second, there seems to be a gap between managerial understanding and auditors' real-world experiences concerning job satisfaction. While some managers are adamant that stress does not adversely affect satisfaction to any great extent, other managers tend to agree that working long hours can result in a lack of motivation to the point where financial rewards become insignificant. Notably, these differing managerial attitudes are important in that they demonstrate inconsistent managerial understanding concerning worker needs. In terms of Herzberg's two-factor theory (1959), salary serves as a hygiene factor because financial satisfaction prevents dissatisfaction but does not promote real-world workplace motivation. As shown in these stories supporting satisfaction analysis, increasing financial reward does not rectify continued dissatisfaction related to workload.

Thirdly, there are mechanisms to monitor satisfaction or turnover. However, these mechanisms are found to be less effective. Although managers indicated implementation of survey methods, use of suggestion boxes, and exit methods to monitor satisfaction or turnover in the organization, there are still issues like overtime pay that remain untouched. In fact, there are serious implications arising from these observations. One possible interpretation could be that there is resistance to disgruntled reactions. In other words, there could be methodological losses due to design-related barriers. More specifically, there could be ineffectiveness because organizational members in charge are not acting upon those

mechanisms. In other words, regardless of what actually happened, there are implications that firms are acting in a symbolic manner concerning organizational members' monitoring.

One of the most interesting results concerns burnout. In fact, burnout was consistently minimized or denied by managers. Not one of those firms did burnout assessment, or it was simply considered irrelevant because of the age component or because vacations could resolve it. In fact, these managers' conceptions are not aligned with scientific literature that shows burnout symptoms become evident even for those who are relatively early in their careers. Also, these managers' conceptions are not aligned because burnout can actually not only pose consequences to those who are doing the jobs but to the firms too. As these managers are considering these employees' burnout

Finally, turnover decision analysis reiterates the ever-present issue in auditing practicum with regard to compensation. Specifically, managers pointed to lower salaries as the principal cause of resignation, and other reasons are burnout, problems with appraisal schemes, and prospects elsewhere. These observations are within expected scholarship since both monetary and non-monetary issues are identified to shape staff resignation intentions. The point to note here is that managers are intensely focused on salary differences that could ultimately obscure other organizational-level issues driving members away. The preoccupation with salary differences as underlying causes for resignations seems to point to managerial preferences to perceive 'causes' which are apparently not theirs to make.

Based on these observations, there are a few contributions made by the study. From a theoretical stance, there seems to be an embedded normalization agenda related to stress within auditing that restrains efforts to translate models related to burnout or satisfaction into reality. From an organizational point of view, there is a need to shift away from symbolic surveillance efforts related to satisfaction in audit firms and explore serious efforts related to workload or development. Finally, there seems to be an implication for firms to realize that efforts related to employee retention based only on adjustments to salaries are not sufficient.

These results collectively point to a need to shift focus in managerial efforts from reactive to proactive approaches in supporting auditor well-being. It is crucial to acknowledge that stress and burnout are not occupational hazards but preventable risks to both employee satisfaction and organizational resilience.

5. Conclusion

The purpose was to gain insight into managerial thinking concerning job satisfaction, burnout, and turnover in auditing firms to better understand organizational procedures' impacts upon auditors' well-being. In fact, organisational procedures' impacts upon auditors' well-being are found to be quite complex in terms of stress, satisfaction, and burnout.

One major advantage of this particular study lies in its comprehensive analysis of managerial attitudes conducted using semi-structured interviews. These enable a thorough understanding to be gained concerning audit managers' or human resource managers' perceptions regarding the difficulties faced by their workforce. From these test results, it has been observed that these managers are well aware of the stressful conditions emanating from audits but treat these as if they are natural to their environment. Also, though there are methods like survey analysis, suggestions in a box, or exit interviews to check satisfaction or resignation, yet these not only prove ineffective to a great extent but are unable to address basic problems like excess working hours. These observations are in line with those made by Schaufeli & Enzmann (1998), which emphasized the organizational characteristics of burnout.

The study further illustrates the role of compensation in affecting auditors' resignation decisions, agreeing with past studies conducted by Persellin et al. (2018), who asserted that inequitable remuneration structures are major causes of dissatisfaction that trigger resignation. Nonetheless, evidence shows that monetary benefits are not sufficient to promote individual long-term satisfaction with occupation. In fact, non-compensatory organizational elements are vital to prevent burnout

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syndrome to avoid resignation, supporting Herzberg's two-factor theory (Herzberg, 1959), Maslach's burnout model (Maslach & Leiter, 2016).

Notwithstanding these contributions, there are some limitations to acknowledge. Firstly, due to a small non-probabilistic sample consisting only of three managerial participants, there are necessarily limits to generalization. Although these observations are richly informative and indicative, these are necessarily idiosyncratic to specific organizational contexts or managerial points of view instead of necessarily reflecting the experience of auditors per se. Secondly, since there are no direct observations or longitudinal data concerning burnout or satisfaction prior to ultimately determining participation in turn-over, there are necessarily alternative explanations potentially possible—such as individualized methods of coping or other labor market-related forces.

Still, there are real-world implications to draw from this study. Audit firms are encouraged to look beyond token satisfaction studies in favor of more proactive structural efforts to address role overload, improve role ambiguity, and improve development opportunities. Management can benefit from adopting both quantitative methods to measure employee well-being periodically to supplement these efforts with more in-depth employee experiences to ensure that these efforts are targeting burnout effectively. Finally, linking pay to workload and encouraging a recognition culture can reduce staff turnover challenges to maintaining worker motivation.

Future studies should continue to explore these results using a more diverse population of auditing firms. Comparative studies between various nations or jurisdictions could prove to be quite informative regarding what dimensions of context are important in determining job satisfaction, burnout, or employee turnover. Finally, examining the potency of specific organizational interventions to mitigate burnout could allow managers to institute more data-driven burnout-related personnel decisions.

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EXPLORING THE STRATEGIC ROLE OF DIGITALIZATION IN SME PERFORMANCE (CASE OF GEORGIA)

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Abstract: *Modern technology has become a key driver of business growth across sectors such as media, finance, medicine, and education. As digital tools and automation increasingly shape operations, enterprises are compelled to integrate digital capabilities to enhance sustainability and competitiveness. This study examines the role of digitalization in strengthening the sustainability and competitive advantage of Georgian SMEs, drawing on the Resource-Based View (RBV) and Dynamic Capabilities (DC) frameworks. Over one hundred participants contributed to this quantitative research, with data collected via surveys and analyzed using correlation and regression methods. Results indicate that while 68% of respondents view digitalization as important for sustainability, no direct relationship was found between perceived importance and actual digital adoption or performance. The findings underscore that technology alone does not ensure advantage; rather, strategic integration and adaptive utilization of digital tools determine SMEs' sustainable competitiveness.*

Keywords: *Digitalization, SME, sustainability, competitive advantage.*

INTRODUCTION

Technology is the future when discussing the means of scaling a business. Organizations, media, banking sectors, and every industry division thrive on the use of digital tools and automated system software for day-to-day tasks. We can lately see newer professions and jobs being created to keep up with the digital presence in the world. This causes a lot of business enterprises to adopt digital capabilities and, therefore, focus on acquiring a competitive edge while managing their resources sustainably (Al-Omush, Momany, Hannon, & Anwar, 2023). This type of change has caused industries, especially small and medium enterprises, to keep up with the market demands and ease their operational systems (Miranda, Saunila, Cruz-Cázares, & Ukko, 2024). Old ways of storing, analyzing, and manipulating data are not as valuable as it was 10 years ago. For context, during the coronavirus (COVID-19) pandemic, the mass switch on cloud systems, Artificial Intelligence (AI), Enterprise Resource Planning Systems (ERP), and ICT bettered the sustainable and competitive performance of SMEs by 70-80% and cut systematic costs by 15-30% in more than 90% of enterprises (Reichert & Candelon, 2020). Whereas, in 2015, only 20-30% of SMEs were digitally mature with basic operating systems like Microsoft Suite (OECD Digital Economy Outlook 2015, 2015). That gives us sustained results that Small and Medium Enterprises tend to move their digitalization ratio as time goes by, acknowledging newer trends being set to the market and internal operations. Digitalization is never a singular construct SMEs and the market have to deal with because it comes from a bundle of variables that creates synergy for companies to successfully adapt and integrate advancements for their company to operate in the long term. That is good news because, in today's world, sustainability and a competitive edge towards digitalization are a never-ending battle SMEs must go through to survive. (Trueba-Castañeda & Torre-Olmo, 2024).

However, questions remain: How and what strategies are suitable for the current state where the adoption of digital tools is getting more popular, the market faces saturation, and SMEs want to keep competitiveness and sustainability? As well as why companies do or do not single out sustainability while being exposed to digitalization. In the history of advanced development, many strategies with unique approaches have emerged. However, Author and management consultant Dr. Ichak Adizes brings forward the “Crawl-Walk-Run” strategy, which suggests that gradual adoption mitigates risks in SMEs, as they often lack the capital and expertise to make drastic shifts. Therefore, “Crawl” starts with the technological maturity of fundamental systems (Basic Digitalization), “Walk” with slightly advanced process automation (e.g., Low-code Automation, the connection of workflows), while “Run” puts the organization in an advanced setting (AI and IoT services) (Peláez, Escobar, & Félix, 2024).

Walking through that point, The Public Service Hall in Georgia is a notable example of the “Crawl, Walk, run” strategy as their development gradually went into ascending phases. In the years 2011-2015, through the “Crawling” phase of storing property, civil and license records tracking systems were in line with the basic digitalization cycle. By this, service time was decreased by 80% for people living in Georgia, as digital tools made it easier to find and analyze the resources. In the “Walking” phase, we have an introduction to Cloud paperless systems, Digital Signatures, Automated Queue process, Online Business Registry, Electronic Tax Systems, etc. Lastly, the “Run” stage of AI, Blockchain, and Mobile Software, such as chatbots, mobile apps, and blockchain systems, for a secure experience. Through these gradual movements, the Georgian Public Service Hall marked a competitive edge on an international scale while combining their digitalization process with sustainable initiatives: paperless offices saved 10 million sheets a year and roughly 1,200 trees. They also focus on green initiatives such as using the saved money from capital cuts to turn hall buildings into solar power systems.

These steps amplify the positive outcomes of digitalization's role in the 21st Century as it navigates through healthy and competitive development and scaling of one's business processes. (Trueba-Castañeda & Torre-Olmo, 2024). However, gaps and barriers stand in line by aligning innovation with sustainability goals as globalized approaches for saturated markets push SMEs into difficult positions as opposed to different expertise and interest areas.

The current study contributes to the literature by using the Resource-Based View and Dynamic capability theory models to answer the question: Does digitalization help SMEs to be sustainable and have a competitive advantage? Digitalization acts as a mediator between sustainability performance and competitive advantage while also using a Resource-Based View and Dynamic Capability model constructs such as operational efficiency, digital capabilities, organizational agility, and, additionally, to enrich the literature - market responsiveness. The research aims to explore the relationship between the given variables. With the data collected, the study will provide practical implications and recommendations for entrepreneurs and managers in SMEs to better satisfy the needs of current market conditions and sustainable prospects of enterprises

MATERIALS AND METHODS

The RBV model integrates several concepts, each of which unifies elements of core theories related to the acceptability and use of digital technologies. Given the specificity of SMEs' lack of resources, researchers have increasingly used the Resource-Based View (RBV) to investigate how internal capabilities and assets affect a firm's ability to adopt, implement, and benefit from digitalization initiatives. The RBV perspective is interesting because it argues that a firm's sustainable competitive advantage derives from its unique, valuable, rare, inimitable, and non-substitutable resources (VRIN), and it is particularly well-fitted to address the specific challenges faced by SME operations in the complex digital economies. (Antero & Riis, 2011) Reinforce the idea that competitive advantage for SMEs arises from resources that are uniquely developed and difficult to replicate. The authors demonstrated that complementarity among digital resources in an SME ERP ecosystem leads

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to competitive advantage, although sustainability is not addressed. Recent empirical and theoretical studies have used RBV to examine both the beginnings and consequences of digitalization in SMEs. For example, (Rupeika-Apoga, 2023) used RBV to investigate the influence of digital orientation and digital capability on measuring digital transformation in Latvian SMEs during the COVID-19 pandemic, concluding that these characteristics are significant indicators of revenue enlargement as well as increased business model portfolio. Similarly, (Zhang, 2022) unites and connects the RBV with resource-dependence theory to analyze how organizational resources mediate the influence of technological and environmental factors on Chinese SME's digital transformation success.

Across the studies, digital and smart technologies such as smart manufacturing systems, digital platforms, and integrated digital operations are presented as internal strategic resources that align closely with the RBV perspective. Rather than emphasizing scale or external market power, the authors argue that SMEs can leverage their internally developed digital capabilities to overcome resource limitations and build sustainable competitive advantage. For instance, (Trueba-Castañeda & Torre-Olmo, 2024) discuss that digital capabilities increase the value and achievement of SMEs in environmental sustainability and simultaneously create financial performance. These capabilities improve operational efficiency, product map, and customer satisfaction, which demonstrates the internal resourcing focus of the RBV with regard to innovation and sustainability. (Kumar, Saunila, Rantala, & Ukko, 2024) Provided some practical evidence claiming the application of smart technologies in SMEs increases business sustainability, which in return improves environmental sustainability. Thus, advanced internal technological resources are important for performance. (Vrontis, Belas, Thrassou, Santoro, & Christofi, 2022) analyzing the RBV and dynamic capabilities approach, claiming the use of digital technologies enables SMEs to create economic and social value. It is shown in their analysis that these internal technological resources perform as critical drivers of organizational outcomes, and their positive impact is enhanced by entrepreneurial orientation.

While some of these sub-capabilities may be applied individually in a non-digital environment, the emergence of new digital technologies such as blockchain, cloud, and IoT platforms is changing the nature of dynamic capabilities. The convergent and generative nature of these digital technologies makes building dynamic capabilities for the wider organization a key strategic imperative. As a result, digitalization forces incumbents to think and act more entrepreneurially and respond to new threats from the dynamic environment by strategically developing digital capabilities.

DDC is an extension of the broader DC framework, adapted for the digital age. DDC is defined as the ability of an organization to integrate, build, and reconfigure digital resources and capabilities to respond to a rapidly changing technological environment (Warner & Wager, 2018). DDC is particularly important for companies to master digital transformation because it provides the flexibility and adaptability needed to leverage digital technologies for competitive advantage. Companies with superior digital capabilities can leverage technological advances to automate processes, improve efficiency, and reduce costs (Bowman & Ambossini, 2009). Digital capabilities can also help companies improve their ability to innovate to develop new products and services (Schepis & Purchase, 2021), such as mobile applications or digital platforms, to improve customer experience and create revenue growth (Gustomo & Prasetio, 2024). The ability to recognize and evaluate new digital opportunities and risks in the workplace, including looking for new technology developments and comprehending the effects they have, is known as digital sensing (Warner & Wager, 2018). The ability to mobilize resources and implement strategies to take advantage of opportunities that have been recognized, such as implementing digital platforms or reworking workflows to integrate new technology, is known as digital capturing (Teece, 2018). Reconfiguring organizational structures, procedures, and cultures to meet the needs of the digital age through the promotion of agility and creativity within the company is known as "digital transformation" (Vial, 2019).

According to the literature currently in publication, businesses that embrace digital transformation see improved financial outcomes and returns on assets, which boosts their profitability and competitiveness (Miranda, Saunila, Cruz-Cázares, & Ukko, 2024). Nevertheless, professional

scholars and research centers have predominantly examined the phenomena of digital transformation and its impact on business, while academic scholars have contributed very little to this area of study (Pereira & Bamel, 2021). However, scholars and research institutes have mostly investigated the phenomena of digital transformation and its impact on business, while academic scholars have made a relatively small contribution to this field of study (Pereira & Bamel, 2021)

For SMEs, which often operate under resource constraints, building strong digital capabilities is both a challenge and a strategic imperative. Digital transformation, often described as the fourth industrial revolution or Industry 4.0, involves the integration of information and communication technologies (ICTs) with production systems to enable autonomous decision-making and interconnected value networks (Sarbu, 2022). This integration supports innovation by allowing firms to collect and analyze data, collaborate digitally with stakeholders, and respond swiftly to market shifts (Suseno, Sick, & Laurell, 2018)

According to (Radicic, 2023), SMEs can benefit from three main forms of digitalization: big data analytics, digital production and logistics systems, and digital value chains. Each of these enhances innovation performance differently. For example, big data tools help firms extract valuable customer insights and make informed decisions under uncertainty (Nebel, Rasel, & Viète, 2018). Digital interconnection in production processes increases efficiency and enables faster product development cycles (Hahn, 2020), while digital value chains foster collaboration across supply networks, often leading to co-created innovation (Lee & Schmidt, 2016)

However, digital adoption is not uniform across SMEs. Resource limitations, cultural resistance, and lack of technical expertise often slow digital transformation in micro and small firms (Gruber, 2019). Despite these challenges, SMEs that develop internal digital skills and strategically integrate digital tools can strengthen their capacity to innovate and grow (Scuotto, Nicotra, Giudice, Krueger, & Gregori, 2019). Investing in digital literacy is thus not merely a technical upgrade—it is an organizational shift essential for long-term survival.

Interestingly, internal R&D plays a nuanced role in the digital-innovation relationship. While in-house R&D is traditionally seen as a driver of innovation (Raymond & St-Pierre, 2010), found that SMEs without internal R&D benefitted more from digital tools in terms of product and process innovation. This may be because digital technologies often embed standardized and easily transferable knowledge, which complements the DUI (doing-using-interacting) innovation mode prevalent among smaller firms (Jensen, Johnson, Lorenz, & Lundvall, 2007) Additionally, SMEs in traditional sectors are increasingly hiring digitally capable talent to navigate new business models and meet the expectations of digitally native consumers such as Gen Z and millennials (Rachinger, Rauter, Ropposch, & Vorraber, 2018). This shift is crucial for aligning with Industry 4.0, where physical and digital systems must work in tandem. Moreover, policy initiatives play a vital role. For instance, Germany's "Digital Jetzt" program supports SMEs in upskilling their workforce and adopting secure IT systems (European Commission, 2021). These efforts highlight how external support can catalyze internal digital capability development, particularly in firms lacking R&D resources. Digital capabilities also influence a firm's absorptive capacity—the ability to recognize, assimilate, and apply external knowledge (Sarbu, 2022). Access to big data and real-time information enhances this capacity, leading to more agile innovation cycles. However, without appropriate skills or managerial support, data remains underutilized, especially in smaller enterprises (Peláez, Escobar, & Félix, 2024)

Digital capabilities are not just technical enablers but strategic assets that shape how SMEs create value, innovate, and compete. Developing these capabilities requires a multifaceted approach that combines investment in human capital, access to technology, supportive policies, and a mindset geared toward change.

In addition to that point, digital adoption is not uniform across SMEs. Resource limitations, cultural resistance, and lack of technical expertise often slow digital transformation in micro and small firms (Gruber, 2019). Despite these challenges, SMEs that develop internal digital skills and strategically integrate digital tools can strengthen their capacity to innovate and grow (Scuotto,

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Nicotra, Giudice, Krueger, & Gregori, 2019). Investing in digital literacy is thus not merely a technical upgrade—it is an organizational shift essential for long-term survival. While existing studies have primarily aimed to understand digitalization development, usage, and adoption in more developed markets of SMEs, there is a lack of research examining digitalization and its affecting constructs in an emerging economy such as Georgia. Thus, there is a clear gap in current studies on how SME managers deal with sustainability and competitive advantage in relation to technological advancements, especially considering post-COVID transformational trends.

We understand that digitalization is a practice oriented on positive outcomes, however both RVB and DCT propose that only adoption without specific knowledge, strategic alignment and long-term roadmap is not something SME's should participate into. In many EU countries, sustainability is an emerging word that companies want to acquire thus do not fully understand it's daily operations.

Considering the identified gap in understanding how digitalization influences SME growth and competitiveness, the following hypothesis were formulated:

H1: SMEs whose sustainability-related digital initiatives attract new customers or business partners report a higher digitalization and competitive level than those whose initiatives do not .

H2: Perceived importance of digitalization for sustainability is positively associated with a firm's self-rated level of digitalization.

H3: SMEs that use digital tools for sustainability tracking are more likely to report that digitalization has improved their environmental sustainability.

H4: SMEs that consider digitalization important for sustainability are more likely to use digital tools to support sustainability efforts.

A quantitative research design was employed to investigate the determinants impacting the SME's digitalization level, it's acceptance and role on sustainability and competitiveness among managers in the diverse sectors. A questionnaire was structured to collect the responses, and then statistical analysis was conducted using Microsoft Excel.

In total, 100 responses were collected. All participants had experience working in the small and medium enterprise, ensuring the relevance of their insights regarding digital orientation adoption in the field. Respondents were reached directly through social media platforms (LinkedIn, Facebook, Gmail). The participants were selected based on their working experience (SME professionals).

The survey consisted of 4 sections. The questionnaire began with demographic questions to get data about the participant's age, gender, and experience with digital platforms. The remaining sections were dedicated to the variables explored in the study, and seven questions were structured for each of them. The respondents answered the questions using multiple-choice options. This study used a non-probability sampling method to collect data for analysis. Participants were reached randomly through online social media platforms. All participants had professional experience in the SME industry, either currently employed or previously worked in this field. Positions varied across different levels, from entry-level to managerial roles. In total, 100 responses were collected from an initial outreach to more than 200 respondents. The sample included both men and women, aged under 25 to 55+.

Gender split is almost even ($\approx 54\%$ female, 46% male). Largest age band is 25-34 ($\approx 37\%$), followed by 35-44 ($\approx 31\%$). About one-third of firms are "250 +" employees; the rest are mostly 10-49 and < 10 . Professional Services, retail and healthcare make up the biggest industry groups in this sample. A simple linear regression was conducted to investigate whether the attraction of new customers or business partners through sustainability-related digital initiatives could predict the overall level of digitalization within companies. The regression results ($R^2 = 0.00047$, $F(1,97) = 0.05$, $p = 0.83$) indicate that the model is not statistically significant. The p-value ($p = 0.83$) is greater than the conventional 0.05 significance level, suggesting we fail to reject the null hypothesis that there is no relationship between these two variables. Furthermore, the regression coefficient for sustainability-related initiatives is tiny and negative ($\beta = -0.017$), indicating a very weak and inverse, but no significant, relationship. The 95% confidence interval (-0.18 to 0.14) includes zero, which underscores

the lack of significance. The Pearson's r of -0.022 also reflects a very weak, nearly non-existing, and negative association.

RESULTS AND DISCUSSION

The research examined how digitalization among small and medium enterprises effect competitive advantage as well as sustainability. The study found that while digital adoption is high in researched small and medium enterprises, differentiation is low. Most of the respondents representing healthcare, professional services and retail, highlighted usage of mainstream digital resources, such as: customer relationship management systems, Business Intelligent tools, social media marketing and cloud services, confirming that SME's progress in adopting modern demanded digital tools is positive. Although, simple regressions and χ^2 analyses did not reveal significant relationship between digital orientation and examined variables such as competitiveness and sustainability. Testing hypothesis one between sustainably-related digital initiatives and attraction of new customers, therefore a competitive edge, did not emerge a linear relationship because identified sectors did not give evidence of deeper capability, rather than symbolic differentiation. This finding suggests that in this concrete case and chosen industries, healthcare, retail and professional services, a company might land a sustainable-related customer by something they do by narrative, thus when we look deeper they're not more digitalized or strategically competitive than similar firms without that initiative. The thesis suggests that technology independently in my researched industries does not guarantee advantage in the market. Organizational culture, process integration, and data governance will be needed to advocate for the value creation. Thus, the following result could be impact of the saturation, when similar digital tools are adopted, technology becomes basic requirement to stay in business and tolerate the market. The results therefore validate principle of the dynamic capabilities theory: subject of how firms choose, create, and orchestrate capabilities.

Alongside, second hypothesis of this research provided insight that managers who chose digitalization as "important" or "somewhat important" are not automatically along the journey. Result: $r = -0.16$, $p = 0.12$ suggests that other constructs such as compliance responsibilities and strategic enthusiasm is needed for a company to meet its resources and align with future prospects. The digitalization metrics which questionnaire provided does not translate into real-world digitalization maturity.

Similarly, H3, H4, draws a pattern of adoption not being equal to actual integration, on a bigger picture – implication that importance does not cover successful execution. Hypothesis 3 demonstrated digital sustainable tracking dashboards not being significant to the day-to-day usage. Suggesting that sustainable tracking tools are passive rather than result and effort in environmental improvement.

H4 with the chi-square result ($X^2 = 0.568$, $df = 2$, $p = 0.753$) faced attitude-behavior gap, meaning while firms understand strategical value of differentiation and digitalization, they still face budget problems, lack of expertise, time constraints. Therefore, this hypothesis was not supported due to similar reasons.

Managers of small and medium enterprises can use the following findings of this study to improve the efforts of the integration and adoption process with value and strategy. For example, rather than acquiring software or tool directly, they need to accept how those resources of deployed, emphasizing strategic clarity, organizational culture, data literacy and accurate calculations of the ROI.

Despite contributing to the existing literature the study has some limitations. The number of responses does not provide a whole picture. The responses were gathered from people of different industries, yet the ratio is uneven. In addition, the convenience sampling method limits the findings generalizability. Moreover, the study utilized quantitative approach by employing pre-defined, closed-ended items. This sets back the possibility of gathering more in depth responses.

CONCLUSION

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The thesis helps advance the understanding of the digitalization picture on SME's in the emerging economy, which confirms that mass adoption of digital tools in firms are not reliable without further emphasis on strategy and internal capabilities. Digital resource adoptions do not guarantee success in competitiveness and sustainability. While SMEs have progress in enriching the digital market, for competitive edge and sustainable development – stronger internal capabilities are needed. RVB correctly argued that sustainable competitive advantage come from VRIN framework, regarding how valuable, rare, inimitable and non-substitutable resources are. As well as DCT's agreement on reconfiguring subjects to strategically integrate capabilities based on its valuable ownership.

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REGULATION OF DIGITAL BANKING SERVICES: OBJECTIVES, PRINCIPLES AND FRAMEWORKS

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***Abstract:** In recent years, the rapid growth of technological advances has reshaped all sectors of the economy and changed the behaviour of both institutions and customers. By implementing the latest innovations, banks are digitalizing their services and automating most of the internal banking management processes. Digital banking makes services more accessible to customers, increases their transparency and efficiency, and reduces costs for both banks and customers. Today, everyone can conduct banking transactions from home and at any time. But in addition to their benefits, digital banking services also pose serious challenges in terms of privacy, security and customer protection. This article highlights the importance of regulating digital banking services and discusses the objectives and principles of regulation. In addition, it provides a comparative overview of the current state of digital banking regulatory models in selected regions, outlining the main objectives of regulatory authorities.*

***Keywords:** digital banking services, regulation, regulatory framework, customer protection*

1. INTRODUCTION

In recent years, the global financial system has undergone a significant evolution under the influence of innovations and digital technologies. Modern innovations contribute to increased productivity, functionality and efficiency in all sectors of the economy. They also affect society and have led to changes in customer behaviour. The application of digital technologies has now become a necessity in order to remain competitive in all sectors.

One of the most important results of technological development is digital banking - a technology-based model of banking services that operates mainly or entirely through digital channels. As a result of the rapid development and constant change of technology, customer expectations regarding banking services are also constantly changing and their new needs arise. Unlike traditional banking, banks now provide simplified, wide-ranging and customer-oriented banking services through mobile applications, web platforms and interfaces powered by artificial intelligence. (Harchekar, 2021)

The application of digital technologies to banking increases the accessibility of banking services, improves efficiency, helps to create new banking products and improve existing ones, and reduces costs for both banks and customers. The application of technology also raises concerns about privacy, cybersecurity and customer protection. Moreover, from a legal point of view, no one can prove that digital technologies in the banking sector are used only for their intended purpose. (Bety, 2023). Regulators should take appropriate measures to minimize these problems.

Regulation of digital banking services should be carried out in a balanced manner. It should support the development of digital technologies, protect the integrity of the financial system, and fully cover the rights of banks and customers in the digital environment. Strict and burdensome regulation can slow down the development of digital technologies and harm the banking sector. On the other hand, weak regulation can lead to the misuse of technologies.

Countries also vary significantly in their approaches to regulating digital banking services. For example, the European Union has many acts and directives related to the operation of digital services, including banking. But in developed countries of Asia, more innovative methods are applied to regulating digital services.

Traditional regulatory frameworks, designed primarily for brick-and-mortar banking models, are insufficient to control the complex nature of technology-based banking services. To this end, regulators in each country should set regulatory standards specifically for the operation of digital banking services.

2. Main Objectives of Regulation of Digital Banking Services

Considering the benefits and risks brought by technological innovation, the main objectives of regulating digital banking services are as follows:

Figure 1. *Objectives of Regulation of Digital Banking Services*



Protecting financial stability. One of the key objectives of regulating digital banking services is to ensure the stability and integrity of the financial system. Financial stability is a core concern of economic regulation, particularly in environments characterized by rapid technological change. Although new financial technologies and innovations in today's digital environment support the growth of diversity and accessibility of banking services, the rapid pace of innovation, the emergence of new business models and non-traditional financial institutions pose a threat to the stability of the financial system. Regulators should assess banks offering digital services on various criteria such as capital buffers, liquidity, stress testing, risk management, etc. and ensure that they operate in accordance with the standards. For example, the Monetary Authority of Singapore regularly conducts stress testing audits of banks and financial institutions offering digital services. (Papathanassiou, 2024). Such measures help identify vulnerabilities in digital technologies and improve the resilience of the entire financial system.

Protecting customer rights. When using digital banking services, customers face new risks such as misuse of personal data, unauthorized transactions and deceptive digital interfaces. These problems can undermine consumer trust and reduce the efficiency of digital financial services. Another key objective of regulating digital banking services is to protect the rights and interests of customers by ensuring transparency between banks and customers. Regulatory methods include clearly disclosing the terms and conditions of using digital services, providing a user-friendly digital interface for using digital services, mechanisms for resolving uncertainties and complaints, etc. Regulators can also give customers full control over their personal data in the digital banking environment to prevent misuse of personal data. (Lee & Thomsett, 2020). Strengthening consumer protection helps increase trust in digital banking services and expand access to financial services.

Cybersecurity. When providing digital banking services, banks collect and process data in real-time using technologies such as application programming interfaces (APIs), cloud services, third-party providers, etc. The widespread use of interconnected digital infrastructures increases operational efficiency, but also expands potential attack surfaces. Despite the numerous benefits of digital banking services, cybercriminals can gain access to banking systems and obtain personal and financial information of customers. (Kern, 2019). Moreover, in recent times, many financial systems are interconnected, a problem in one of them can pose a threat to others. Given the volume and sensitivity of financial data collected in banking systems, regulators should take serious measures to ensure the security and integrity of the digital banking infrastructure from cyber threats. These include data encryption, breach notifications, control of third-party access to the banking system, continuous monitoring of the banking system, etc. Effective cybersecurity regulation is therefore essential to maintaining trust and preventing systemic disruptions.

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Customer identification. The accessibility and borderlessness of digital banking services make them a tool for illegal financial activities such as money laundering, terrorism financing and fraud. Weak identification mechanisms can increase the risks of financial crimes in the digital environment. Anonymous transactions through digital banking and financial platforms make it difficult to determine the source and address of money flows. To prevent this, customers using digital banking services must be identified using biometric data. In addition, to prevent the abuse of digital banking, all banking transactions must be monitored, their validity must be confirmed and reports must be required in case of suspicious or unexplained transactions. (Shoshani, 2024). These measures bring digital banking regulation into line with international standards for combating money laundering and terrorist financing.

Fair competition. Effective regulation should encourage banks and financial companies offering digital financial services to work together and create a fair competition environment by preventing monopolies and anti-competitive behaviour in the banking sector. Competitive digital banking markets drive innovation, lower costs, and improved service quality for consumers. It should also reduce barriers to entry for new or smaller banks and financial institutions, provide simplified licenses to support their activities. However, these licenses should reflect all the essential requirements for the proper provision of digital banking services.

Ethical use of technology. Technological innovation is constantly growing and has an impact on all sectors. Regulators should support the introduction of innovations and new digital technologies in order to improve banking services and the banking sector as a whole. However, regulators should require transparency and a detailed explanation of the purpose of the innovations introduced and monitor their use only for the intended purposes. (Lumpkin & Schich, 2020).

3. Key Principles of Regulation of Digital Banking Services

Regulation of digital banking services should be based on principles such as neutrality, proportionality, risk-based approach, adaptive regulation and international cooperation. Below is a detailed explanation of each principle:

Neutrality. When regulating digital banking services, it is necessary to take a neutral approach to all participants in the banking sector, avoiding a biased approach to digitalization, the financial technologies used and the methods of service delivery. This principle ensures that regulation does not distort market competition or favour particular technologies or business models. Regulation should apply equally to banks offering digital services and to traditional banks, fintech companies and other financial institutions, and a fair competitive environment should be ensured between them. Therefore, when regulating digital banking services, attention should be paid not only to the services and business models that use digital financial technologies, but also to their functions and the risks they bear. (Vasant, 2025). Such an approach allows regulators to focus on economic substance rather than form, which is particularly important in rapidly evolving digital financial markets.

Proportionality. According to this principle, when regulating digital banking services, the rules and requirements should not be the same for all market participants, but different approaches should be applied taking into account the size, complexity and range of services offered by the regulated entity. (Omarini, 2024). This principle reflects the need to balance regulatory oversight with the capacity of institutions to comply with regulatory requirements. Differentiated regulatory rules prepared taking into account the specific features of institutions offering digital banking services prevent overloading small market participants, support their development and encourage the application of various digital financial technologies to banking services. As a result, proportional regulation contributes to innovation while maintaining adequate levels of financial stability and consumer protection.

Risk-based approach. When regulating modern banking services that include digital financial technologies, attention should be paid primarily to high-risk services, products or behaviour that pose

a threat to customer rights and financial stability. This approach is particularly relevant in digital banking, where technological complexity can increase operational, cyber and compliance risks. A risk-based approach helps to prioritize areas that most need regulation, allowing for a timely response to risks and improving the effectiveness of regulation. (Dudin, Shkodinskii & Usmanov, 2021).

Adaptive regulation. Given the pace of change and development of digital financial technologies applied to banking services, rigid legal frameworks “written on paper” may prove ineffective for regulation. Digital innovation often outpaces traditional legislative processes, creating regulatory gaps and uncertainties. Regulatory approaches should adapt to the modern technological environment and be based not only on written rules but also on guidelines, consultations and observations. Innovation centres should be created, and new digital financial technologies applied to banking services and management should be tested in an environment under the control of the regulator, their features assessed and then regulated accordingly. (Sharma, 2022). Adaptive regulation allows regulators to respond flexibly to technological change while reducing regulatory uncertainty for market participants.

International cooperation. Unlike traditional banking, banks can offer banking services to customers from all over the world across national borders using digital technology. This cross-border nature of digital banking increases regulatory complexity and requires coordination among national authorities. For example, anyone living in Romania can use international digital banking services offered by a bank operating in any other country without leaving home. However, the different forms of regulation that each country applies to digital banking and financial services can sometimes prevent banks from offering banking services on a global scale. (Frolova & Perm, 2019). To avoid regulatory diversity, regulators in all countries that regulate digital banking and financial services should collaborate with central banks, international financial institutions, and financial cybersecurity agencies in other countries to develop regulatory forms and standards that meet global requirements. Such cooperation supports financial stability, reduces regulatory arbitrage and facilitates the sustainable development of global digital banking markets.

4. Methodology

The article consists of theoretical and analytical parts. While preparing this article, an extensive literature review was conducted based on relevant articles, books, and journals. Using a qualitative research approach, the theoretical part of the article explains the objectives and principles of regulating digital banking services.

The analytical part of the article reviews and compares the methods of digital banking services around the world. To analyse the regulatory framework in different countries, data are collected from official banking laws, regulatory standards, acts, etc. The conclusion part explains the main limitations of regulating digital banking services based on the research results.

The purpose of this study is to clarify the concept of regulation of digital banking services and provide a comprehensive overview of the regulation of digital banking technologies and services worldwide. Although this article does not rely on primary data collection, it contributes to the literature on how to create a secure digital banking environment while supporting technological advancement.

5. Results - Regulation of Digital Banking Services Around the World

Unfortunately, there is currently no regulatory approach anywhere in the world that would fully cover digital banking services and eliminate all their risks. This reflects the complexity and rapid development of digital financial technologies, which often outpace regulatory responses. As a result, regulatory frameworks remain fragmented and are often adapted gradually rather than comprehensively. In many countries, digital banking services are regulated based on traditional banking standards and some specific rules related to digitalization. However, some countries have already started to create special regulatory frameworks related to digital banks, digital banking and

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financial services. These emerging approaches demonstrate different regulatory priorities and levels of institutional maturity.

In the European Union, the European Banking Authority (EBA) provides banks with advice on financial innovation, digital security and resilience, and oversees financial stability within the union, ensuring that they comply with regulatory standards and rules. The EBA plays a central coordinating role in the harmonisation of regulatory practices across member states. The main objective of the organization is to create uniform standards covering the rights of customers and banks for all EU countries. Examples of existing regulatory standards related to the operation of digital banking services in the European Union include:

General Data Protection Regulation. The GDPR, which came into force in 2018, sets strict requirements for the protection of customer data and privacy across all sectors, including banking, within the European Union. This regulation has significant implications for digital banking services, which rely heavily on the collection and processing of personal data. According to the regulation, banks must obtain consent from customers before collecting personal data and provide each individual with the right to manage and delete their data in the banking system. (GDPR, 2018).

The Network and Information Security Directive (NIS Directive) is a legal framework consisting of rules and controls covering the protection of technologies, information systems and people from cyber threats and risks in 18 key economic sectors of the European Union, including finance and banking. Cybersecurity is a critical component of digital banking regulation given the interconnectedness of digital financial infrastructures. It requires member states to strengthen their security capabilities in the digital environment, to report on recorded cybercrime incidents and to cooperate with the EU in developing their national strategies for managing information security risks. This directive strengthens cross-border coordination in the fight against cyber threats.

The Payment Services Directive aims to regulate payment systems in the European Union, reduce banks' monopoly on customer data and increase competition between banks and non-bank financial institutions. The directive reflects a shift toward open banking models within the EU. Under the regulation, banks must provide payment service providers with access to customers' bank data to create integrated payment systems. All parties are also required to fully comply with data security and privacy rules.

The Anti-Money Laundering Directive (AMLD) requires banks to verify the identity of customers using digital services, investigate suspicious transactions and determine the final address of these transactions in order to prevent money laundering, terrorist financing and illicit financial transactions in the EU.

The Digital Operational Resilience Act (DORA) aims to improve the digital resilience of all financial institutions, including banks, by requiring them to strengthen the security of their information and communications technology (ICT) against cyber risks. (DORA, 2023). The Financial Conduct Authority (FCA), established in the UK in 2013, supervises all financial services providers, including banks. It licenses banks, provides guidance on the appropriate use of digital technologies, and monitors transparency and fraud in banking services. To ensure the integrity and co-evolution of digitally enabled banking and financial systems, nine major UK banks have been instructed since 2016 to allow other officially licensed financial institutions to access their customer databases. The FCA is also responsible for ensuring that customers are kept safe when sharing personal data.

In the United States, the Federal Reserve System regulates and constantly monitors the activities of banks and financial institutions. It regularly conducts studies on the impact of digital technologies on the development of finance, the economy, and society and publishes articles about its findings on its official website. The Federal Reserve System has also been working on a "digital national currency" project for a long time.

The Consumer Financial Protection Bureau is an organization that protects the rights of customers in the banking and financial sector. It requires banks and financial institutions to explain

their terms of services to customers in detail, not to conduct any transactions without the permission of customers, and to prevent deceptive marketing activities. The Bureau also evaluates customer complaints and takes action against the institution to which the complaint relates.

In addition to the regulation methods of these bodies, states sometimes have their own different regulatory standards for banks, privacy, or digitalization. For example, all institutions and companies in the state of California, including banks, must additionally comply with the California Consumer Protection Act, which came into force in 2020. Among the key provisions of the law, it is noted that California residents (consumers):

- Should know what information companies collect about them and for what purpose;
- Can request a copy of the personal information held about them;
- Can request that their personal information be permanently deleted at any time;
- Can request that their personal information not be shared with third parties under any circumstances;
- Should not be discriminated against based on their privacy preferences, etc. (CCPA).

India has only a few digital security standards for banking and financial services. All other activities are regulated under traditional banking regulatory standards. As a result, digital banking services in India largely operate within existing institutional and supervisory frameworks. However, the government supports the implementation of digital technologies to provide access to banking services to people from all corners of the country and improve their well-being. This policy focus highlights the importance of financial inclusion as a national development goal. India's first formal law on digital privacy was passed in 2023. (DPDP Act). The passage of this law marks an important step towards strengthening data protection and consumer trust in digital financial services.

In the United Arab Emirates, one of the main countries that many banks around the world want to enter as a foreign market, the Financial Services Regulatory Authority (FSRA) oversees the activities of all local and foreign technology-based digital financial services operating in the country. The UAE is positioning itself as a regional financial and fintech hub, attracting international banks and digital service providers. The regulatory framework emphasizes oversight of innovation while ensuring compliance with international financial standards. Through the Financial Services Regulatory Authority (FSRA), the UAE aims to balance market openness with effective risk management in the digital banking sector.

Singapore has one of the world's most advanced digital services regulatory frameworks. In 2019, the Monetary Authority of Singapore (MAS) began issuing digital licenses that cover the operating principles of fully digital banks and financial technology (fintech) companies. The organization has a comprehensive framework on AI ethics, digital data governance, risk control, digital systems, and cryptocurrencies. All new financial technologies, banking and financial services are tested in the country. Only when they are deemed acceptable are they allowed to be offered to the public.

China is one of the countries where digital banking and digital financial technologies are rapidly developing. The scale and pace of digital financial technology adoption in China is unparalleled in many regions. WeBank, which operates in China, is the world leader in the number of digital banking services used, with more than 350 million customers per month. In 2019, a virtual bank license was issued in Hong Kong, a special administrative region of China. In order to improve financial inclusion, the Chinese government supports the operation of digital banking and financial services. However, the country has strict controls on digital services, payment systems, data security and data transfer to other countries.

6. DISCUSSION/CONCLUSION

The results of the research show that the number of digital technologies and software used in banking is constantly increasing. However, no matter how much they are improved, the regulatory methods of countries cannot fully cover digital financial technologies and are constantly lagging

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behind. Taking into account the diversity and complexity of digital banking services, the main limitations of their regulation include the following:

Rapid technological development. As technology advances, the technologies used by banks are also constantly changing, the range of digital banking services is increasing, and new digital financial products are emerging. At the same time, the methods of regulation of digital services in the countries are constantly lagging behind and losing effectiveness because they cannot keep up with the pace of technologies. For example, in many countries, regulatory authorities are still unable to determine how to approach banks and non-traditional financial institutions operating in digital form when granting them licenses.

Costs of regulation. New digital technologies are constantly being introduced in the banking sector, new services and products are being created, existing ones are being improved, etc. In order to keep up with these and implement more effective regulation, regulatory authorities must thoroughly understand the essence of each technology applied in the banking and financial sector, involve specialists in digital services and products when developing regulatory methods, and conduct training for existing personnel. Since implementing each of the above requires financial resources from regulatory authorities, it is often not possible to fully implement them, and this negatively affects the quality of regulation. (Alatovic, Gerson & Saade, 2021).

Cross-border incompatibility. Currently, many banks want to serve customers in other countries, beyond the borders of the country in which they operate. However, each country may have its own requirements in terms of banking activities, provision of services, bank and customer rights, security, etc. When entering new markets, banks are often able to adapt to the requirements of those countries and operate in accordance with the local environment. But sometimes countries can demand significant changes in forms or types of digital services. Obstacles such as strict rules and burdensome regulatory methods cause banks to abandon new markets in those countries, which hinders the globalization of modern digital banking services. To minimize such situations, international cooperation between countries, international banks and financial institutions is required. For example, the activities of banks in the European Union countries are regulated through the standard Eurosystem, which is the supervisory mechanism of the European Central Bank. banks in these countries can operate comfortably in each of the European Union countries and offer digital banking services to customers.

Data security and privacy. Protecting the security and privacy of customer data is very important for the trust of both customers and banks. Although regulatory authorities have developed strict frameworks for banks and financial institutions offering digital banking services to ensure the security of customer data, it is often not possible to be completely sure to what extent they comply with these requirements, for what other purposes they use the data, and whether they share it with others without permission. In addition, the vulnerability of all digital platforms to cyberattacks poses a constant threat to the security of customer data stored in any banking system. (Jovan, 2025).

Customer identity verification. As mentioned earlier, the accessibility of digital banking to everyone creates conditions for its use as a tool for illegal financial activities. Therefore, banks, financial institutions and regulatory authorities must be able to verify the identity of customers using digital services. However, in the digital environment, sometimes transactions can be carried out without registration, fake identities can be created, and even transactions can be carried out in someone else's name. Unfortunately, in the current conditions, even with the most modern methods, it is sometimes impossible to identify the real users behind the transactions. (Alatovic, Gerson & Saade, 2021). The future of every sector of the economy is shaped by technological progress. Banks should always use innovations for intended purposes and implement the latest technologies in banking services to meet the growing needs of customers and remain competitive in the financial environment. On the other hand, regulatory authorities should improve their methods of regulating digital services to protect customers and the stability of the financial system.

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FAIRNESS AT A PRICE: UNDERSTANDING THE PSYCHOLOGICAL MECHANISMS BEHIND PRICE DISCRIMINATION

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Abstract: *This research examines how different price discrimination strategies influence consumers' sense of fairness and their willingness to repurchase — one of the most decisive indicators of brand loyalty. In markets where competition and transparency are intensifying, pricing has become more than a financial decision; it is a statement of a firm's ethics and respect for its customers. The study distinguishes between four major forms of price discrimination — time-based, location-based, quantity-based, and customer characteristics-based — and reveals that not all discrimination is perceived equally. Consumers accept time-based and customer-oriented differences when they perceive a clear logic or reward behind them, such as loyalty benefits or off-peak discounts. In contrast, arbitrary or opaque practices, especially those tied to location or purchasing volume, provoke perceptions of injustice and distrust. The findings demonstrate that fairness is not a secondary sentiment but the central bridge between pricing strategy and consumer behavior. When customers feel treated fairly, they do not merely repurchase — they internalize the brand's values and advocate for it. The study underscores a crucial managerial insight: in the long term, fairness-driven pricing is not only ethically superior but strategically indispensable for sustaining competitiveness and trust in modern markets.*

Keywords: *price discrimination, price fairness, repurchase intention, consumer trust, ethical pricing.*

1 Introduction

In an age of digital transformation and hyper-competition, pricing has transcended its traditional economic role to become one of the most visible reflections of corporate philosophy. The price of a product or service no longer merely conveys cost or value—it communicates intent, transparency, and fairness. As markets grow increasingly informed and interconnected, consumers evaluate prices not only in monetary terms but also as moral indicators of how firms respect and value their customers. In this context, pricing becomes both a strategic decision and an ethical act, shaping the relational and psychological contract between a company and its audience.

Historically, the concept of price has been grounded in classical economic theories that assume rational agents, perfect information, and equilibrium-based efficiency (Pigou, 1920; Varian, 1989). Yet, decades of behavioral research have fundamentally challenged this assumption. Pioneering scholars such as Kahneman, Thaler, and Tversky revealed that human judgment about prices is embedded in emotions, perceptions of justice, and social comparisons rather than purely rational calculus (Kahneman et al., 1986; Thaler, 1985). Consumers interpret price changes through the lens of fairness — assessing not just what they pay, but why they pay it. When the motive behind a pricing decision is perceived as justifiable, transparent, or benevolent, fairness perception strengthens. Conversely, when motives appear opportunistic or exploitative, perceived injustice erodes both satisfaction and loyalty.

At the heart of this moral evaluation lies the concept of price discrimination — the deliberate strategy of charging different prices for the same good or service based on consumers' characteristics,

behaviors, or circumstances. Economically, price discrimination is rational: it allows firms to align prices with willingness to pay, capture surplus, and improve resource allocation (Stigler, 1966; Stole, 2007). Yet psychologically, it is fraught with tension, as consumers instinctively link unequal treatment with unfairness. The same economic logic that benefits a firm can be perceived as moral transgression by the consumer. This conflict between managerial optimization and moral legitimacy constitutes the core paradox of contemporary pricing.

With the advent of algorithmic pricing and digital data, this paradox has intensified. Modern technologies now empower firms to implement precise, real-time differentiation across customers, regions, and contexts (Borgesius & Poort, 2017). Online retailers, airlines, telecommunications firms, and even subscription-based digital platforms employ sophisticated systems to tailor prices dynamically. However, this digital precision, while economically optimal, exposes firms to heightened scrutiny. Consumers today are not passive participants—they are informed, connected, and empowered evaluators capable of detecting inconsistencies and questioning the fairness of corporate motives. A pricing algorithm may achieve marginal efficiency gains, but a single perception of unfairness can inflict lasting reputational harm.

Fairness perception, therefore, emerges as a psychological mediator that determines how consumers translate pricing strategies into emotional and behavioral responses. The Dual Entitlement Theory (Kahneman et al., 1986) posits that consumers perceive fairness when firms maintain a balance between their right to profit and the consumers' right to reasonable value. When this balance is violated—when the firm's gain appears to come at the customer's expense—perceptions of injustice emerge. Similarly, Equity Theory suggests that individuals assess fairness by comparing their outcomes and inputs relative to others. In pricing contexts, this translates into judgments about whether one's price differs unjustifiably from that of similar consumers.

Recent research highlights that fairness judgments depend heavily on inferred motives (Campbell, 1999). If consumers interpret price differences as stemming from efficiency, loyalty rewards, or legitimate cost variations, their perception of fairness improves. Conversely, if they infer opportunistic or discriminatory motives—such as exploiting data or location—perceptions of unfairness intensify. Thus, fairness perception is not merely a reaction to the price level itself but a moral interpretation of the firm's underlying intentions.

The consequences of these fairness judgments are profound. Perceived unfairness triggers anger, resentment, and distrust, leading to adverse behavioral outcomes such as reduced repurchase intention, switching behavior, and negative word-of-mouth (Haws & Bearden, 2006; Choi & Mattila, 2009). Conversely, when pricing is seen as fair, consumers exhibit stronger emotional attachment, repeat purchase behavior, and long-term loyalty (Lii & Sy, 2009; Vogel & Paul, 2015). In the long run, fairness perception transforms from an ethical ideal into a strategic asset that sustains competitive advantage.

Despite extensive literature on fairness and pricing, notable research gaps persist. Much of the existing work has examined isolated pricing practices—discounts, promotions, or dynamic pricing—without systematically comparing how different types of price discrimination (time-based, location-based, quantity-based, and customer-based) differentially shape fairness perceptions. Furthermore, the majority of studies are situated within developed economies, neglecting cultural contexts where collective norms, social comparison, and institutional trust play distinct roles in fairness judgments. In emerging economies, such as Azerbaijan, consumers' sensitivity to perceived justice is often amplified by evolving digital literacy, market transparency, and social inequality—all factors that can heighten the emotional response to price differences.

This study addresses these gaps by integrating behavioral, ethical, and managerial perspectives into a unified empirical framework. Specifically, it investigates how various forms of price discrimination influence consumers' perceptions of fairness and their subsequent repurchase intentions. The research proposes that price fairness perception acts as a mediating construct,

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translating the technical and economic design of price discrimination into psychological and behavioral outcomes. By doing so, it bridges the theoretical gap between rational pricing models and behavioral consumer responses.

The context of the study—Azerbaijan’s GSM service market—offers a particularly suitable setting for this inquiry. Mobile operators frequently employ differentiated pricing schemes, such as time-based promotions, loyalty rewards, regional discounts, and volume-based tariffs. These practices make consumers continuously aware of pricing disparities, thus providing a natural laboratory for examining how fairness perceptions evolve. Moreover, the rapid digitalization of the telecommunications sector mirrors broader global transformations, making the insights of this study both locally grounded and internationally relevant.

The expected contributions of this research are threefold. First, it offers a comparative assessment of four distinct price discrimination strategies, providing empirical clarity on which types foster fairness and which erode it. Second, it empirically validates the mediating role of perceived fairness in linking price discrimination to repurchase intention, thereby contributing to behavioral pricing theory. Third, it extends the ethical discourse in marketing by framing fairness not as a moral constraint but as a strategic enabler—demonstrating that firms can pursue profitability without compromising justice.

Beyond its theoretical relevance, this study holds significant practical implications. In a world of algorithmic pricing, fairness becomes a competitive differentiator. Firms that cultivate fairness-centered pricing architectures can transform consumer relationships from transactional to relational. Such firms are not merely selling products—they are selling respect, predictability, and trust. As markets evolve toward data-driven precision, the ability to maintain a perception of fairness may determine which companies sustain loyalty in the long term.

Ultimately, this study advances a central thesis: price fairness is the invisible currency of modern markets. It shapes how consumers interpret commercial intent, how they decide to return, and how they define loyalty in an increasingly fragmented economy. The challenge for today’s firms is not simply to find the optimal price, but to discover the ethically optimal price—one that resonates with both reason and justice.

2 Theoretical Background

The theoretical background of this study provides the conceptual foundation for understanding how price discrimination, fairness perception, and repurchase intention interact within the broader framework of behavioral economics and consumer psychology. It traces the intellectual evolution of pricing theory—from classical assumptions of rationality and efficiency toward contemporary perspectives that recognize the moral and emotional dimensions of market exchange. By integrating insights from equity and dual entitlement theories, the discussion elucidates how consumers’ perceptions of fairness mediate the relationship between differential pricing and behavioral outcomes. This section therefore situates the study within a multidimensional paradigm that views pricing not merely as an economic mechanism but as a social and ethical process through which trust, legitimacy, and loyalty are negotiated between firms and consumers.

2.1 From Classical Economics to Behavioral Contextualization

In classical economic theory, price represents the equilibrium point where supply meets demand, reflecting the marginal utility of goods within a rational marketplace. Consumers are assumed to be informed, utility-maximizing agents who make decisions based solely on objective evaluations of cost and benefit (Pigou, 1920; Varian, 1989). Within this framework, price discrimination—charging different prices for the same good or service to distinct market segments—emerged as a legitimate and efficient managerial strategy. It allows firms to capture consumer surplus, align prices with willingness to pay, and increase market efficiency (Stigler, 1966; Stole, 2007).

Yet, the rationalist assumption underlying these models has been increasingly challenged by behavioral economics, which reinterprets economic behavior as deeply embedded in psychology, context, and social meaning. Pioneering research by Kahneman, Tversky, and Thaler revealed that individuals evaluate prices not only through economic reasoning but through perceptions of fairness, intent, and justice (Kahneman et al., 1986; Thaler, 1985). Consumers interpret pricing decisions as moral signals that reveal the firm's respect—or lack thereof—toward them. Thus, a price is no longer merely a number; it becomes a social and ethical message.

Within this behavioral paradigm, fairness operates as a heuristic of moral evaluation. Consumers assess not only what they pay, but also why they pay it, drawing inferences about corporate motives. When a price difference is perceived as logical or beneficial to both parties, it strengthens the sense of legitimacy; when it appears opportunistic, it evokes psychological resistance. Therefore, fairness perception transforms price discrimination from an economic instrument into a moral experience (Campbell, 1999; Xia, Monroe & Cox, 2004).

2.2. Fairness as a Moral and Psychological Schema

Fairness is both a normative and psychological construct that governs human responses to inequality in exchange relationships. Theoretically, it rests on two major foundations: Equity Theory and Dual Entitlement Theory.

According to Equity Theory (Adams, 1965), fairness is achieved when the ratio between a consumer's inputs (e.g., money, effort) and outcomes (e.g., benefits, value) is balanced relative to reference others. Discrepancies—such as paying more than others for the same service—create cognitive and emotional discomfort, leading to corrective actions such as complaint, avoidance, or negative word-of-mouth.

The Dual Entitlement Theory (Kahneman et al., 1986) extends this understanding by arguing that both firms and consumers possess legitimate entitlements within a transaction: firms are entitled to a reasonable profit, and consumers are entitled to a fair price. A sense of fairness emerges when both entitlements coexist harmoniously. However, when price increases or discrimination seem to violate this equilibrium—by transferring welfare from the consumer to the firm—perceptions of injustice arise.

Empirically, fairness is not determined by the absolute level of price but by its relational justification. Transparent and well-communicated rationales for differential pricing enhance fairness perceptions, while opaque or manipulative justifications diminish them (Haws & Bearden, 2006). Moreover, fairness is both cognitive—based on rational assessment—and affective—shaped by emotions such as trust, gratitude, or anger. It is therefore not a passive perception but a multidimensional evaluative process through which consumers negotiate the moral legitimacy of market exchanges.

Cultural and contextual elements further influence this process. In emerging economies or collectivist cultures, fairness is closely tied to shared norms of equality and community balance (Reinartz & Wiegand, 2019). Hence, what may be deemed economically justified in one cultural context may appear exploitative in another. This intersection of fairness with social norms reinforces its character as both a psychological lens and a sociological principle that shapes consumer behavior.

2.3 The Fairness Paradox in Price Discrimination

Price discrimination embodies an inherent duality: it is simultaneously economically rational and morally sensitive. Firms adopt it to improve profitability and market segmentation, yet it often challenges consumers' moral expectations of equal treatment. This tension—between efficiency and ethics—constitutes the Fairness Paradox of pricing.

Empirical research consistently demonstrates that consumer reactions vary across discrimination types. Time-based price discrimination, such as off-peak pricing or early-bird

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discounts, tends to be perceived as fair, since it aligns with controllable behaviors. Customer characteristics-based discrimination, including loyalty programs, is often seen as merit-based, rewarding long-term commitment. By contrast, location-based discrimination frequently triggers skepticism, as geographic differentiation rarely appears justifiable in moral terms. Quantity-based discrimination occupies an ambiguous middle ground, accepted when it rewards consumption efficiency but rejected when it appears exclusionary or elitist.

The fairness of such strategies depends less on the pricing mechanism itself than on inferred corporate motive—what consumers believe the firm intends by its pricing decision (Campbell, 1999). When motives are perceived as benevolent—such as compensating for demand fluctuations or rewarding loyalty—fairness strengthens. When motives are perceived as opportunistic or exploitative, fairness perceptions deteriorate. This “motive inference” mechanism highlights the relational nature of modern pricing: firms and consumers are engaged in a continuous moral negotiation. Fairness, therefore, acts as a moral contract, invisible but powerful, that governs the sustainability of exchange relationships. Once broken, it cannot be easily restored through financial incentives alone.

2.4 Fairness as a Mediating Mechanism Between Pricing and Behavior

A central proposition in behavioral marketing is that fairness perception mediates the relationship between pricing strategies and behavioral outcomes. Consumers’ perception of fairness directly influences satisfaction, trust, loyalty, and repurchase intention (Vogel & Paul, 2015; Choi & Mattila, 2009). Fairness perception operates as both a psychological filter and a behavioral regulator—translating managerial actions into cognitive judgments and emotional reactions.

Two complementary mechanisms explain this process. First, Cognitive Consistency Theory posits that consumers seek harmony between their beliefs and experiences. When a price is perceived as fair, it reinforces brand trust and justifies continued engagement; when perceived as unfair, it generates dissonance that consumers resolve by distancing themselves from the firm. Second, Trust Theory suggests that fairness serves as a heuristic for moral integrity—consistent fairness in pricing builds confidence in the firm’s reliability, while perceived opportunism erodes it. As a result, fairness perception bridges the managerial and behavioral domains: it transforms pricing policy from a static managerial decision into a dynamic psychological experience. Fairness, in this sense, functions not merely as an emotional reaction but as a relational governance mechanism that sustains the social legitimacy of market exchanges.

2.5 Integrative Behavioral Framework

Integrating economic, psychological, and ethical dimensions yields an overarching theoretical logic: price discrimination influences repurchase intention through the mediating role of perceived fairness. This framework positions fairness at the heart of consumer–firm interaction.

Economically, firms pursue price discrimination to maximize efficiency and profitability. Psychologically, consumers decode such pricing through fairness heuristics shaped by transparency, justification, and perceived motive. Ethically, these judgments produce moral evaluations that either reinforce or undermine consumer trust. Hence, fairness is the behavioral hinge that connects rational pricing strategy with moral legitimacy. In the digital era—characterized by algorithmic personalization, information asymmetry, and heightened consumer awareness—the moral legitimacy of price differentiation has become an indispensable element of competitiveness. Firms that institutionalize fairness in their pricing logic can transform differentiation into loyalty; those that neglect it risk transforming efficiency into alienation.

This theoretical synthesis thus reframes pricing not merely as a function of economic optimization but as an expression of ethical governance. Fairness, rather than constraining competitive behavior, legitimizes it—turning price from a transactional element into a relational and reputational asset.

In this broader sense, price fairness functions as the invisible infrastructure of market trust, converting numerical differentials into moral judgments and emotional bonds. The capacity of a firm to align its economic interests with fairness expectations ultimately determines the sustainability of its consumer relationships.

3 Methodology

The conceptual model of this study builds on the behavioral understanding that consumers' reactions to differential pricing are mediated by their perceptions of fairness. In this framework, price discrimination represents the managerial mechanism, price fairness perception functions as the psychological mediator, and repurchase intention emerges as the behavioral outcome. The model therefore reflects a multi-level causality, where economic logic, moral cognition, and behavioral loyalty interact dynamically.

3.1 Price Discrimination and Price Fairness Perception

Price discrimination has long been considered an efficiency-enhancing strategy that allows firms to align prices with consumers' willingness to pay (Stole, 2007). However, the behavioral dimension of pricing reveals that the success of such strategies largely depends on how consumers interpret the fairness of price differences. Drawing upon dual entitlement theory (Kahneman et al., 1986), consumers expect firms to balance profit motives with equitable treatment. When price differentials are perceived as transparent and controllable, they are likely to be interpreted as justified; when they appear arbitrary or exploitative, fairness perceptions decline (Campbell, 1999).

Among various types of price discrimination, time-based strategies—such as off-peak discounts or early-bird offers—are generally perceived as fair because they are grounded in objective, situational factors and allow consumer choice (Choi & Mattila, 2009). In contrast, location-based discrimination often lacks moral justification, as price differences across regions are rarely associated with meaningful cost variations (Xia, Monroe & Cox, 2004).

Similarly, quantity-based discrimination (e.g., bulk discounts) can enhance perceived fairness when it reflects genuine efficiency gains, yet it may also be viewed as inequitable when smaller consumers feel disadvantaged. Finally, customer characteristics-based discrimination—such as loyalty-based or demographic pricing—tends to evoke positive fairness perceptions when framed as reward-based recognition rather than exclusion.

Thus, the following hypotheses are proposed:

H1a: Time-based price discrimination positively influences price fairness perception.

H1b: Location-based price discrimination has an insignificant or negative effect on price fairness perception.

H1c: Quantity-based price discrimination exerts a weak or insignificant influence on price fairness perception.

H1d: Customer characteristics-based price discrimination positively influences price fairness perception.

Collectively, these hypotheses suggest that the moral logic embedded in pricing—its transparency, controllability, and perceived intent—determines whether discrimination is viewed as acceptable or unjust.

3.2 Price Fairness Perception and Behavioral Intention

Once consumers interpret a firm's pricing behavior as fair, they are more likely to translate that moral judgment into trust and behavioral commitment. Prior research consistently demonstrates that fairness perception enhances satisfaction, loyalty, and repurchase intentions (Vogel & Paul, 2015; Lii & Sy, 2009). From the perspective of Cognitive Consistency Theory, fair treatment aligns with consumers' expectations of justice and fosters psychological comfort, reinforcing their decision to

maintain the relationship. Conversely, perceived unfairness disrupts this consistency, generating dissonance that manifests as reduced loyalty, complaints, or brand switching.

Therefore, the following hypothesis is advanced:

H2: Price fairness perception positively influences repurchase intention.

This assumption positions fairness as a behavioral regulator, mediating the translation of moral evaluations into concrete purchase behavior.

3.3. Mediating Role of Price Fairness Perception

While firms implement price discrimination primarily to optimize revenue, consumers evaluate such strategies through fairness heuristics. This gap between managerial intent and consumer interpretation underscores the mediating role of fairness perception. According to behavioral economics, individuals do not react to price structures mechanically; they reconstruct meaning through perceived motives and relational justice (Thaler, 1985).

When price differentiation is perceived as fair, it strengthens emotional attachment and trust, encouraging repeat purchases. Conversely, when discrimination appears opportunistic, even rational economic justifications fail to elicit positive behavioral responses. This mediating process converts managerial pricing actions into moral experiences, which ultimately shape consumer loyalty.

Accordingly, the following mediation hypotheses are formulated:

H3a: Price fairness perception mediates the relationship between time-based price discrimination and repurchase intention.

H3b: Price fairness perception mediates the relationship between location-based price discrimination and repurchase intention.

H3c: Price fairness perception mediates the relationship between quantity-based price discrimination and repurchase intention.

H3d: Price fairness perception mediates the relationship between customer characteristics-based price discrimination and repurchase intention.

Bringing together these theoretical links, the research model suggests a chain of influence in which the structure of price discrimination shapes consumer interpretations of fairness, which then determines behavioral outcomes. Fairness thus serves as the psychological bridge connecting firm-level pricing mechanisms with consumer-level loyalty dynamics.

This relationship is not purely linear but interpretive and moral in nature: firms' economic differentiation strategies succeed only when consumers internalize them as legitimate and justifiable. Hence, fairness perception is the pivot through which price discrimination transforms from a managerial tactic into a sustainable behavioral strategy.

3.4. Ethical Considerations

All procedures conducted in this research complied with established ethical standards for behavioral and social science studies. Ethical approval was obtained from the Institutional Review Board of the affiliated university prior to data collection. Participants were informed in detail about the study's academic purpose, the voluntary nature of their participation, and their right to withdraw at any time without consequence. No identifying information was collected, and all responses were treated with strict confidentiality and analyzed in aggregate form. The study adhered to the principles of the Declaration of Helsinki (2013) and the APA Ethical Guidelines (2017), ensuring respect for human dignity, privacy, and data protection. Moreover, transparency and integrity were maintained throughout the entire research process—from scenario design and survey administration to data analysis and reporting—ensuring that the study upholds both scientific credibility and ethical accountability.

4 Results

The results section presents the empirical findings derived from the analysis of the conceptual model, examining both direct and mediated relationships among the constructs. It begins with an overview of the sample characteristics, followed by the evaluation of the measurement model to confirm reliability and validity. Subsequently, the structural model results are reported to test the hypothesized relationships between different price discrimination strategies, fairness perception, and repurchase intention. The presentation of findings is supported by path coefficients, significance levels, and mediation tests, allowing for a comprehensive understanding of how pricing practices influence consumer judgments of fairness and their behavioral intentions.

4.1 Descriptive Findings

The study included 403 valid responses collected from active GSM service users across Azerbaijan. Respondents represented a balanced demographic profile: 52% were female and 48% male, with ages ranging from 18 to 60 years. The sample was also diverse in terms of education and income levels, enhancing the generalizability of the findings within the telecommunications sector. Overall, descriptive statistics indicated sufficient variation across key variables, suggesting that the data were suitable for inferential analysis using PLS-SEM.

4.2 Measurement Instruments

The reliability and validity of constructs were first examined prior to hypothesis testing. All indicators displayed factor loadings above the minimum threshold of 0.70, demonstrating adequate indicator reliability. Cronbach's α and composite reliability (CR) values exceeded 0.70, confirming internal consistency. The average variance extracted (AVE) for each construct was above 0.50, supporting convergent validity. Discriminant validity was verified using both the Fornell–Larcker criterion and HTMT ratios (< 0.90), indicating that all constructs were empirically distinct.

These results confirmed the robustness of the measurement model and validated the use of the constructs in the subsequent structural model analysis.

4.3 Structural Model Assessment

Following the validation of the measurement model, the structural relationships among variables were tested using bootstrapping (5,000 resamples) in SmartPLS. The path coefficients (β), t-values, and p-values for each hypothesized relationship are reported below.

4.4 Validation of Hypotheses

The validation of hypotheses constitutes the core of this study's empirical inquiry, linking the statistical outcomes to the theoretical foundations discussed earlier. This section goes beyond numerical verification to interpret how the observed relationships substantiate or challenge the behavioral model proposed in the conceptual framework. Specifically, it investigates how each form of price discrimination—time-based, location-based, quantity-based, and customer characteristics-based—affects consumers' perceptions of price fairness and, subsequently, their repurchase intentions.

Table 1 Analysis results based on hypotheses

Variables	Path Coefficient (β)	Mean	Std. Deviation	t-value	p-value
Quantity-based price discrimination → Price fairness perception	-0.112	-0.110	0.097	1.146	0.126
Location-based price discrimination → Price fairness perception	0.066	0.066	0.100	0.654	0.257

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Customer characteristics-based price discrimination → Price fairness perception	0.224	0.224	0.092	2.424	0.008
Time-based price discrimination → Price fairness perception	0.250	0.252	0.090	2.800	0.005
Price fairness perception → Repurchase intention	0.313	0.313	0.030	10.336	0.000
Customer characteristics-based PD → Fairness → Repurchase intention	0.008	0.008	0.017	0.471	0.319
Location-based PD → Fairness → Repurchase intention	0.015	0.015	0.017	0.868	0.193
Time-based PD → Fairness → Repurchase intention	0.078	0.079	0.025	2.500	0.012

The analysis employs bootstrapped structural equation modeling to estimate both direct and indirect effects, thereby revealing not only the strength of causal links but also the underlying psychological pathways through which fairness operates as a mediator.

Table 2 *Hypotheses validation and mediation analysis*

Hypothesis	Path Relationship	β	t-value	p-value	Result
H1a	Time-based PD → Price Fairness Perception	0.250	2.800	0.005	Supported
H1b	Location-based PD → Price Fairness Perception	0.066	0.654	0.257	Not Supported
H1c	Quantity-based PD → Price Fairness Perception	-0.112	1.146	0.126	Not Supported
H1d	Customer Characteristics-based PD → Price Fairness Perception	0.224	2.424	0.008	Supported
H2	Price Fairness Perception → Repurchase Intention	0.313	10.336	0.000	Supported
H3a	Time-based PD → Fairness → Repurchase Intention	0.078	2.500	0.012	Supported
H3b	Location-based PD → Fairness → Repurchase Intention	0.015	0.868	0.193	Not Supported
H3c	Quantity-based PD → Fairness → Repurchase Intention	0.008	0.471	0.319	Not Supported

By evaluating these mediation mechanisms, the study identifies which pricing strategies resonate with consumers’ moral logic and which ones generate skepticism or resistance. Hence, this section provides a holistic validation of the model: it empirically confirms that fairness is the interpretive lens through which consumers translate managerial pricing decisions into behavioral loyalty or disengagement.

The results of the hypothesis testing are summarized below. Time-based and customer characteristics-based price discrimination strategies exhibited significant positive effects on price fairness perception (H1a and H1d supported).

Quantity-based and location-based price discrimination strategies did not show statistically significant effects (H1b and H1c not supported).

The path from price fairness perception to repurchase intention (H2) was strongly significant ($\beta = 0.313$, $p < 0.001$), indicating that perceived fairness directly drives consumers’ willingness to repurchase.

Regarding mediation, fairness perception significantly mediated the relationship between time-based price discrimination and repurchase intention ($\beta = 0.078$, $t = 2.50$, $p = 0.012$), confirming H3a.

5 Discussion and Conclusion

The discussion section interprets the empirical findings in light of the theoretical framework and existing literature, highlighting how the results contribute to the understanding of consumer behavior in price discrimination contexts. Rather than merely restating numerical outcomes, this section explains why certain relationships emerged as significant and how fairness perception operates as the key psychological mechanism linking pricing strategies to consumer loyalty.

The discussion also situates these findings within broader theoretical debates in behavioral economics, equity theory, and marketing ethics, offering new insights into how economic rationality interacts with moral cognition. By connecting empirical evidence with conceptual reasoning, this section clarifies the theoretical, managerial, and societal implications of treating fairness not as a constraint on profitability but as a foundation for sustainable market relationships.

The empirical findings of this study reaffirm the central proposition that price fairness perception serves as the psychological bridge between managerial pricing strategies and consumer loyalty. The results demonstrate that not all forms of price discrimination are perceived equally by consumers; rather, their acceptance depends on the transparency, controllability, and moral justification of the pricing logic.

Among the examined strategies, time-based and customer characteristics-based price discrimination had significant positive effects on fairness perception. These findings align with behavioral economics theory, which suggests that when consumers perceive control or rationale in pricing—such as choosing when to purchase (time-based) or being rewarded for loyalty (customer-based)—they interpret price differentiation as legitimate and fair (Thaler, 1985; Reinartz & Wiegand, 2019). These mechanisms fulfill the fairness principle embedded in the Dual Entitlement Theory, wherein firms' profit-seeking motives coexist with consumers' right to equitable treatment (Kahneman et al., 1986).

Conversely, location-based and quantity-based price discrimination did not produce significant effects on fairness perception. The weak results can be attributed to the absence of perceived fairness logic in such strategies. For instance, geographical price variation is often seen as arbitrary, particularly when production or delivery costs are not visibly different across locations. Similarly, quantity-based discrimination may disadvantage small-scale buyers, creating perceptions of inequality rather than efficiency. These outcomes underscore that economic rationality alone cannot justify differential pricing unless it is accompanied by a sense of procedural or distributive fairness.

Furthermore, the strong positive relationship between price fairness perception and repurchase intention validates fairness as a key behavioral determinant in consumer retention. This finding extends prior research (Vogel & Paul, 2015; Lii & Sy, 2009) by empirically showing that fairness is not a peripheral emotional reaction but a central cognitive schema that governs trust and long-term behavioral commitment. The confirmed mediation effect of fairness in time-based pricing particularly highlights that fairness acts as a moral lens through which consumers reinterpret managerial actions. In other words, fairness not only influences satisfaction but also legitimizes continued engagement with the brand. Collectively, these findings advance the understanding of pricing as a moral exchange process, where fairness perception transforms an economic decision into a relational and ethical experience. The study thus contributes to the emerging field of behavioral pricing by revealing that consumer reactions are not merely price-sensitive but also value- and motive-sensitive.

This research makes several substantive contributions to the academic discourse on pricing and consumer behavior, advancing both theoretical understanding and empirical validation of fairness mechanisms within price discrimination contexts.

First, it bridges classical pricing theory with behavioral economics, providing empirical evidence that consumers evaluate price differentials not purely on rational grounds but through moral and psychological lenses. This integration moves the pricing literature beyond transactional utility toward moral utility, emphasizing fairness as a mediating construct that translates price perception into behavioral outcomes.

Second, by distinguishing between four major forms of price discrimination, the study refines the conceptual understanding of how structural (time, location, quantity) and personal (customer-based) criteria differently influence fairness judgments. It demonstrates that fairness perceptions are context-dependent, moderated by controllability, transparency, and the perceived legitimacy of pricing motives.

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Third, the findings expand the theoretical scope of Dual Entitlement Theory by confirming that fairness operates dynamically rather than symmetrically. Consumers are willing to tolerate certain profit-seeking behaviors if firms demonstrate procedural integrity and reciprocity. In this way, fairness functions as both a cognitive filter and a relational contract, legitimizing the moral boundaries of market exchange.

From a managerial perspective, the results of this study provide several important insights for designing and implementing pricing strategies in competitive and transparency-driven markets. The findings demonstrate that fairness is not merely a moral aspiration but a strategic lever that directly shapes consumer loyalty and repurchase behavior. Managers should therefore view fairness as a value-creating component of pricing policy rather than a limitation to profit maximization.

The significant impact of time-based and customer characteristics-based price discrimination on fairness perception suggests that pricing strategies rooted in transparency, logic, and controllability are more likely to foster trust and long-term engagement. Managers are encouraged to design price differentiation mechanisms that consumers can easily understand and justify, such as off-peak discounts, loyalty-based rewards, or personalized offers that reflect clear reciprocity. Communicating these rationales explicitly can strengthen consumers' belief in the legitimacy of the firm's pricing conduct.

Conversely, strategies such as location-based or quantity-based discrimination should be applied with caution, as they risk being perceived as arbitrary or exclusionary. When cost or logistical justifications are not visible to consumers, such approaches may erode perceptions of fairness and harm brand equity. To mitigate this risk, managers should ensure that all pricing policies are accompanied by clear explanations of their purpose and logic, allowing customers to perceive them as efficiency-driven rather than exploitative.

Ultimately, managers should recognize that consistent fairness in pricing cultivates not only consumer satisfaction but also reputational capital. In the long term, firms that institutionalize fairness as a core principle of their pricing strategy are more likely to sustain customer trust, differentiate their brand in crowded markets, and achieve profitability rooted in ethical legitimacy rather than opportunistic advantage.

By aligning economic objectives with fairness-oriented pricing, firms can transform price from a transactional variable into a relational signal of respect and integrity.

This research confirms that fairness is the moral currency of the marketplace. Pricing strategies that are logical, transparent, and consistent with consumers' sense of justice foster trust and drive long-term behavioral loyalty. Conversely, strategies that appear arbitrary or self-serving, even when economically efficient, undermine relational trust and brand equity.

By empirically validating the mediating role of fairness between price discrimination and repurchase intention, this study extends behavioral pricing theory and provides practical guidance for ethical, trust-based pricing design. The results ultimately affirm that in contemporary markets, profitability and fairness are not opposing goals but mutually reinforcing pillars of sustainable marketing strategy.

6 Limitations and Further Research

While this study makes significant theoretical and managerial contributions to the understanding of price discrimination and fairness perception, several limitations should be acknowledged, each of which opens meaningful avenues for future inquiry.

First, the empirical analysis was confined to the Azerbaijani telecommunications market, a sector that provides a relevant yet context-specific setting for examining price fairness and repurchase behavior. Although this environment offers a controlled and behaviorally rich context, the findings may not be fully generalizable across other industries or cultural ecosystems. Future research should therefore validate the proposed model across diverse sectors such as retail, hospitality, financial

services, or digital commerce to explore potential contextual contingencies and cross-cultural variations in fairness evaluation.

Second, although the scenario-based experimental design adopted in this study enhances ecological validity and allows the controlled manipulation of pricing situations, it may not fully capture the emotional complexity and spontaneous decision-making processes that occur in actual market settings. Subsequent research could adopt hybrid methodologies—combining experimental and longitudinal designs—to trace the stability and evolution of fairness-driven behavioral responses over time. Such designs would provide deeper insight into how perceived fairness translates into sustained consumer loyalty beyond hypothetical scenarios.

Third, this research primarily conceptualizes fairness as a mediating mechanism, yet it does not account for other psychological or contextual moderators that may shape this relationship. Future studies could incorporate variables such as cultural orientation, trust disposition, perceived value, or digital transparency to offer a more comprehensive understanding of the fairness–loyalty linkage. Moreover, qualitative approaches—such as in-depth interviews, focus groups, or ethnographic fieldwork—could complement quantitative findings by uncovering the symbolic, emotional, and narrative dimensions through which consumers construct fairness judgments.

Overall, addressing these limitations would not only strengthen the external validity of the current model but also advance a more holistic understanding of how fairness perceptions are formed, negotiated, and sustained within the moral architecture of modern marketplaces.

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THE ECONOMIC ROLE OF MARKETING STRATEGY IN LIGHT INDUSTRY INNOVATION

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Abstract: *This study explores the economic role of marketing strategy in fostering innovation within the light industry sector. As global markets become increasingly competitive, innovative approaches to production and marketing are essential for maintaining sustainability and growth. The light industry of Azerbaijan, encompassing textiles, clothing, and carpet production, has significant potential for innovation-driven expansion. Effective marketing strategies contribute to this process by aligning innovative products with market demands, improving brand competitiveness, and enhancing export potential. The study emphasizes that innovation marketing supports not only technological advancement but also consumer awareness and preference for locally produced goods. Moreover, the integration of innovative products through modern marketing tools—such as digital promotion, market segmentation, and branding—stimulates investment and job creation in the sector. Consequently, marketing strategy acts as a bridge between innovation and market success, ensuring that new ideas translate into economic value. The paper concludes that strengthening marketing capabilities and innovation-oriented management practices is a key factor for the sustainable development of Azerbaijan’s light industry in the global market.*

Keywords: *marketing strategy, innovative products, market research, consumer relations, export promotion*

I Introduction

The light industry sector plays a critical role in Azerbaijan’s economy, encompassing the production of textiles, apparel, footwear, leather goods, and related consumer products. Beyond serving domestic consumption, this sector provides essential materials for other industries, including agriculture, metallurgy, and food processing. Its high labor intensity, rapid production cycles, and sensitivity to changing consumer demand highlight the need for continuous innovation and strategic marketing approaches.

In recent years, the adoption of innovation marketing in Azerbaijan’s light industry has gained momentum. Innovation marketing integrates modern marketing strategies with technological and product innovations to enhance competitiveness, optimize production processes, and meet evolving consumer preferences. However, challenges remain, including limited understanding of marketing principles, inadequate market research, and underdeveloped technical infrastructure (Kotler et al., 2018:75-80).

Government initiatives, such as the promotion of the “Made in Azerbaijan” brand and support for export-oriented enterprises, provide a favorable environment for the sector’s growth (Azexport, 2023:12). Effective innovation marketing requires the alignment of market research, product development, distribution channels, and consumer relationship management. By combining state support with enterprise-level strategic planning, the light industry sector can expand its market share, increase product quality, and strengthen its contribution to the national economy.

The purpose of this study is to examine the role of innovation marketing in Azerbaijan’s light industry, identify existing challenges, and propose strategies for sustainable sectoral development.

2 The Role of Marketing in Innovation Strategies in the Light Industry Sector

At present, the main driving force of economic development worldwide is innovation activity. Economic dynamics and new advancements are leading the global economy, driven by digitalization and changes in socio-economic processes. The processes of digitalization and globalization occurring across the world significantly influence economic development. Therefore, firms and enterprises must focus on creating innovative solutions and integrating them into production processes in order to maintain their market position and ensure profitability.

In the modern era, as in other sectors, the effective planning and management of innovation processes in the light industry sector has become one of the main strategic priorities. The implementation of innovative activities and the formation of development strategies in enterprises within this field can lead to more efficient results through the application of marketing approaches (Kotler et al., 2018:43).

The success of the innovation process is primarily determined by its productivity and the possibility of practical implementation within a short period. The introduction of innovative products to the market directly depends on the proper organization of this process. At this stage, the application of effective communication strategies with consumers, the enterprise's openness to technological innovations, and the rapid integration of innovations into practice play a decisive role (Schwab, 2017:58).

As in all other fields, innovation activity and the strategy of creating innovative products in the light industry can be implemented in various directions and through different types of innovation. However, the creation of an innovative product is ultimately closely linked to the introduction of new management systems and modern technologies. An enterprise may choose multiple directions for innovation development, but a properly structured innovation strategy based on marketing principles ensures a competitive advantage in the market. The key factor determining a company's competitiveness is precisely the application of an effective innovation strategy.

Therefore, to gain high consumer recognition and achieve profitability in the creation and sale of innovative products, innovation development strategies must be implemented in close interaction with marketing strategies.

As seen, the application of marketing in innovation is essential. Once a company decides to create a new product, the role of marketing becomes crucial from the very beginning. During the production planning stage, the use of marketing tools forms the basis for ensuring the product's competitiveness. In general, if the marketing concept is applied in innovation activities and innovative product manufacturing, the resulting product will meet the modern consumer's needs and preferences. Therefore, the use of the marketing concept and its fundamental principles is extremely important when carrying out innovation activities.

Overall, enterprises operating in the light industry sector define the objectives of their innovation activities based on their innovation potential and, in accordance with these objectives, develop and implement appropriate marketing and innovation strategies (Kotler et al., 2018:136). In modern times, enterprises aim to evaluate their selected marketing strategies from a marketing perspective at every stage of implementation. In this process, each enterprise chooses and applies marketing strategies in line with its specific goals. These strategies enable innovative products produced by the enterprise to gain competitive advantages in specific markets, increase their overall competitiveness, and ultimately ensure the enterprise's profitability (Poushneh, 2018:169-176).

3 Key Success Factors in Innovation Marketing for Light Industry Enterprises

There are several important factors that determine the success of marketing strategies chosen by an enterprise. These factors provide wide opportunities for achieving more successful outcomes in innovation marketing. The main factors include the following:

1. *Innovative product with unique features*: The unique characteristics of an innovative product allow the enterprise to differentiate itself in the market and gain a competitive advantage (Poushneh, 2018:169-176).
2. *Innovative product providing additional value to customers*: A product that offers additional benefits to consumers not only increases customer satisfaction but also responds more accurately to market demand (Kotler et al., 2018:83).
3. *Implementation of market- and consumer-oriented marketing strategies*: The application of relevant marketing strategies ensures the effective introduction of innovative products to the market in accordance with market requirements (Teece, 2014:328-352).
4. *Product concept aimed at international competition and foreign markets*: A product concept directed toward international markets helps the enterprise build broader market networks and gain advantages in global competition (Poushneh, 2018:169-176).
5. *Technical and economic justification for the creation of an innovative product*: Technical and economic justification ensures the efficiency and economic feasibility of the product before its introduction to the market (Kotler et al., 2018:81).

Each of these factors enables enterprises to achieve more successful results in the field of innovation marketing and to strengthen their position in the market. During the selection and development of an innovative product concept, a number of important factors must be taken into account. These factors ensure the effective implementation of innovation activities and contribute to achieving successful outcomes in the market. The following factors are essential for the success of this process:

1. *Defining the innovation-oriented objectives of the enterprise*: The enterprise must clearly define its innovation goals and objectives when managing the innovation process (Poushneh, 2018:169-176).
2. *Selection of target markets*: The success of an innovative product depends on the market in which it will be introduced. The enterprise should identify the most suitable markets for its product (Kotler et al., 2018:163).
3. *Ensuring product positioning*: It is important to determine how the product will be perceived in the market and what position it will occupy (Teece, 2014:328-352).
4. *Coordination between operational and strategic marketing*: Operational marketing activities should be aligned with strategic goals to ensure the enterprise's long-term success (Kotler et al., 2018:189).
5. *Coordination and marketing-based evaluation of all stages of the innovation process*: The innovation process should be managed as an integrated system, and each stage must be properly evaluated from a marketing perspective (Teece, 2014:328-352).
6. *Provision of resources and implementation of incentive measures*: Adequate resources and incentives must be provided for the implementation of innovation (Poushneh, 2018:169-176).
7. *Assessment of market attractiveness and demand for the innovative product*: The market potential and consumer demand for the product should be analyzed (Kotler et al., 2018:220).
8. *Evaluation of commercialization opportunities for the innovative product*: The commercialization potential must be thoroughly assessed, and an appropriate market strategy developed (Teece, 2014:328-352).
9. *Monitoring and evaluation of results at each stage of the innovation process*: Each stage must be controlled and evaluated to ensure proper management (Poushneh, 2018:169-176).
10. *Ensuring optimal financial resource provision*: Innovation activities must be supported by adequate and optimally regulated financial resources.
11. *Staff provision and application of motivation mechanisms for research personnel*: Training and motivation of qualified specialists required for innovation are crucial (Teece, 2014:328-352).

12. *The role of time management in the creation and market advancement of innovative products:* Proper time management ensures the fast and efficient introduction of products to the market (Poushneh, 2018:169-176).

13. *Existence of risk in the innovation process:* Innovation always involves risks that must be properly managed.

14. *Knowledge and experience gained from previous innovation strategies:* Previous experiences and lessons contribute to the improvement of innovation strategies (Teece, 2014:328-352).

15. *The role of owners in the innovation process:* Owners and managers can actively intervene in the innovation process and influence the adoption of effective decisions (Poushneh, 2018:114).

The factors listed above are highly important for managing innovation processes and implementing appropriate marketing strategies. They enable enterprises to achieve more successful results in the market and gain a competitive advantage.

When implementing innovation strategies and defining objectives, enterprises use various marketing approaches. The application of these approaches helps to conduct the innovation process more efficiently and successfully.

The main methods include the following:

1. *Incremental improvement method:* This method involves the gradual enhancement of existing products and technologies. Incremental improvement usually focuses on making small but continuous changes to develop products and services and adapt them to customer requirements. This approach is considered conservative and allows significant achievements with minimal risk (Poushneh 169).

2. *Radical innovation (leap) method:* This method covers radical innovations and involves the implementation of fundamental changes in products and technologies. The leap method requires entirely new or different approaches, independent of previous activities. It allows enterprises to enter new markets and gain greater innovation advantages, but it also carries higher risks (Kotler et al., 2018:31).

Both methods help enterprises strengthen their market position and gain advantages through new products and technologies. They offer different approaches to developing marketing strategies, and the choice of method depends on the enterprise's objectives and resources.

In industrial sectors, including light industry, the formation of a marketing system for innovative products involves several marketing activities, primarily: a) conducting market research on demand for the innovative product; b) developing a product concept for creation and commercialization; c) promoting and commercializing the innovative product; d) ensuring the product's competitiveness in the market, among others.

The effective application of innovation and marketing in the light industry is aimed at both improving internal production processes and achieving competitive advantages in the market. Several key directions are particularly important in this regard:

1. *Application of innovation and technology:* The development of the light industry heavily depends on the implementation of innovations and technological advancements. Modernizing technologies, automating production processes, using high-tech equipment, and applying new materials will increase productivity and strengthen competitiveness in the market. Examples include the modernization of primary production and the optimization of production processes.

Modernization of primary production involves the introduction of contemporary weaving machines, high-tech sewing equipment, and leather product manufacturing machinery. Optimization of production processes entails incorporating digital technologies and IoT (Internet of Things) systems into the production chain, which allows monitoring, increasing efficiency, and reducing costs.

The creation of innovative products is essential for further development in the light industry. Innovations should not only focus on new designs but also on functional features, durability, and compliance with environmental standards. Eco-friendly products should be produced, including the use of environmentally safe and recycled materials, enabling the creation of products aligned with

innovation and market demands. Additionally, designing functional and visually appealing products tailored to consumer preferences, particularly for the new generation, can enhance market attractiveness.

2. *Application of marketing strategies:* Proper marketing strategies are crucial for market success in the light industry. Modern marketing approaches play a key role in product promotion, establishing consumer relationships, and increasing market competitiveness. Enterprises must define target markets and consumer segments. Competitor activities, market shares, and strategies should be monitored to inform marketing decisions.

Online marketing, social media campaigns, influencer collaborations, and other digital tools can increase sales of light industry products. Market diversification and access to new markets, particularly international markets and new segments in the domestic market, are also vital for positive outcomes. In Azerbaijan, the development of the light industry and its sub-sectors, along with the implementation of innovation marketing, is of great importance for accelerating economic growth and enhancing competitiveness.

Although there are some shortcomings in the application of innovation marketing in Azerbaijan's light industry, several steps can be taken to address these challenges:

Promotion of innovative products in the market: Effective marketing and advertising campaigns should be organized to introduce innovative products, with broader use of social media and digital platforms.

Competition analysis and adaptation to consumer demands: Product lines should be optimized considering consumer preferences and the competitive situation in different regions.

The proposed measures to develop innovation marketing can stimulate the efficient growth of the light industry in Azerbaijan. Strengthening interactions between enterprises and consumers, offering scientifically grounded products, and establishing a proper legal framework are crucial. These measures can increase the production of innovative products, enhance the number of competitive products in the market, and foster the overall development of the innovation sector.

Sustainable development of innovation marketing cannot be achieved in the short term; it can only be realized in the medium- and long-term perspectives. Therefore, increasing innovation activity and forming a competitive economy are among the most urgent priorities. The implementation of a national innovation development concept would boost the production of high-value innovative products, strengthen competitiveness, and support economic modernization. Challenges and obstacles along this path must be overcome, and both public and private sector support should be enhanced alongside the development of innovation infrastructure.

The light industry—covering sectors such as textiles, clothing, leather, and footwear—is labor-intensive, responds quickly to changing consumer demand, and is sensitive to fashion trends. These characteristics indicate the sector's need for continuous innovation and differentiation strategies. Therefore, innovation marketing complements and expands traditional marketing approaches.

In the highly competitive and rapidly changing structure of the light industry, innovation marketing is strategically important for successful product positioning and ensuring sustainable demand. This approach not only increases market share but also contributes to technological development and the expansion of export potential.

A marketing strategy reflects the enterprise's objectives and activities. Without it, it is impossible to justify the budget and operational steps. Moreover, a marketing strategy ensures that operational activities are coordinated. Enterprises in the light industry should establish a unified marketing strategy, with annual marketing activities planned in advance according to this strategy.

The developed marketing strategy should be measurable and constantly monitored, evaluated, and adjusted as necessary. As a sector producing consumer goods, the light industry's main task is to meet the growing needs of all segments of the population.

The light industry is a sector in which the production of consumer goods is carried out in a complex and integrated manner. It produces a wide range of products for the population, including fabrics, clothing, footwear, knitwear, socks, fur products, textiles, and leather goods.

However, the light industry is not limited to consumer goods; it also manufactures various products for other industrial sectors. For instance, it produces steel cords for coal mining and metallurgy, filters and sieves for the food, chemical, and electrical industries, and different types of fabrics and auxiliary materials for the agricultural sector. These products have broad applications and play a significant role in the functioning of various economic sectors. Therefore, the light industry contributes not only to consumer goods production but also to the supply of raw and auxiliary materials for different branches of the national economy. Light industry has a notable impact on the overall economic situation, primarily due to its rapid capital turnover.

Innovation is a constant necessity in light industry products, as technology evolves rapidly and new competitors emerge. To overcome these challenges, market research must be conducted, and innovation should remain central. Several factors contribute to delays in Azerbaijan's light industry, such as insufficient financial resources and the additional costs associated with implementing new technologies.

Despite these challenges, there are promising development opportunities. One of the main advantages supporting the growth of light industry in Azerbaijan is the availability of a raw material base. Effective utilization of this base, coupled with continuous modernization of production and scientific-technological development, is essential. Progress in the light industry will reduce dependency on imported products and raw materials while increasing market share for innovative products. The expansion of locally produced light industry goods enhances the country's economic situation and the sector's share in overall production.

Recent years have witnessed improvements in the marketing strategies of Azerbaijan's light industry. Economic development policies increasingly emphasize the export of non-oil products. Accordingly, the government implements incentives, tax breaks, and other benefits for entrepreneurs. Furthermore, industrial parks, industrial zones, agroparks, and special economic zones have been established in different regions (Kerimova et al., 2024).

Light industry requires relatively low investment compared to other sectors. Capital invested in this sector is quickly returned, and production costs are relatively low. The textile sector is an exception, as it requires significant investment in machinery and equipment due to high competition in the market. The clothing sector, in contrast, is more labor-intensive, and machinery and equipment used are mobile and can be easily relocated.

International industrial experience indicates that the development of light industry is one of the most effective ways to increase production, strengthen entrepreneurship, and create multiple new business entities. This is because light industry produces goods for everyday consumption, making the establishment of such enterprises relatively simple.

The foundation of Azerbaijan's light industry is the availability of raw materials, ensuring low production costs and continuous consumer demand. Marketing strategy, as a component of micromarketing, is aimed at creating and strengthening the high image of a light industry enterprise. Its main objectives are to determine demand and market conditions, make informed decisions regarding consumer needs for innovative products, and align production with market requirements.

4 Marketing Strategies and Their Objectives in Azerbaijan's Light Industry

Overall, the primary goal of a marketing strategy is to ensure that all enterprise activities are based on the study of consumer demand and potential future changes in it. As in other sectors, the marketing strategies applied in light industry reflect the following objectives:

1. *Maximization of consumption:* The primary goal of maximizing consumption is to increase production volumes. Increasing production positively impacts employment in the economy, which in turn contributes to the overall welfare of society.

2. *Maximization of fulfillment of consumer demand for innovative products*: Here, the focus is not merely on increasing consumption, but on ensuring that consumer demand is effectively met to the highest possible degree.

3. *Maximization of consumer choice*: The objective is to provide consumers with the opportunity to select products that correspond to their tastes and preferences.

4. *Maximization of quality of life*: The goal is to ensure the cultural and physical environment quality for individuals, enhancing overall living standards.

Currently, in organizing the production of innovative products in the light industry, products known as “market innovations” should be developed. Such products either meet new consumer demands or raise the quality level of fulfilling already existing demands. Typically, these products are fully competitive and generate demand among a wider consumer base.

The application of marketing strategies in Azerbaijan’s light industry enterprises has only begun in relatively recent years. However, in several enterprises, the essence of marketing has still not been fully grasped. In some cases, marketing activities are equated solely with the sales function, which complicates the formation of products and services that meet market demand.

An analysis of marketing activities in the country’s light industry sector reveals a number of significant problems. The most notable among these are: (a) enterprises’ insufficient understanding of the essence of marketing; (b) inadequacy of marketing information systems and lack of data; and (c) a weak material and technical base for production development based on innovation.

The current state of the light industry necessitates managerial decisions focused on the proper formulation of commodity policy, pricing, product distribution, sales organization, and the effective implementation of communication policy. All of these aspects are interrelated, allowing enterprise marketing activities to be evaluated as an integrated system for production and sales decision-making (Armstrong et al., 2022:401-411). Decisions related to commodity policy aim at expanding product ranges, developing innovative products, product branding, packaging, and enhancing product competitiveness. Currently, most of these decisions are implemented in the marketing practices of Azerbaijan’s light industry enterprises, though there remains a substantial need for their improvement.

As emphasized in the “Azerbaijan 2020: Outlook for the Future” Development Concept, the light industry sector—one of the country’s traditional economic sectors—possesses significant development potential. Reforms in this sector have facilitated the reorganization of light industry enterprises and increased the volume and quality of innovative product manufacturing. Positive results have been particularly observed in raw material processing, textile, sewing, leather, and leather product manufacturing. Notable progress has been made in leather and leather product production, as well as footwear, and it is considered important to utilize these opportunities more effectively. Currently, numerous enterprises and workshops operate in the carpet weaving sector across various cities and regions of the country. In the future, strengthening the raw material base, modernizing production technologies, and improving the quality of carpet products are identified as key goals.

In the context of global competition, the development of the non-oil sector should not be limited to reviving traditional industries, but should also include the formation of modern industrial sectors producing innovative products. One of the priority directions of economic development should be to ensure the dynamic growth of high-tech industries, increase investments in research and development, enhance the scientific and technological content of products and services, and expand the innovation activities of enterprises.

The transition from a raw-material-based economic model to an innovation-driven economic development model should be defined as a strategic goal, particularly for the light industry sector. Accelerating this transition requires the creation and operation of industrial parks and technoparks. Such parks contribute to the commercialization of existing knowledge and technologies, the

development of knowledge-intensive enterprises, the improvement of industrial structure, regional development balance, increased employment, and accelerated implementation of high technologies.

Establishing an effective marketing strategy requires highly qualified marketing specialists. Marketing professionals working with innovative products must analyze all relevant factors, which should also be considered during the development of innovations and planning of marketing programs.

Marketing strategy is a key factor in the development of the innovative products market. To produce innovative products, market research is essential, and this task is performed by marketers. According to the marketing strategy, activities such as consumer segmentation, selection of sales channels, and implementation of sales promotion measures must be executed in the proper sequence.

It is well known that the fundamental concept of marketing is needs. Human needs are variable and inherent to their nature and character. The primary principle of marketing is for marketers to identify these needs. The task of marketers is to convert needs into demand.

In the light industry sector, the marketing strategies applied should aim at increasing the sales of innovative products through the integrated operation of the marketing mix. Therefore, the essence of marketing strategies applied for innovative products in the light industry is reflected in improving the production process, selecting target markets, and enhancing the competitiveness of innovative products.

When developing a marketing strategy, the main focus should be on the ability of the industry to implement that strategy. The marketing strategy should cover a long-term period, starting from the calculation of consumers' purchasing power and extending to the long-term production capabilities of the light industry sector.

The marketing strategy should be designed in such a way that it can respond timely and appropriately to changes in the external environment. It must include a properly defined pricing and sales policy. Correctly establishing the sales policy is critical because appropriate sales channels must be selected to deliver innovative products to potential consumers. In general, a marketing strategy must answer questions such as: which innovative product to sell, in what quantity, at what price, where, and how.

Marketing strategies implemented in light industry enterprises plan activities that leverage the available resources and potential of the sector to meet the existing or emerging consumer demand. This activity plan also includes the work of enterprise marketers, the innovative product project, and measures to address problems arising during production and presentation.

Even if a marketing strategy reflecting the enterprise's marketing activities is professionally developed, it will fail if it does not focus on fulfilling consumer demand. Similarly, if the enterprise lacks the resources and economic capacity to produce an innovative product, the marketing strategy prepared for that product becomes irrelevant.

As mentioned, an enterprise's marketing strategy is based on its available resources. Therefore, an enterprise must have a comprehensive inventory of its resources. Not all resources are necessary for the development of an innovative product; some may be irrelevant for marketing strategy development. The core strategy should identify resources that create a foundation for the enterprise's development. These resources may include the enterprise's assets and capabilities.

It is evident that marketing in our country has not yet been fully understood and does not exhibit a high pace of development as an independent activity. However, in recent years, state support for domestic and foreign market research in business indicates the potential for marketing development. A clear example of this is the decree signed by President Ilham Aliyev in 2016, which aims to promote Azerbaijani production in international markets and strengthen the "Made in Azerbaijan" brand. The decree also supports local companies' market entry abroad by covering the costs of export-related research and development programs from the state budget.

Unfortunately, most enterprises in Azerbaijan still consider marketing research unnecessary, and many lack a dedicated marketing department. By comparison, in several CIS countries, per

capita marketing expenditures reach 1–2 USD, while in developed countries, research costs account for 10–12% of advertising expenses. In Azerbaijan, however, research spending is less than 1% of advertising costs.

Marketing activities are a key factor in the development of innovative product markets and typically begin with market research. Such research identifies consumer needs, collects and analyzes their feedback, and delivers this information to producers. In the modern era, producing innovative products is only possible through continuous and effective consumer engagement. Managing customer relationships, gaining their loyalty, and developing a potential customer portfolio constitute the core of marketing activities.

Moreover, enterprises must implement automated marketing processes and maintain agile management platforms. These platforms should enable rapid response to emerging situations and ensure the effective implementation of marketing strategies.

5 Discussion / Conclusion

In Azerbaijan, the application of innovation marketing in the light industry sector is a relatively recent development. Despite notable progress, several challenges remain, including insufficient understanding of marketing principles by enterprises, limited use of market research, and weak material and technical infrastructure. Nevertheless, recent state initiatives, such as promoting the “Made in Azerbaijan” brand and supporting export activities, create favorable conditions for the development of innovation marketing and enhancement of market competitiveness.

Effective implementation of innovation marketing requires enterprises to conduct market research, understand consumer demand, select appropriate sales channels, and maintain constant consumer engagement. Strategic planning, including pricing, distribution, and product positioning, ensures that innovative products meet market expectations and gain a competitive edge. Such approaches not only increase sales but also contribute to the modernization of production, technological development, and expansion of export potential.

The availability of raw materials, low initial investment requirements, and constant consumer demand make the light industry sector highly promising. Long-term sustainable growth in this sector depends on the integration of state support, enterprise strategic planning, and modern marketing technologies. Continuous market research, effective consumer relationship management, and innovation-driven product development will strengthen sectoral competitiveness and contribute to the broader modernization of Azerbaijan’s economy.

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LINK BETWEEN EXPORT, FEMALE EMPLOYMENT AND PRODUCTIVITY: EMPIRICAL EVIDENCE FROM BHUTAN

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Abstract: *Influence of export orientation on overall employment level is a fairly well-established fact but its impact on female employment and gender wise differences in productivity is not yet very well established. Using a Cross-sectional data of 164 Bhutanese manufacturing units, this study finds that female employment intensity in export-oriented Bhutanese manufacturing industry is not only low as compared to domestic market-oriented firms but it also declines as the share exports rises. Case wise, standard Cobb-Douglas production function establishes that productivity of female labour is only marginally higher in export-oriented units. Female labour in Bhutan is trapped in a catch 22 situation- lower employment intensity combined with lower productivity in export-oriented units as well as in the domestic market-oriented firms.*

Keywords: *export intensity, female employment intensity, productivity, FDI, manufacturing.*

1. Introduction

Women empowerment is a defining feature of the development agenda of the 21st century designed by the United Nations in form of Millennium Development Goals and Sustainable Development Goals (United Nations , 2015). This initiative for women empowerment should be seen at the backdrop of rampant discrimination and neglect faced by women in pastⁱ (Sen, 1990). Arguably, the most important element of women empowerment is economic empowerment- providing opportunities for productive employment in the expanding sectors of the economy which employ advanced technology. Economic empowerment of women helps to enhance their prestige and self-esteem and help to overcome barriers imposed by the socio-religious-cultural stereotyping. Women empowerment also have a multiplier effect on welfare gains through various channels- reduced fertility rate, more equitable intra-household allocation of resources, higher education achievement for girl child and improved health outcomes.

Ideological and institutional adjustment in expanding sectors of the economy determines the final impact on the use of labour as well as human skills (Kuznets, 1971) Unique feature of development across the countries since 1950 has been undeniable progress towards convergence of gender wise achievements in the knowledge and health-based indicators. While much progress has been made to bridge the gender gaps in knowledge attainment, wider gender gaps still persist in the labour market. Women face discrimination to take paid work and at a global level they receive only three-fourth of what male receive from the work (United Nations , 2015). In the context of recent changes, Sen's concept of missing women needs to be interpreted in a different context- missing women from the labour market.

How does international trade impact employment opportunities for female? This question is of great import, especially, in the wake of rapid globalisation. International trade has emerged as an engine of economic growthⁱⁱ. World GDP has tripled from US\$ 23 trillion in 1990 to US\$ 75 trillion in 2016 and this feat is achieved in the shortest duration in the history of mankind. Higher growth in global GDP since 1990 was driven by two significant factors- international trade and technological transformation (World Trade Organisation, 2017). Despite such stupendous expansion in the volume of international trade and global GDP, employment to population ratio has remained virtually constant

(International Labour Organization, 2017). Yet, country specific factors have played a pivotal role in shaping the country specific labour market response to international trade and gender related issues therein. Impact of export orientation on female employment intensity depends on interplay between three broad factors- pattern of comparative cost advantages, level of competition and influence of foreign culture in management. Interplay of these factors brings about diverse gender differentiated impact on employment across types of activities within a country. In section 3, these factors are discussed in detail.

Does the rising female employment intensity (FEI) in export-oriented industries address gender gaps in the labour productivity? It is a significant question by itself. Alongside the impact of export orientation on feminisation of the labour force, corresponding changes in the gender discriminated productivity also needs to be examined to assess the overall welfare outcome. Gender based labour productivity differences provide analytical tools to explain gender-based wage differences. Although the share of female in employment has received greater attention from the researchers, the issue of gender-based productivity differences has largely been ignored. Greater concentration of women in low skill- less capital-intensive technology activities is an indication of lower productivity of female labour and consequent lower female wages. At a global level, female wages are 77% of the male wages, further it might take 70 years to bridge the gap (International Labour Organization, 2017). So profound and universal is the issue of gender disparities in wages that it can be clubbed along with death and taxes as universal events, if not inevitable events (Seguino & Grown, 2006).

1.1. Gender distinguished labour market trends in Bhutan

Since the 1990s, Bhutan has steadily established greater linkages with the outside world by undertaking a series of measures, mainly through bilateral agreements, liberal trade and FDI policy and export promotion measures. It is worth investigating that how the labour market in Bhutan responded to the liberalisation and globalisation efforts. Major gender differentiated trends/facts in Bhutan's labour market are:

- In the last 15 years, employment elasticity of growth declined. It was a period of jobless growth in Bhutan.
- Overall LFPR increased from 56.5% in 2001 to 68.5% in 2009 and declined consistently thereafter to 63.1% in 2015. Corresponding changes in female LFPR is sharper- it jumped from 38.1% in 2001 to 67.4% in 2011 and declined very sharply thereafter to 55.9% in 2015. Sharp fall in female LFPR is a natural outcome of improved access to education for females and greater opportunities to enter tertiary education. Strikingly in contrast to female LFPR, the male LFPR remained almost stable over this period.
- In 2015, only 23% of the total labour force in Bhutan was engaged in regularly paid jobs in the non-agriculture sector and female labour accounted only 27% of it. Female labour share was far more predominant (54%) in the employment as family workers and own account producers. This trend is indicative of the fact that female labour is largely engaged in low productive activities. However, the share of female in regularly paid jobs in non-agriculture sector has increased by 4 percentage points since 2000.
- The female unemployment rate has remained higher than the male unemployment rate. In the last 6 years female unemployment rate has fallen from 4.1% to 3.2% whereas male unemployment rate has remained unchanged at around 1.8%.
- The female labour force also experiences a higher incidence of underemployment. About 67% of the labour force in Bhutan, which works for less than 30 hours a week, is female. For higher working hours in a week, the share of male labour rises.

2. Objective

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This paper seeks to link two dominant issues, especially in context of Bhutan- the impact of increased export orientation on the intensity of female employment and underlying gender discriminated productivity differences. This paper aims to discern the heterogeneous patterns across industries in term of female employment intensity and productivity. Major research objectives are-

- i) Examine differences in the female employment intensity across industries
- ii) Determine major predictors of female employment intensity
- iii) Examine gender-based productivity differences in Bhutanese industries

3. Conceptual Framework

Female employment intensity of an export-oriented firm can be mainly explained by three factors- pattern of comparative cost advantages, level of competition in the industry and impact of foreign culture.

Notion, that a country specialises in and exports a product which intensively uses its abundant factor endowments, forms the analytical backbone of the Hecksher-Ohlin theory, in terms of the source of comparative advantage. Availability of cheap female labour in low and middle-income countries is the major source of comparative cost advantage for them. Unlimited supplies of cheap female labour offer an opportunity for unskilled labour-intensive industries to harness comparative advantages- almost in line with the Lewis model (Lewis, 1954). Low skill intensive export-oriented industries are more likely to have higher female employment intensity. A large volume of research indicates that export orientation of a firm tends to positively influence female employment intensity. Export oriented industries, such as readymade garments, tend to use abundant female labour. Since female labour embodies less skill, it is used intensively in the products that do not require higher skills (Bhalla & Kaur, 2011), (Fontana, 2009). In higher skill intensive service sectors, such as IT, female employment intensity is lower.

It is logical to assume that trade liberalisation offers greater scope for export promotion. Empirical studies highlight that the impact of trade liberalisation (hence export orientation), on female employment intensity is not uniform but firm specific. The trade liberalisation process that promotes unskilled labour-intensive activities and integrates domestic firms into the global value chains tends to have a more favourable effect on female employment intensity, while the growth of capital-intensive activity that uses new technology tends to work against female employment intensity (Banerjee & Veeramani, 2017). Higher female employment intensity is only one side of the picture of gender equity. It is important to note that trade also tends to exacerbate wage inequality by depressing the wages of less skilled female labourⁱⁱⁱ (Black & Brainerd, 2004), (Korinek, 2005).

The second factor that affects female employment intensity is the prevailing level of competition in that industry. Gary Becker's seminal work on the economics of discrimination used the argument rooted in the dynamics of competitive forces which tend to reduce discrimination in employment. He asserted that firms can continue with their "taste for discrimination" only at the expense of profit. Firms with greater monopoly power are more likely to practice employment-based discrimination (Becker, 1957). Export orientation exposes a firm to intensive competition in the foreign market and they respond by breaking away from traditionally held gender discriminatory practices. Emerging competition in the market forces the firms to jump over inherent gender biases in employment and replace expensive male labour with cheap female labour. Constructs of Business and entrepreneurship are firmly rooted in the profit orientation. Despite growing emphasis on emerging business terminology like Corporate Social Responsibility (CSR), green and social entrepreneurship, the profit orientation still remains the main driver of economic activities. Profit orientation of business is also socially beneficial as pointed out by Adam Smith (Hunt & Lautzenheiser, 2011) "In a competitive, laissez faire, capitalist economy, the free market channelled all self-seeking, acquisitive, profit oriented into a socially beneficial and harmonious, obvious and simple system of natural liberty". In the face of global efforts to bridge the gender gaps, the businesses have to take a lead role by creating more productive employment opportunities for female labour.

The third factor is the effect of foreign culture. Foreign firms bring not only foreign capital and foreign technology, but they also bring foreign culture. Foreign culture gets manifested in the ways management makes decisions, such as, decamping of prevalent gender biases in employment. Empirical evidence from Japan reflects that foreign firms tend to employ more female labour than their domestic counterparts and such changes become more pronounced after some years of their operation (Kodama et al., 2016). Even Gary Becker's analysis helps to fathom the impact of FDI on female employment. The impact of foreign firms on female employment will depend on how their entry affects the level of competition in the market. Entry of a foreign firm through merger and acquisition may lead to continuation of gender biases, while a Greenfield investment may positively stimulate female employment intensity (Buckley & Artisien, 1987).

Empirical evidence is divided over the impact of export orientation on female employment intensity. Empirical evidence drawn from (Cagatay & Berik, 1990), (Wood, 1991), (Joekes, 1995), (Korinek, 2005), (Chen et al., 2013), (Juhn et al., 2014), (United Nations, 2009), (Abraham & Sasikumar, 2011) suggest that share of female in employment rises with the rising share of exports. Export oriented manufacturing sectors in developing countries tends to have higher female intensity in employment than their counterparts in developed countries (United Nations, 1995) (Wood, 1991)^{iv}. Contrasting claims are made by other work (Gray et al., 2006), (Cooray et al., 2012), (Wamboye & Seguino, 2014), (Meyer, 2006) that share of female in the employment declines with rising export intensity. Differential gender discriminated labour market outcomes of rising export intensity can be explained by sector specific competitive forces, choice of technology and influence of foreign culture. Findings of these empirical works should be understood in the context of the inherent methodological framework applied.

Female labour being kept away from the capital-intensive processes and their limited access to productive resources explains gender-based productivity differences (Lichtenstein, 2016). Empiricists have paid relatively limited attention to the issue of gender differences in productivity and wages. Welfare gains arising from increasing female employment intensity in export-oriented sectors can be significantly diluted if gender productivity and wage gaps get accentuated in the process. Most of the empirical studies that have investigated this issue point towards a declining share of female in the wage bill despite rising female employment intensity. There are two possible explanations for such asymmetrical changes in the male-female wages.

One, horizontal discrimination- female labour is discriminated against and is paid less for a similar job as compared to their male counterpart. Horizontal discrimination is also defined as occupational gender wage gap. Since horizontal discrimination goes against the principle of same pay for same work, it is the worst form of gender discrimination.

The second source is vertical discrimination- female labour is more intensively employed in the low skill-low paid jobs and male labour is more intensively employed in high skilled-high wage jobs. Evidence from the readymade garment (RMG) industry in Bangladesh reflects that productivity and resultant gender wage disparities is not due to horizontal discrimination (gender discrimination, per se), but, due to greater concentration of female labour in low skill jobs (Bhattacharya & Rahman, 1999). Some empirical work indicates that women are concentrated in unstable and low paid manufacturing jobs (Barrientos, 2001) and women engaged in export-oriented sectors lack features to achieve wage equity (Seguino & Grown, 2006). Productivity growth of female labour can help to bridge gender wage gaps but firms will have little incentives to do so.

A similar issue was raised by (Kucera, 2001) that gender wage disparity is highly concentrated in the industries with dominant vertical FDI. A very comprehensive study based on cross-country data drawn from wage surveys found that trade liberalisation in low-income countries has contrasting effects- significant narrowing down of occupational gender wage gaps in low skills occupations, at one hand, and, at another, widening of gender wage gaps in high skills occupations (Oostendorp, 2004). On similar lines (Gupta, 2002) found that the gender wage gap tends to rise with industrialisation and emergence of the market.

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A large number of these studies are based on two types of data: first, macro level cross sectional multi country data and micro level firm specific data drawn from a given country. A major limitation of the macro level data, which is drawn from household surveys, is its implicit assumption of homogeneity among firms. Homogeneity assumption fails to capture firm specific differences, such as, pattern of comparative advantages, level of competition faced, impact of foreign culture, age and size of the firm and ownership pattern that play a dominant role in creating employment for women. This study is based on micro level single period, firm specific data from a wide array of Bhutanese industries.

4. Data and Model

This study is based on cross-sectional data covering 164 large, medium and small-scale Bhutanese manufacturing firms. The data was obtained through a questionnaire based random stratified sample survey undertaken between December 2018 and February 2019. List of registered industrial units in Bhutan as on June 1, 2017 provided by the Department of trade, Ministry of Economic Affairs, Royal Government of Bhutan, served as the sample frame. Stratification based on the scale of industries and share large, medium and small units in total units was used as weight. Industrial units are classified on the basis of ISIC two-digit classification for manufacturing firms. For the purpose of this study, firms are clubbed into following groups:

- Group 1 (ISIC code 16): Manufacture of wood and wood-based products and furniture
- Group 2 (ISIC code 23, 24 and 25): Manufacture of chemical, metal and non-metallic products
- Group 3 (ISIC code 19): Manufacture of coke and refined petroleum products
- Group 4 (ISIC code 10, 11 and 12): Manufacture of food, beverages and tobacco products
- Group 5 (ISIC code 13 and 14): Manufacturing of textile, apparel and related products
- Group 6 (ISIC code 17): Manufacturing of paper and paper products
- Group 7: Other manufacturing

Table 1 shows the sample distribution across industrial groups.

Table 1. Samples Size

Name of the Industrial Group	Sample Size	Share in Sample (in %)
Wood and wood-based products and furniture	20	12.2
Chemical, metal and non-metallic products	64	39
Coke and refined petroleum products	8	4.9
Food, beverages and tobacco products	40	24.4
Textile, apparel and related products	4	2.4
Paper and paper products	4	2.4
Others	24	14.6
Total	164	

4.1. Predictors of female employment intensity

A Multiple linear OLS regression model is used to determine the predictors of female employment intensity. It is termed as regression model 1 and is specified as-

$$FEI = \beta_1 + \beta_2 EI + \beta_3 TC + \beta_4 FDI + \beta_5 age + \alpha_1 D1 + \alpha_2 D2 + u$$

Dependent variable: *Female employment intensity* (FEI) enters as the dependent variable in the regression model. Female employment intensity is defined as the ratio of female labour (FL) to the total labour (TL) employed in the firm. $FEI = \frac{FL}{TL}$

Independent variables: The independent variables chosen for this regression model are based on the inferences drawn from the survey of empirical works. The independent variables and their expected effect on FEI –

- a) *Technological coefficient* (TC) reflects the technological choices made by the firm's gender distinguished labour hiring behaviour. Technological coefficient is measured as a ratio of labour to the current value of fixed capital installed.

$$TC = \frac{L}{K}$$

In this study, technological coefficient (L/K) is used as an indicator of technology. Higher L/K ratio means relatively higher labour-intensive technology and vice versa. It is expected that a firm using more labour-intensive technology is more likely to employ female labour.

- b) *Export Intensity* (EI): Export intensity is defined as the ratio of exports to turnover.

$$EI = \frac{Ex}{TO}$$

, where Ex means value of exports and TO stands for turnover.

If $EI > 0.5$, the firm is defined as an export-oriented unit, and if $EI < 0.5$, the firm is defined as a domestic market-oriented firm.

Higher export intensity reflects greater competitiveness of the firm. Since export-oriented units are more competitive, it is expected that they would not have taste for discrimination.

- c) *Share of FDI in fixed investment* (FDI): FDI tends to bring a new culture which helps to overcome gender biases and allows domestic subsidiaries to hire more female labour. FDI share is defined as the share of foreign capital (K_f) in total fixed investment (K_t). $FDI = \frac{K_f}{K_t}$

- d) *Age of the firm* (age): empirical findings discussed in previous sections indicate that older firms tend to hire more female labour than the newer firms.

- e) *Dummy for ownership* (D1): State owned firms tend to practice less gender discrimination than the privately owned firms because they are willing to compromise productivity gains at the expense of social gains.

- f) *Dummy for female CEO* (D2): Empirical evidence also suggests that a female chief executive officer (CEO) of any firm may help to overcome gender biases in employment.

4.2. Gender distinguished productivity differences

Cobb Douglas production function is used to discern gender-based productivity differences in employment, which is termed as regression model 2. In the absence of data on gender discriminated wages bills, gender wage gaps cannot be established. Data on the productivity of female and male labour can be used as a proxy for wage gaps. Productivity of female and male labour is measured using modified Cobb-Douglas production function (CDPF) - $Y = A Lm^\alpha Lf^\beta KS^\gamma e^u$

Where Y= value of the firm's annual output. A, Lm, Lf, KS are total factor productivity, number male labour employees, number of female employees and stock of fixed capital respectively. Whereas α , β and γ are partial elasticity coefficients for male labour, female labour respectively. It is assumed that the sum of these coefficients should be positive. The regression function takes the form of a double log model for estimating parameters of CDPF. For this, logarithmic transformation of both the dependent and independent variables is undertaken. The regression model 2 is constructed as – $\ln Y = \ln A + \alpha \ln LM + \beta \ln Lf + \gamma \ln KS + u$

This model is also used for a case wise analysis, to distinguish between the estimates for cases of export-oriented units and domestic market-oriented firms.

The model is run twice, once with selecting cases where $EI > 0.5$ and next with cases with $EI < 0.5$. Case wise diagnosis helps in distinguishing the productivity differences in the two sectors.

5. Discussion on Findings

Gender distinguished published baseline data on manufacturing employment in Bhutan is very limited. Labour force surveys and establishment census /surveys are two major sources of such data. The number of manufacturing units in Bhutan expanded from 390 in 2009 to 457 in 2016 (RGoB, 2016) (RGoB, 2009), compounding at a rate of 2.3%^v. During the same period, gross value added of the manufacturing sector compounded at 6.2% (RGoB, 2017). Total employment in the manufacturing

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sector declined from 3700 in 2009 to 3659 in 2016^{vi}. It is quite obvious that growth in the manufacturing sector between 2009 and 2016 can be characterised as a period of jobless growth. Decline in total employment in the manufacturing sector hides highly contrasting gender distinguished outcomes. At one hand, male employment compounded at an annual rate of 6.8%, growing from 1700 in 2009 to 2694 in 2016. During this period female employment declined from 2000 in 2009 to 785 in 2016. The female employment intensity has declined by a half from 54% in 2009 to 22% in 2016. Steep decline in the absolute number of female-employment in the manufacturing sector in Bhutan is an indicator of changing dynamics of the economy, which provides limited incentives to hire female labour. In the absence of disaggregated data nothing more can be analysed. There exists a data gap which prevents us from undertaking a deeper analysis of the problem. This study helps to bridge some of these gaps.

A quick analysis of table 2 reflects that overall FEI in the manufacturing industries of Bhutan is 0.28- only 28% of the employees are female. Within the manufacturing sector, the FEI varies significantly across sub sectors, from a high of 56.3% in group 6 to a low of 13.4% in group 2. (Refer table 2). As identified in the literature review section manufacturing group specific characteristics play an important role in explaining the group-based differences in FEI.

Table 2. *Values across Industrial Groups*

Name of the Industrial Group	L/K Ratio	FEI (in %)	Export intensity (in %)	FDI share (in %)
Wood, Wood Based Products and Furniture	.00000169	25.6	26.2	0
Chemical, Metal and Non-Metallic Products	.00000042	16.8	67.4	8.8
Coke and Refined Petroleum products	.00000014	13.4	20.2	0
Food Beverages and Tobacco Products	.00000389	46.3	25.2	11.9
Textile, Apparels and Related Products	.00000375	53.3	26	0
Paper and Paper Products	.00000235	56.3	40	0
Others	.00000251	25.4	50.8	60
Total	.00000184	28	45.7	15.1

Source: Researcher's Survey

The FEI in the export-oriented industries is 0.25, while that in domestic market-oriented firms is 0.31. Although overall FEI is negatively associated with the export orientations of the firms, sector specific exceptions can be observed- from lower EI and lower FEI in group 3 to higher EI and higher FEI in group 6. Group 2 has the highest export intensity but second lowest FEI. Group 4 and 5 reflects lower export intensity but relatively high FEI. What explains these diverse trends? The answer probably lies in a complex and combined impact of technological choices and FDI share, besides other factors. Group 2 largely consists of the natural resource-based power intensive industrial units in Bhutan. Lower power tariff in Bhutan in relation to India is the major source of comparative cost advantage to the manufacturing industries in group 2, mainly consisting of the Ferro-alloys industry which has vertical linkages with the steel industry in India. In this case, Bhutanese exports from this sector does not compete with the cheap labour-intensive products, hence these firms have limited incentive to hire cheaper female labour. Technology used in group 2 is also relatively more capital intensive in nature (as reflected by a lower L/K ratio). The L/K ratio in group 2 is almost 9 times lower than that in group 4. Besides, activities in this group require strong manual labour, for which female labour is not considered suitable.

Significant rise in the share of group 2 industries in total exports from Bhutan from 24% in 2008 (RGoB, 2009) to 53% in 2016 (RGoB, 2017) explains the steep decline in female employment in the manufacturing sector. It represents a shift of manufacturing activities from high FEI activities to low FEI activities. A large part of the FDI has also gone to group 2, mainly sourced from India, also explains why the desired effect of the FDI on FEI has not taken place.

Exports from group 4 compete with labour intensive products in the export market, mainly India. In this case, firms aim to maintain comparative advantage by hiring cheaper female labour.

In section 3, it was pointed out that FDI brings a new culture that helps to overcome gender barriers and discrimination in business. However, initial evidence emanating from this study does not support this proposition. Female employment intensity in FDI based industries in Bhutan is not very much different from domestically owned firms. FEI in domestically owned firms is 27%, while that for the FDI based firms is 32.4%, which seems to support the hypothesis that FDI based industry bring a new culture of a less gender bias. FEI in the state-owned enterprises is 37% as compared to 27% in privately owned firms. This reflects state owned firms that tend to create more opportunities for female employment.

5.1. Predictors of Female Employment Intensity

SPSS output of regression model 1(Refer table 3) reflects that model is a good fit model ($P < 0.05$, $F = 14.02$) and it explains almost 49% of the variation in the FEI. Multicollinearity and heteroscedasticity problems are not observed in the data. All the predictors are found to be statistically significant, however the age of the firm has a minuscule impact on female employment intensity. Technological choice (TC) measured in terms of labour to capital ratio is found to be the most effective predictor of FEI. Its unstandardized beta coefficient suggests that 1% increase in labour to capital ratio causes female employment intensity to rise by 23033 percent. This implies that application of labour-intensive technologies would generate more employment opportunities for female labour.

Regression findings also convey that there exists a trade-off between export intensity and FEI. Regression estimates suggest that 1% increase in the exports intensity of a firm causes FEI to fall by 0.09 percent. Rising export intensity will marginally reduce FEI in manufacturing industries. Group 2 industries have the highest export intensity in Bhutan largely because of the power intensive nature of technology. Since Bhutan has substantial cost advantage in terms of cost of electricity over India and other South Asian Countries, It is the main source of comparative cost advantage to Group 2 industries.

The FDI based industries tend to positively influence the FEI. One percent change in FDI inflows will cause FEI to rise by 0.282% percent. Foreign firms tend to favour more females in jobs. Findings also reflect that age of the firms also positively affects FEI, albeit by a small magnitude. It is probably because the older firms in Bhutan do not draw the comparative cost advantage from the cheap electricity but from cutting down costs. In this case, they prefer more labour-intensive techniques and cut costs by hiring cheaper female labour. This finding is significant to understand that trade-off between exports and FEI can be addressed by shifting to non-power intensive industries which will work under competitive pressure to cut down other costs.

FEI in publicly owned enterprises is 0.109 points higher than in privately owned enterprises. Female headed firms tend to promote FEI as reflected by differential intercept coefficient for D2. FEI in Female headed firms is 0.149 points higher than male headed firms. Promotion of women enterprises will also promote the cause of gender parity in employment.

Table 3. SPSS output of the regression model 1

Dependent variable: female employment intensity (FEI)	
Independent variables	Coefficients
EI	-0.091 (0.043)**
TC	23033 (3191.5)***
age	0.007 (0.01)***

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FDI	0.282 (0.057)***
D1	0.109 (0.049)**
D2	0.149 (0.047)***
Constant	0.099 (0.045)*
Adjusted R squared	0.494***

Standards errors are in parenthesis. Significance is denoted by *** (1%), ** (5%) and * (10%).

The FEI can be predicted using the derived function

$$FEI = 0.099 + 23033 TC - 0.091EI + 0.007age + 0.282 FDI + 0.109 D1 + 0.149D2$$

A low FEI by itself does not mean that females are engaged in low paid jobs. It only means that females get fewer jobs. To explore whether fewer jobs translate into low wages, the gender-based productivity differences of labour need to be analysed.

5.2. Gender Distinguished Productivity Differences

This analysis helps us to get the complete picture of the nature of female employment in terms of gender-based productivity differences. After having established that FEI is low in Bhutan, we investigate whether there exist any gender distinguished productivity differences in Bhutanese industries, as well as, to examine whether export intensity tends to affect gender distinguished productivity. Cobb Douglas production function is applied to answer these questions.

This model is found to be a good fit model (refer table 4), where $P < 0.001$, $F = 48.1$, adjusted R square is 0.671- 67% of the variation in the output is explained by changes in all the quantities of male labour, female labour and capital stock. Total factor productivity (TFP) is found to be 1101.32. Partial output elasticity coefficient of female labour (β) is 0.049, and that for male labour (α) is 0.772, while and that for capital stock (γ) is 0.448. It has a significant implication- females contribute very less to output- 1% increase in female employment causes output to rise only by 0.049%. This is largely due to the concentration of women in low skill jobs and also a very low share of females in technical and top managerial positions. On the contrary, 1% rise in the male employment causes output to rise by 0.772%, while 1% increase in the stock of capital causes output to rise by 0.448%. The sum of three elasticities is 1.27, which means that the given production function is subject to increasing returns to scale. Applicable Cobb-Douglas production function can be written as-

$$Y = 1101.3 Lf^{0.049} LM^{0.772} KS^{0.448}$$

A very low partial elasticity coefficient tends to reflect very marginal contribution of the female labour to the output. In this low female productivity scenario, it is realistic to expect that there might exist large gender wage gaps in the manufacturing sector in Bhutan. These wage gaps may not reflect absence of horizontal equity (they must be paid the same for the same job) but higher concentration of men at more productive jobs means higher wages to men as compared to women. Based on the calculated partial coefficients, it can be inferred that gender wage gaps are very high in the manufacturing sector in Bhutan.

Table 4. SPSS output of the regression model 2

Cobb Douglas production function	
Dependent variable: $\ln Y$, Given $EI \leq 0.5$	
Constant (TFP)	7.005 (2.303)***
$\ln Lf$	0.049 (0.132)*
$\ln Lm$	0.772 (0.23)***
$\ln KS$	0.448 (0.15)***
Adjusted R squared	0.671***
F static	48.1

Standard errors are in parenthesis. Significance is denoted by *** (1%), ** (5%) and * (10%).

5.3. Case wise diagnostics

The findings (refer table 5) reflect that for the export-oriented units (EI>0.5) regression model is statistically significant at 95% (p<0.001). Adjusted R squared value suggests that independent variables in the model accounts for 67% of variance in turnover of the firm. TFP for this case is 3905.5, partial output elasticity coefficient of male labour (α) is 0.896, that for female labour (β) is converted as 0.078, and for capital stock the coefficient (γ) is 0.363. Since the $\alpha + \beta + \gamma > 1$, there are increasing returns to scale. Applicable Cobb-Douglas production function for the export-oriented firms can be written as-

$$Y = 3905 Lf^{0.078} Lm^{0.896} KS^{0.363}$$

For the domestic market-oriented units (EI<0.5) regression model is statistically significant at 95% (p<0.001). Adjusted R squared for the export-oriented units is 0.621, which means the model accounts for 62.1% of variance in turnover of the firm. TFP for this case is 1235.5 and partial elasticity coefficient of male labour (α) to the total turnover is 0.696 and that for female labour (β) is 0.048, and for capital stock the coefficient (γ) is 0.453. Since the $\alpha + \beta + \gamma > 1$, there are increasing returns to scale. Applicable Cobb-Douglas production function for the domestic market-oriented firms can be written:

$$Y = 3905.5 Lm^{0.896} Lf^{0.078} KS^{0.363}$$

Table 5. SPSS output for case wise regression

Cobb Douglas production function Dependent variable: ln Y, given EI >0.5		
	Case EI <0.5 (domestic market oriented firms)	Case EI >0.5 (export oriented firms)
Constant (TFP)	7.12 (2.941)***	8.271 (4.881)***
ln Lf	0.048 (0.203)	0.078 (0.197)*
ln Lm	0.696(0.327)***	0.896 (0.404)**
ln KS	0.453(0.091)***	0.363(0.184)***
Adjusted R squared	0.621***	0.607***

Standards errors are in parenthesis. Significance is denoted by *** (1%), ** (5%) and * (10%).

Case wise diagnostics reflect that export-oriented firms are more productive than domestic market-oriented firms. The partial elasticity coefficient of the female labour in the export-oriented firms is 0.079 as compared to 0.048 for the domestic market-oriented firms. Although the productivity of female labour remains far below male labour in all the manufacturing units, the gap is reduced, albeit marginally, in the export-oriented units. In export-oriented units, female labour productivity gains exceed that of male labour. Partial elasticity coefficients for male and female labour are higher in export-oriented units as compared to domestic market-oriented firms. Despite lower female employment intensity, the export orientation among the Bhutanese firms tends to work only marginally in raising female productivity.

6. Conclusion

Export orientation of the Bhutanese manufacturing sector is based on reaping comparative cost advantage derived from cheaper power. The power intensive industries depend less upon cheap labour and consequently most of the jobs in this sector bypass female labour. Female employment intensity in the manufacturing sector in Bhutan varies in a wide band of 13-56%. Size of exports, technological choices, and their market orientation, existence of foreign capital and age of the firm are found to be significant firm specific determinants of the FEI. Productivity coefficients of male and female labour derived from the Cobb Douglas production function reflects that the productivity of female labour is very low, both absolutely, and also in relation to male labour. Female productivity, although remains lower than male, rises marginally in the export-oriented units. The findings strongly indicate that the issue of gender bias in the manufacturing sector cannot be left to the forces of the market.

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End Notes

ⁱ Amartya Sen made a very forceful argument on the centuries of neglect and discrimination has led to more than 100 million women are missing from the population. He used country specific male female ratio to estimate poetical loss of women in the population.

ⁱⁱ Static gains, also known as allocative efficiency gains, are obtained through increased specialisation and consequent transfer of resources to more productive activities. According to the World Trade Report 2017, static efficiency gains itself are very large- almost 30% of GDP under autarchy.

ⁱⁱⁱ Female labour is usually less skilled, due to large gaps in literacy rates, greater hurdles in accessing higher and technical education and limited working experience. Despite significant as well as universal progress in recent times, female labour still lags behind male labour in developing world.

^{iv} Empirical evidence suggests that that women constitute a high proportion of the labour force in some conspicuous parts of developing-country export-oriented manufacturing (clothing and electronic products, and export processing zones). In developed countries, women are over represented in the sectors on which manufactured imports have been concentrated, and under-represented in the manufacturing sectors which export to developing countries (Wood, 1991).

^v According to the Establishment Survey report 2016, about 85% of the total manufacturing units were small scale units, while only 5% of these units were large scale units and the rest were medium scale units. Size of employment size and fixed investment is used as a criteria to classify these units, as shown in the table below (RGoB, 2016).

Size of unit	Employment size (in number)	Fixed Investment (in BTN million)
Small	5-19	1-10
Medium	20-99	10-100
Large	100+	100+

^{vi} The data collected from the researcher's survey reflects that there were 6069 employees in 41 industrial units, of which 1768 were female.

EVOLVING HEALTH, EDUCATIONAL AND SOCIAL NEEDS OF CHILDREN WITH TYPE 1 DIABETES IN GEORGIA: A COMPARATIVE STUDY 2023–2025

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Abstract: *Type 1 Diabetes (T1D) in children poses complicated medical, psychological, and educational challenges, especially in countries where development is limited. In Georgia, data do not cover the evolving needs of children with diabetes and their families. This research compares 2023 and 2025 data in identifying successes and challenges in diabetes care in children. A quantitative cross-sectional survey was performed with 177 parents and caregivers of children with T1D using a structured online and telephone interview questionnaire. The new survey was a modified version of the 2023 survey with additional questions about access to diabetes technology, education, and psychosocial support. Descriptive and comparative analyses were performed using SPSS version 29.0 and results were interpreted on the population basis. Access to continuous glucose monitoring (CGM) increased from 38% to 61%, and parental participation in diabetes education programs increased from 42% to 68% between 2023 and 2025. Awareness of psychosocial support services increased by 29%, and reported barriers to insulin affordability decreased by 18%. Although this trend changed dramatically, 32% of families - especially in rural areas - still had trouble accessing consistent endocrinology care, and 40% did not have appropriate school-based diabetes management support. The present study addresses a lack of understanding on the challenge in diabetes care post transition in Eastern European health systems with the continued technological development and its correlation with socioeconomic and regional differences. It offers quantitative information of improved access, awareness and highlights systemic gaps of educational and psychosocial care. These results underscore the requirement for integrated, multidisciplinary diabetes care models that integrate medical, family, and school support. Such findings may inform ongoing policy and healthcare efforts to shape equitable treatment to better pediatric diabetes in Georgia and comparable developing countries.*

Keywords: *Challenges related with T1D, pediatric diabetes, T1D management, caregiver perspectives about T1D, psychosocial support for T1D.*

Introduction

Type 1 Diabetes (T1D) is an autoimmune condition characterized by pancreatic β -cell destruction, leading to absolute insulin deficiency. According to the International Diabetes Federation (IDF) Diabetes Atlas 11th edition (2025), an estimated 1.8 million children and adolescents under 20 years are living with type 1 diabetes worldwide. (IDF Diabetes Atlas 2025).

Management of the disease requires lifelong insulin administration, continuous glucose monitoring, and comprehensive education on self-management. However, despite technological advances in insulin delivery systems and digital health tools, substantial disparities persist between high- and low-income countries, particularly in pediatric populations (Saiyed et al., 2021).

Children with T1D face multifaceted challenges that span medical, psychological, educational, and social domains. Studies show that medical management complexities (such as fluctuating insulin needs, hypoglycemia, and delayed diagnosis) are compounded by psychological burdens, including stress, anxiety, and parental burnout (Baş & Dönmez, 2025); (Br & Raman, 2019). Educational barriers further intensify these difficulties - many children and parents lack structured training on insulin adjustment and dietary management (Marklund et al., 2022). In developing nations, the economic burden of insulin and glucose testing often consumes a significant portion of household income, making effective disease control challenging (Raha et al., 2009).

From a health economics perspective, T1D remains one of the costliest chronic diseases to manage, both directly through insulin and devices and indirectly through lost productivity and complications (Quattrin et al., 2023). Although technologies such as insulin pumps and continuous glucose monitoring have been shown to be cost-effective in the long term, their uptake in low- and middle-income countries remains minimal due to limited infrastructure, affordability, and awareness. These disparities highlight a pressing need for health system reforms that ensure equitable access to pediatric diabetes care.

Research Problem Statement: There is still a regional variation of diabetes care for children in Georgia, despite advances in technology, representing unequal patient access to endocrinology, poor diabetes literacy in schools and the economic realities of lack of access to insulin in the region. Closing these disparities calls for an understanding of the changing medical, educational, and social challenges of this population.

This study aims to:

1. Evaluate changes in the access to diabetes technology, education, and psychosocial support for children with T1D between 2023 and 2025.
2. Assess caregiver knowledge and healthcare systems responsiveness in the management of patients with pediatric diabetes.
3. Explore persistent barriers to equitable diabetes care in Georgia.

Research Methodology

This study developed a quantitative research design using a structured questionnaire survey for the assessment of the changing health, educational, and social needs of children with Type 1 Diabetes (T1D) in Georgia. The community was parents and relatives of children diagnosed with T1D. A total of 177 valid responses were collected and analyzed. The instrument, adapted from the 2023 baseline study which was developed after focus group interviews and in-depth interviews of parents and health care professionals, has contained relevant information from the survey.

In the current study, in 2025, several new items were applied, specifically, to assess changes in access to diabetes technology, psychosocial support, and knowledge awareness of how to become educated about diabetes. Initially, the questionnaire was piloted with five participants, and modified accordingly, to clarify its purpose and contextual relevance.

Convenience sampling technique was adopted owing to the lack of a national database of children with T1D and practical challenges in reaching a medically-related population. This approach enabled efficient recruitment based on well-established community networks, including Internet parent forums and telephone outreach. Although convenience sampling methods allow for access to a spectrum of subjects, within little time and resources, it also could include selection bias, impeding generalizability of the results. However, to alleviate some limitation of the sample, recruitment was conducted across multiple geographic areas and social groups from which a broad selection of samples was generated to help to reduce limitation in generalizability of the findings.

Two main data collection methods were deployed:

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1. Surveys via Google Forms through closed Facebook groups and targeted email lists of parents of children with diabetes.
2. Telephone-assisted interviews, performed by trained interviewers who filled in responses for those who could not participate in the online form.

All participants also provided informed consent prior to data collection and participation was voluntary. Analyses were performed with SPSS version 29.0. The analysis used descriptive statistics (frequencies, percentages, means) for summarizing responses.

A comparative trend analysis was used to understand differences between both cohorts including in technology adoption, access to healthcare, and parental awareness. As there were no cohort or similar individual observations across the datasets, findings were only interpreted at the population rather than using analysis of inferential data.

A convenience sampling scheme was also utilized, as there was no national registry of T1D children and restricted clinical populations. Though this restricts the statistical generalizability of results, this approach allowed us to reach a typically hard-to-reach group via targeted Facebook communities and snowball sampling. Moreover, self-reported data create the possibility of recall and response bias. Regardless of these limitations, replication of the 2023 instrument and multiple data collection modes strengthen the robustness of trend-based conclusions on pediatric diabetes care in Georgia.

Research Findings

Quantitative research involved 177 parents or guardians - 86% mothers of children with diabetes, 6% fathers, and 8% other close family members of the children. Almost equally distributed among the children whose parents or relatives took the questionnaire was the gender composition: 51% were male and 49% were female. As such, it is important to note that 90% of interviewees were people participating in the survey for the first time, while 10% had previously participated in earlier research.

In addition, as to the respondents' place of residence: 25% live in Tbilisi, 18% in the Adjara region, 14% in Imereti, 14% in Shida Kartli, 10% in Samegrelo, etc. Data on household income and employment were considered important in accordance with the objectives of the study. For example, 8% of respondents (14 families) earned less than 500 GEL per month, 24% (43 families) were earning 501–1000 GEL, 31% had an income between 1001 and 1500 GEL, 15% were in 1500–3000 GEL, and 11% had an income above 3000 GEL (Diagrams #1 & #2).



Diagram 1. *Monthly salary distribution*

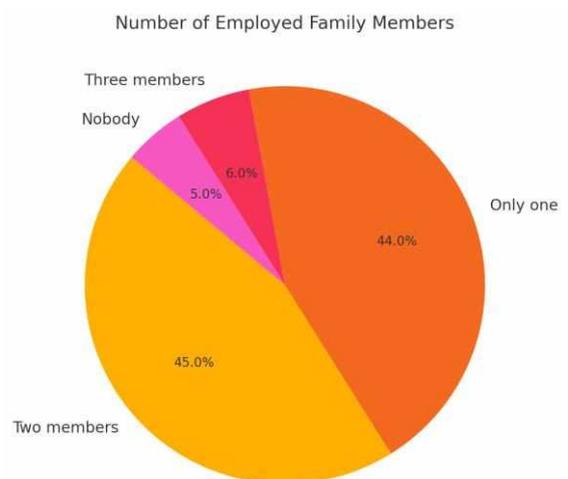


Diagram 2. *Number of employed family members*

In the qualitative portion of the 2023 survey, parents noted the importance of effective communication during focus group discussions, pointing out past failures in this regard. Therefore, this also comes up in the quantitative analysis. In the subsequent questionnaire, individuals were asked to evaluate their experience receiving information following a diagnosis of diabetes. In the demographic of the respondents, 72% (125 people) selected “The doctor had given the information clearly,” 17% (30 people) the one that “The information regarding diabetes management was unclear to me,” and 11% chose “Other.” (Diagram #3).

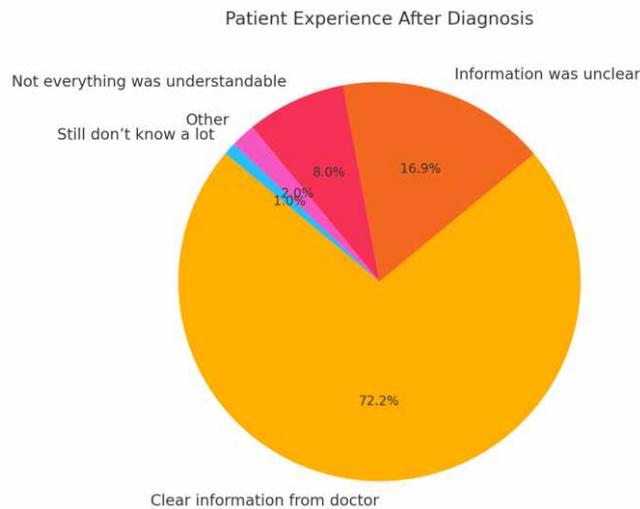


Diagram 3. Evaluation of after diagnosis experience

During the qualitative phase of the study, focus group discussions identified several notable critiques and some key negative experiences associated with the Diabetes School in 2023. Therefore, in the quantitative phase, participants rated the courses they had attended at the Diabetes School. The topic was investigated in the 2025 study as well. In the study, it was reported that 23.6% of the respondents (41 people) said that the course was “very informative,” while 47.1% said it was “informative.” At the end 23% were neutral, 4% (7 individuals) found it to be “not informative at all” and 2.3% did not. In comparison, the 2023 research showed distribution as follows for the same question: 26% (40 subjects) considered it to be “very informative,” 28% (40 participants) considered it to be “informative,” 26% (40 individuals) considered as neutral, 12% (18 subjects) thought it was “not informative at all” and 7% as “not informative.” Diagram #4.

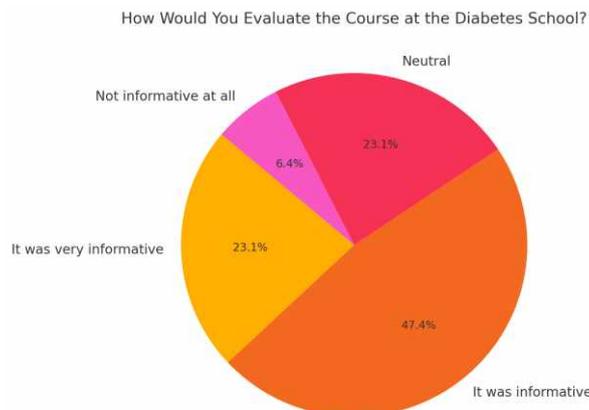


Diagram 4. Evaluation of the course completed at the Diabetes School (2025)

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Furthermore, parents in the 2023 Focus Group commented on the challenges related with clear communication from the healthcare provider. The 2025 study also investigated this concern. In response to the question - “Do you think medical staff give you enough information about the management of Type 1 diabetes?” - 26% (46 survey respondents) fully agreed, 53% (93 surveyed respondents) agreed, 18% were neutral, 2% disagreed and 2 completely disagreed (Diagram #5)

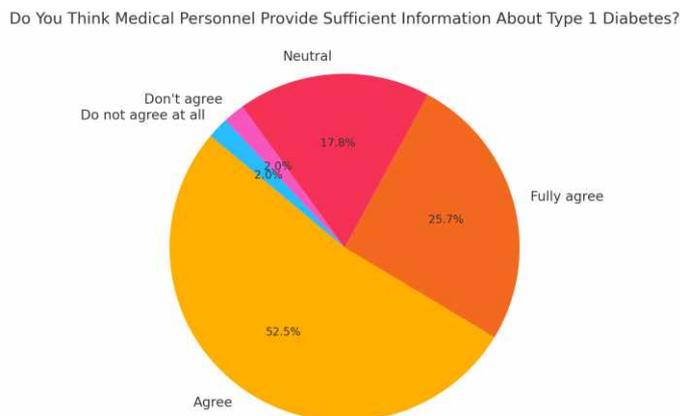


Diagram 5. *Do you believe that medical staff provide sufficient information about the management of Type 1 diabetes?*

The 2023 study, via all three focus groups, did find that the current method of scheduled (routine) check-ups, which included hospitalization of the child, was viewed as problematic. That prompted an open-ended question in the questionnaire: “What changes would you like to see made in the conduct of scheduled check-ups?” This question also appeared in the 2025 survey. The most widely reported response, among 93 answers, was that the majority of patients would prefer the examinations to be performed as outpatient assessments, rather than the need for a hospital stay, which increases the strain on the children and the requirement of bringing them to work or travel to Tbilisi. The results from the interviews also noted that these tests should be available anywhere, focusing on regional access to eliminate the need to travel to Tbilisi for these types of checkups.

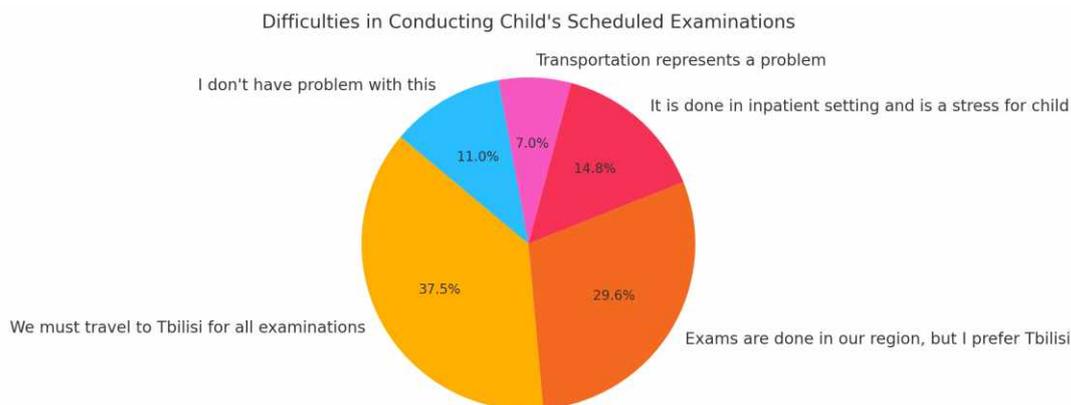


Diagram 6. *Difficulties in conducting child’s scheduled examinations*

In addition, respondents indicated that psychologist consultations should be made and that funded diagnostic services should be expanded. Because the qualitative phase of the previous study had focused on scheduled examinations, another inquiry presented, was: “If the

scheduled check-ups of your child are difficult for you to perform, please select your response or comment.” According to the results - 22% of respondents answered the question: “I must take my child to Tbilisi; these tests are not available in our district”; 26% said: “They are done on an inpatient basis, and this is very stressful and I would like it to be done outpatient”; 15% noted scheduled tests within the district, which they still choose to take their child to Tbilisi but 12% answered: “Transportation is an issue.”

In the present case there is a stronger need to separately analyze Tbilisi parents' and other regions', parents' responses. When looking at the question from this point of view, it is clear that close to half of parents living in the regions were willing to choose the answer, "I have to bring my child to Tbilisi. These tests are not carried out in our district" -which means one can see that this is such an issue. (Diagram #6).

The diagram bellow illustrates how parents and guardians assess their awareness of diabetes control. 43% of those surveyed said, “I need to know more,” whereas 28% said, “It would be desirable to have more information.” 23% felt they had enough knowledge in place, and 6% told us they had questions without a quick answer.

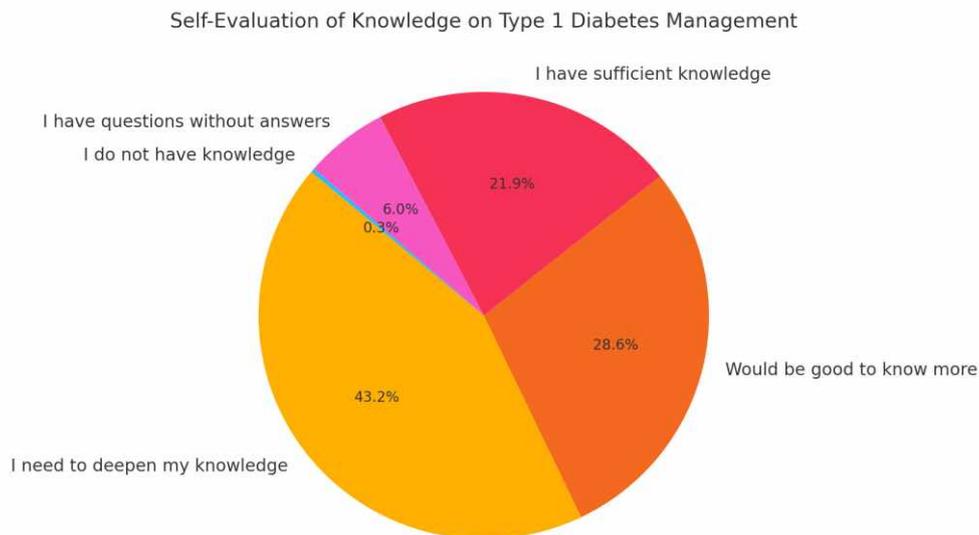


Diagram 7. *How would you assess your knowledge regarding diabetes management?*

A second question, recognizing the importance of educating parents, was “In your opinion, how necessary is it to make diabetes school more accessible to parents?” In most responses about it - 95.4% said that is necessary, with 4.6% answering "I don't know." A separate, similar question asked respondents' preferences with regard to frequency, timing and format of diabetes school.

Generally, the majority of respondents voted for the school to be held twice yearly. A lot of parents preferred the question-and-answer format, so they could ask as many questions as they possibly could, which is especially handy in hearing the latest news. Some also supported placing the diabetes school online.

Parents and guardians surveyed were asked to rate their own skills in managing their child's diabetes on a five-point scale. Thus, 62.3% (109 persons) rated their management skills at 4 out of 5, 17.7% rated themselves at 3, and only 18.3% rated themselves at a maximum of 5. Three respondents scored themselves just a 2 or one point on their ability.

The item of the survey examined the needs of children with diabetes within the school. Participants selected different responses. A significant 82% of respondents feel “teacher education is needed and that the teaching of a child can address this” with regards to diabetes;

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51% feel with “The school doctor should be more involved”; 55% have “School nurses must be trained and active”; 68% agree that “Classmates should be informed about diabetes and ways to offer support”; 15% of participants believe that one child with diabetes needs to have an assistant at school. Interestingly, an additional 19% of participants in the 2025 survey ask for professional development and information from teachers, and 23% think that students need to know about it. Plus, 21% less than in 2023 say that a personal assistant is required.

In terms of the need for kindergartens for the children with diabetes, 20 percent indicated that "the child needs an assistant in kindergarten" and 73.3 percent declared that "We should prepare teachers on diabetes aspects." Moreover, 21.3% expressed the need to select "Other." By 2025, respondents who considered teacher training and awareness important had risen by 35% and those who believed a personal assistant was crucial for the child had declined by 26% in contrast to the 2023 data.

Researchers have brought up in the qualitative part of the 2023 study that psychologists’ participation represented an issue and necessity. This question arose in following-up study. For the necessity of psychologist involvement, a five-point rating was given by 63.2% (110 people), followed by four by 27%, three by 8%, two by 0.6%, one by two or other people. As for the importance of a nutritionist or dietitian helping with dealing with a child's diabetes, 82% of respondents in the survey graded it as highly (five point) important; 13% rated it with 4 points, 4 percent three points, among other scores. (80% of respondents rated it as a five-point, 12% rated four-point, and 5% rated the need three-point, etc.). On this point, both years’ surveys yield findings that are almost the same. As a result, the majority of respondents see the involvement of both a psychologist and a nutritionist/dietitian as key to controlling a child's diabetes.

In the 2023 trial, participants noted key problems with the state-funded continuous glucose monitoring (CGM) devices. As such, this concern was included within an issue-led research tool and a follow-up question is mentioned: “Do you use the CGM device (continuous glucose monitoring system) (Medtronic) provided by the diabetes program?” From the 2025 survey, 81 percent used Medtronic, 3 per cent did not use it, 7 per cent could not use it and 9 per cent had a different CGM system. In 2023, 48% reported using Medtronic, 17% told us they don’t use it, 15% would say they “can’t use it” and 20% use one of them. (Diagram #8.)

Use of CGM Device Provided by Diabetes Program (Medtronic)

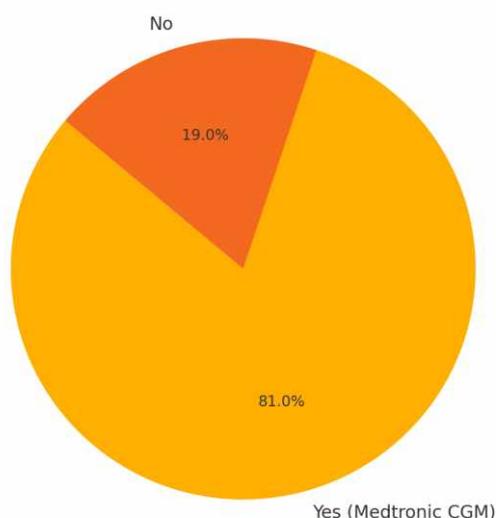


Diagram 8. *Do you use the CGM device (continuous glucose monitoring system) (Medtronic) provided by the diabetes program?*

An alternate question was about these devices: “If you use the CGM devices provided by the diabetes program, how satisfied are you? “14% are very satisfied, 54% are satisfied, 27% are neutral, 4% are dissatisfied and 2% are very dissatisfied,” the responses said. (Comparison between previous surveys indicated that the answers on 2023 survey were as follows: 7% very satisfied, 19% satisfied, 32% neutral, 28% dissatisfied, and 14% very dissatisfied). Those responses indicate that some respondents are more content with the state-funded Medtronic device as compared to the existing figures (up 7% in those people who were very satisfied and up 35% in those who were satisfied) and a decrease in dissatisfaction (12% less very dissatisfied and 24% less dissatisfied). (Diagram #9).

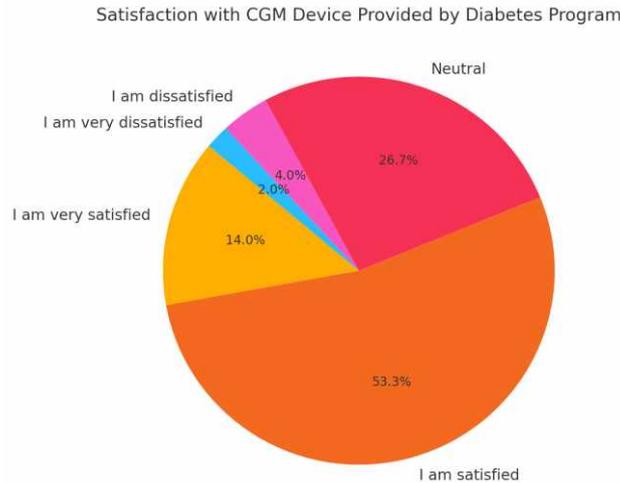


Diagram 9. *If you use the CGM devices (continuous glucose monitoring systems) provided by the diabetes program, please indicate how satisfied you are*

Respondents had the opportunity to comment regarding why they were unable to use or felt dissatisfied with the Medtronic CGM device. The most common complaints cited were skin irritation in children; being too large; and not being painless to take off and reapply. Most respondents also indicated a choice that they wished were offered to them like other manufacturers of such devices like Libre and Dexcom.

Still another question asked participants to list and rate the most serious problems faced in maintaining a child’s diabetic health with multiple choices. Diagram #10 is the chart below for the results of the 2025 survey.

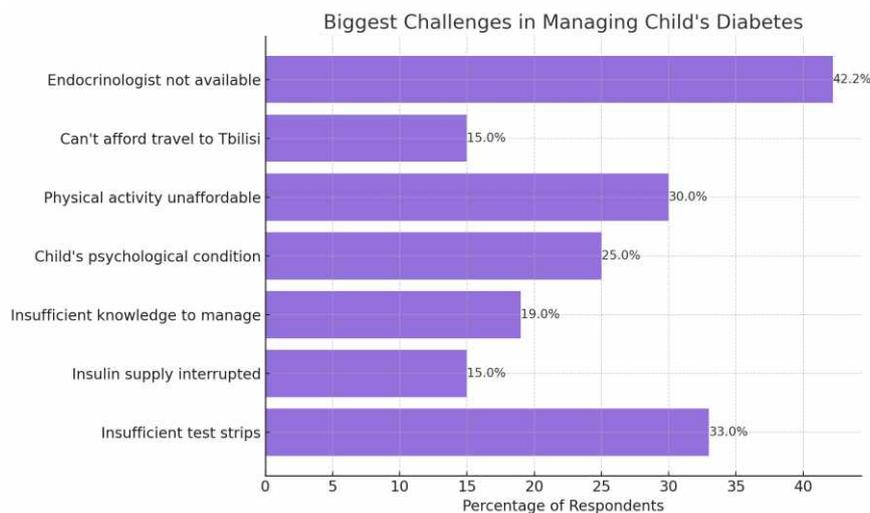


Diagram 10. *What represents the biggest challenge in managing a child’s diabetes?*

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Through the lens of focus group discussions, it was noted that communication and social interaction among children with diabetes are vital. For instance, “camps for children living with diabetes are important.” They provided examples of situations when contact with other diabetics and sharing information positively affected their offspring's motivation. Consequently, the quantitative survey included this question: “How important do you believe it is for your child to communicate with other children who have diabetes?” In response, 49% of participants said it is "essential", 40% said it is "important", 9% selected "I don't know", and only one respondent answered that it is not necessary.

The quantitative study also looked into which digital technologies could help enhance a child’s diabetes management. Two or more responses were allowed from respondents. Diagram #11 presented below shows results and distribution.

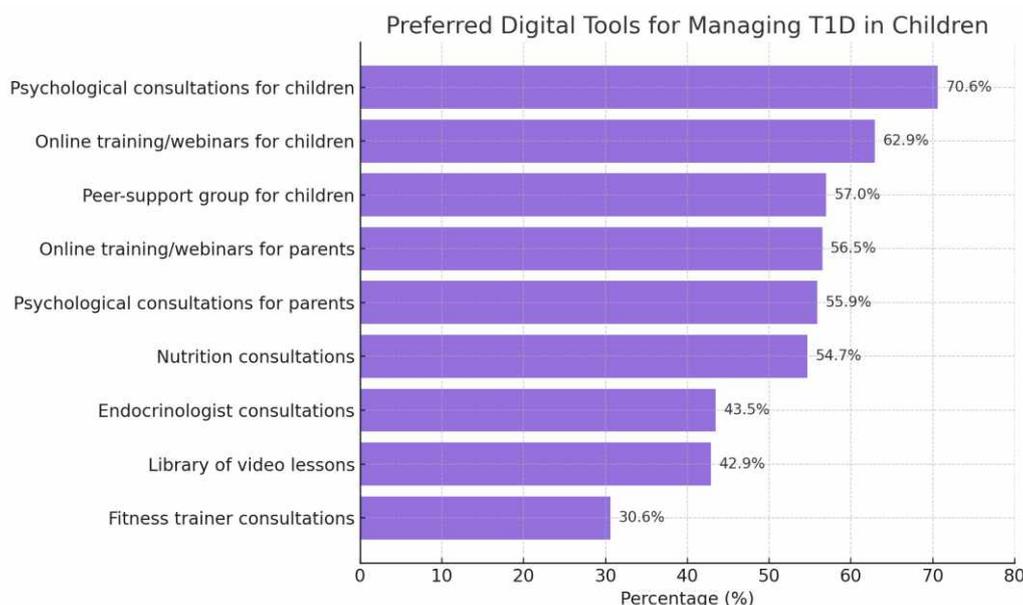


Diagram 11. Which digital technologies would help better manage your child’s diabetes?

The research instrument also asked questions relevant to insulin pumps. On the question - “Do you know about insulin pumps?” 83% of respondents replied "Yes" and 17% responded "No." It should be noted that 63% in the 2023 study answered “Yes” and 37% answered "No". When asked - Would you like your child to receive an insulin pump? - 61.5% responded "Yes", 34.3% "I do not know" and 4.2% "No". (In the 2023 survey, 54% wanted their child to have a pump, 39% said 'I don't know,' whereas 7% replied 'No'.)

Change in Access to Diabetes Services Over the Last 3 Years

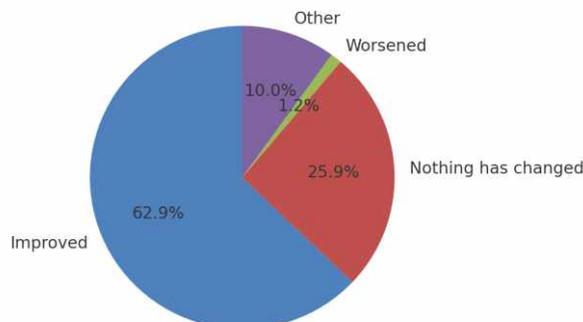


Diagram 12. Respondents’ assessment regarding access to services and materials needed for diabetes management over the past three years.

For the survey, it was imperative to know what perceptions and evaluations people had of how access to services and materials for a child with diabetes changed over the last three years. In this question, 64% said it had improved, 24% said nothing had changed, and 10% of them that the child had just been diagnosed with diabetes, and thus they could not compare it with the last time, etc., for this question.

In the same vein another question pertained to the perception and assessment of change during the last three years – “Define the changes of the past three years in your child’s diabetes management”. In response to this question - 94% of participants answered, that their education/knowledge about how diabetes is managed was better; For 6% it was not; In terms of financial expenses - 17% believe it is better, 41% don't think so and 42% think it has changed for the worse;

Regarding child’s psychological condition - 47% of respondents say it’s improved, 44% think not to have changed and 9% believe it has worsened; “My confidence in managing my child’s diabetes ” - 84% say it has improved, 16% note that it hasn’t changed; CGM continuous glucose monitoring device - 87% feel it is improved, 13% think it is the same; access to insulin and consumable materials - 27% say it has improved, 69% say it hasn’t changed at all, and 4% answer that it has changed for the worse. (Diagram #13)

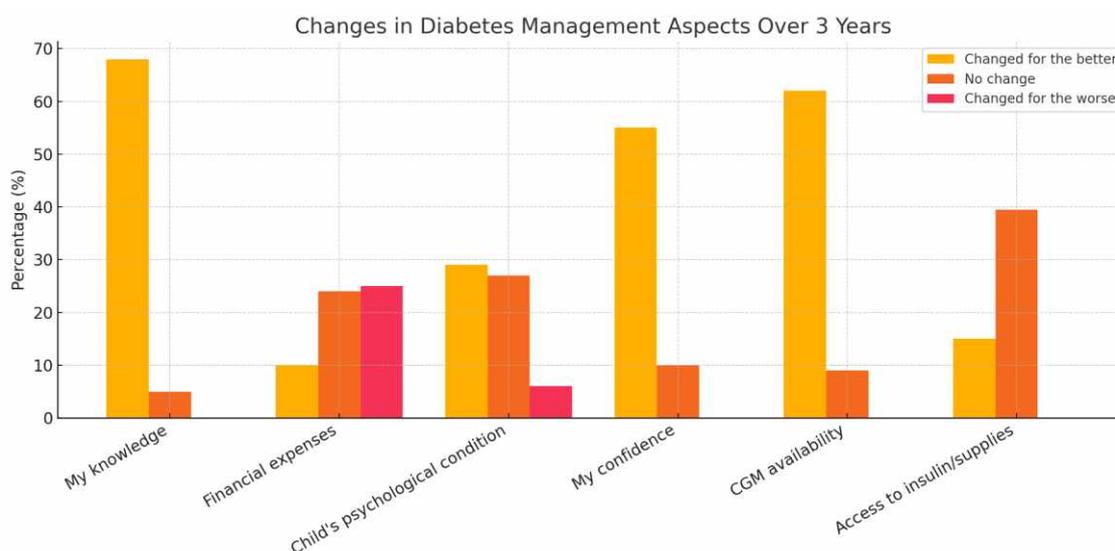


Diagram 13. According to respondents’ opinions, how important issues related to the child’s diabetes management have changed over the past three years

Discussion and Recommendations

This study was repeated and revealed the needs of children with type 1 diabetes in Georgia in terms of health, education and social support and the changes in these aspects according to parents/guardians' view. Overall conditions improved - knowledge and self-confidence levels of parents improved as did the use of modern diabetes management technologies, such as continuous glucose monitoring (CGM) devices. But some challenges linger. The following conclusions and recommendations can be drawn from the results of the study findings and analysis:

1. Educational and Confidence Boost of Parents:

94% of parents/guardians described better understanding about management of diabetes in the past three years, and 84% reported increased self-efficacy in controlling their child’s diabetes. Moreover, 87% mentioned some improvement in CGM device usage. Additionally, 64% of parents said access to diabetes-related services and materials had improved.

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2. **Still Unhealed Economic Barriers:**
Large percentages of families with diabetic children are still in dire financial straits. About one-third (32%) reported monthly family income below 1,000 GEL, and approximately 75% earn less than 1,500 GEL. In 44% of families, just one family worker is employed (compared to 50% in 2023 who reported the same income and employment status).
3. **Limited Access to Qualified Pediatric Endocrinologists in Regions:**
According to the result of the repeated study, the access to qualified pediatric endocrinologists by residents living in regional areas remains a challenge. For example, 37% of respondents said that they have to take their child to Tbilisi for regular checks because service isn't available there. With low health coverage in these areas, parents lack a regular doctor to care about child locally. A further 29 percent would like to see doctors in Tbilisi because of poor trust in local specialists. And 43 percent said lack of endocrinologists in the region is the biggest obstacle in managing their child's diabetes, with 15 percent saying they can't travel to Tbilisi.
4. **What Are the Important Points to Be Pertaining To Parent Education Formats?**
There are still needs for more effective formats for educating parents about type 1 diabetes, particularly early postdiagnosis. Adopting best practices from abroad - such as including psychologists and the parents' psychological and emotional wellbeing - should be more in line with international best practices. Many respondents say they want to receive updated information at least every six months, ideally through Q&A-style sessions focused on the major issues.
5. **Use of Digital Technologies:**
Digital tools may positively improve parents' education and diabetes care, they reported. They may receive online training and consult with endocrinologists, psychologists and nutritionists, or they may have video lecture libraries and other access to the internet.
6. **Better Satisfaction with CGM Devices:**
State-sponsored CGM devices and related concerns were critical in 2023 study. In the follow-up study, 81% of participants currently use these devices (compared with 48% in 2023). Satisfaction has improved - 54 percent are satisfied, 14 percent very satisfied and 19 percent satisfied (42 percent dissatisfied) in 2023. Nevertheless, it still faces problems such as skin irritation. Based on their needs parents should be able to choose their device from different suppliers.
7. **Training school and kindergarten staff:**
Educational needs of the teachers, nurses and doctors are evident. More parents are demanding more awareness and engagement from educators and peers than in 2023. In 2025, for example, 19 percent more respondents supported training teachers, and 23 percent supported informing classmates. In 2025 21% less respondents requested personal assistants for children with T1D at schools, compared to 2023 year's study. And similar trends in kindergartens - 35% more requested teacher training, and 26% less felt a personal assistant was needed. This highlights importance of training sessions and information campaigns for educators and caregivers, printed or video materials, and electronic distribution to enhance access.
8. **Access to Sports Activities:**
Access to sports is a current challenge for children with diabetes. Tailored programs based on the specificities of diabetes are required. According to 29 percent of respondents, financial constraints prevent their children from getting adequate physical activity.
9. **Urgence of Multidisciplinary Teams:**

A team of specialists from all disciplines, such as psychologists and nutritionists, is an ongoing challenge. These teams should be assimilated to primary healthcare clinics. The introduction of a systemic approach of qualification raising - for example, continuous medical education modules. The need for strengthened and integrated primary care is underscored again.

10. Peer Socialization Platforms:

The other needs identified are platforms with programs to encourage socialization among children with diabetes. Some of these platforms would offer them chances to learn about diabetes and become more involved with managing their health problem.

11. Public Awareness Campaigns:

Education of teachers, doctors, parents, and nurses is in addition to raising diabetes awareness in all parts of society. Respondents stressed that their children need “support, not pity.” Public health campaigns should educate society what diabetes is and how best to support affected children. As 2025 noted having a 23% increase in respondents supporting this compared with 2023, the need to inform classmates would be particularly emphasized.

Conclusion

This article adds a new empirical understanding to developments in pediatric diabetes care in Georgia, where national-level data on Type 1 Diabetes (T1D) among children has been limited in the past. Through comparing 2023 and 2025, the research draws on emerging advances across diabetes technologies - from continuous glucose monitoring to blood glucose measurement - and reveals continued gap rates in educational equity, caregiver assistance, and health equity.

In contrast to previous regional studies that were predominantly concerned with medical outcomes, this study investigates the health, educational, and psychosocial aspects of family participation in chronic disease management within healthcare infrastructures constrained in the wider society.

In addition, the results contribute to international literature by contextualizing the Georgian experience in wider discussions on health system transition and social determinants of pediatric health. The comparative assessment reveals that Georgia has advanced in terms of both parental capacity building and diabetes technology adoption significantly, but the changes are not enough to overcome structural inequities. Families based outside the capital are still disproportionately set up to face barriers resulting from limited access to specialists, increased travel costs, insufficient school support to care for the child, and inadequate integrated psychosocial care.

Persistent socioeconomic vulnerability compounds these disparities: almost one-third of families living below the subsistence income level. In the absence of targeted financial protection measures as well as more comprehensive social policy reform, these households will suffer from further levels of exposure. Educational and psychological disadvantages undermine the child and his or her integration into school settings. It is important to use prevention and structured awareness campaigns to reduce stigma, prevent social isolation, and manage the disease more effectively.

This second research also identifies changes in care, education and psychosocial aspects of children living with type 1 diabetes in Georgia and their families. The analysis compares 2023 and 2025 data, revealing significant improvements in parental understanding, confidence to manage their children's diabetes, and access to necessary technologies (particularly continuous glucose monitoring [CGM]) during parental care.

However, the vast majority of surveyed participants (94%) report enhancing awareness and understanding of diabetes management and 87% say they see further improvement in

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adopting CGM technology and care, indicating that strides are being made in modernizing the care we provide to diabetics. Despite this progress, it still identifies areas of persistent and emerging challenges that must have immediate attention, the report said.

Systemic gaps are revealed in the lack of support within educational settings, availability, and limited access, especially to diabetes-appropriate physical activity programs, as well as multidisciplinary teams, consisting of psychologists and nutritionists.

The study's findings also highlight the importance of additional educational intervention efforts for parents and teachers, peer groups and the broader community to develop a better environment for children with diabetes. Awareness raised among classmates and trained school staff could serve to reduce stigma and support psychological well-being and school integration in children.

By reflecting the lives of care givers across a two-year period, this study provides insights into the dynamics of diabetes care provision in post-transition health care settings in Eastern Europe. It emphasizes the importance of sustained resources for enhancing primary care strengthening, digital health capacity, inclusiveness of education strategies, and public outreach aimed at creating a more just and robust health system to meet the demands of children with chronic conditions.

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THE IMPACT OF BANKING SECTOR LIQUIDITY AND STABILITY ON ECONOMIC GROWTH IN THE WESTERN BALKANS: EVIDENCE FROM 2013–2023

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Abstract: *This paper examines the impact of banking sector liquidity and stability on driving economic growth in the Western Balkans (comprising Kosovo, Albania, Montenegro, North Macedonia, Bosnia and Herzegovina, Croatia, and Serbia) from 2013 to 2023. Using panel data analysis, the study includes linear regression, Fixed Effects (FE), Random Effects (RE), Hausman-Taylor (HTH), and Generalised Method of Moments (GMM) to examine the relationship between key banking indicators and economic growth. The dependent variable is economic growth, while independent variables include private sector credit, bank deposits, non-performing loans, government expenditure and inflation. The empirical results suggest that the banking sector plays a crucial role in driving economic growth Western Balkans countries. Specifically, bank deposits have a positive and statistically significant effect, while private sector credit also shows a positive effect but is not statistically significant. In contrast, non-performing loans and inflation have a negative impact on economic growth. These findings underscore the importance of strengthening banking sector liquidity, stability and enhancing credit access to promote sustainable economic growth, providing valuable insights for policymakers and financial regulators.*

Keywords: *banking sector, economic growth, deposits, financial stability, panel data*

1. INTRODUCTION

The banking sector plays a key role in promoting economic growth in the Western Balkans. Household consumption remains a major driver of economic activity, supported by increasing public spending and rapid growth in household credit. Banks and other financial institutions facilitate access to finance for the private sector, making the stability and efficiency of the banking sector essential for sustainable economic development.

The primary objective of this paper is to investigate the impact of the banking sector on economic growth in the Western Balkan countries, with the research providing an empirical statistical analysis based on secondary data. The research questions of this paper are:

1. How do bank deposits influence economic growth in these countries?
2. To what extent do non-performing loans negatively impact economic growth in the Western Balkans?

The research hypotheses are:

- H1: Bank deposits have a statistically significant and positive effect on economic growth in Western Balkan countries.
- H2: Non-performing loans significantly negatively impact economic growth in the Western Balkans.

Previous studies have found mixed evidence on the relationship between the banking sector and economic growth in transition countries. Levine (2005) in his study, he emphasises the role of financial development in promoting economic growth, while Koivu (2002) emphasizes that high interest rate margins can hinder economic expansion, reflecting banking inefficiencies. Mehl and Winkler (2004) argue that financial sector reforms are necessary to influence growth, and Caporale et

al positively. (2009) demonstrate a strong link between bank credit availability and economic growth in EU transition countries, suggesting that limited access to credit restricts growth potential. The study contributes to the literature by providing an updated empirical analysis focused on the Western Balkans for the period 2013–2023, addressing a gap in regional evidence.

This paper examines the impact of the banking sector on economic growth in the Western Balkan countries, utilising panel data analysis. The study employs linear regression model, Fixed Effects (FE), Random Effects (RE), Hausman–Taylor (HTH), and Generalized Method of Moments (GMM) models to examine the relationships between key banking indicators and economic growth. The research includes private sector credit, bank deposits, non-performing loans, government expenditure, and inflation as independent variables.

The paper is structured as follows: the next section reviews relevant literature; the third section details the methodology; the fourth section presents empirical results; the fifth section discusses the findings and concludes.

2. LITERATURE REVIEW

In this section, we examine empirical evidence on the impact of the banking sector on economic growth and situate this study within the existing literature. The dominant body of research indicates that the relationship between banking sector and economic growth is both positive and bidirectional. This topic has been analyzed in the economic literature and most studies confirm a strong link between financial sector expansion and GDP growth (Levine, 2005; Fetai, 2018, Hasani-Limani, 2025).

According to Petkovski and Kjosevski (2013) the development of the banking sector impacts economic growth in several Central and Southeastern European countries, suggesting that inefficient credit allocation may hinder growth. Their study suggests that inefficient credit allocation may hinder economic growth in the region. Their results indicate that private sector credit and interest rate spreads have a negative impact on economic growth, whereas the quasi-money ratio has a positive effect. Similarly, Hasanov and Samadova (2019), focusing on Southeastern European countries, found that private sector credit and bank deposits have a significant influence on economic growth. They also emphasised the importance of a stable banking sector as a pillar of macroeconomic stability.

Recent studies in the Western Balkans further support these findings: Hajdari et al. (2024) It is shown that bank credit, interest rate spreads, and non-performing loans directly affect economic growth. In contrast, Hoxha et al. (2025) demonstrate that both internal bank factors and macroeconomic conditions influence banking profitability, thereby indirectly affecting growth. According to Pjetri et al. (2024) review the progress of the microfinance sector in Albania and highlight that constraints on liquidity and access to financing can limit the growth of small businesses, indirectly affecting overall regional economic performance.

As noted by Fetai (2018) in 20 European transition economies, financial development indicators have a statistically significant and positive effect on real GDP per capita growth. The study highlights the negative effects of financial crises, government spending, and inflation, showing both the role of financial development in fostering growth and the potential macroeconomic risks associated with excessive public spending and inflationary pressures.

Rajan and Zingales (1998) argued that industries that rely more on external financing tend to grow faster in countries with more developed financial systems, thus supporting the idea that well-functioning banking sectors can stimulate investment and enterprise development, especially in economies with less developed capital markets. Similarly, Jaffee and Levonian (1999) confirmed the positive link between banking sector efficiency and economic output in a study of 23 transition economies—meanwhile, Demirgüç-Kunt et al. (2007) highlighted the inclusive role of finance in promoting growth, improving income distribution and reducing poverty. Despite progress in increasing financial inclusion, particularly in terms of access to payment services and basic financial products, a significant portion of the population and businesses still remain excluded from financial services.

Recent studies emphasize the role of banking sector structure and policy in the Western Balkans. Ahmeti et al. (2023) highlight that the capital structure of banks affects their lending capacity, a key channel for stimulating economic growth, with profitability positively related to leverage, while liquidity and earnings volatility have negative effects.

According to Hasani-Limani (2025) provides empirical evidence linking financial deepening to economic growth in nine Western Balkan countries, addressing gaps in the literature regarding the region’s financial integration and development.

Finally, Popescu et al. (2024) examined the cases of Spain, France, and Romania. Their study found a long-term structural relationship between the development of the banking sector and economic growth, with deposits and real interest rates playing a particularly significant role.

Sotiropoulou (2025) examined the relationship between financial development, economic growth, and income inequality in the transition economies of Central and Eastern Europe. The study highlighted the dual role of the banking sector in promoting economic growth while mitigating social disparities. The findings of this study indicated a causal relationship among financial development, economic growth, and income inequality.

3. RESEARCH METHODOLOGY AND DATA

This study uses panel data covering the period from 2013 to 2023 for seven Western Balkan countries: Kosovo, Albania, North Macedonia, Montenegro, Bosnia and Herzegovina, Croatia, and Serbia. Data are obtained from the World Bank for banking sector indicators and macroeconomic indicators. The banking sector variables analysed are credit to the private sector (% of GDP), bank deposits (% of GDP), and non-performing loans (% of total loans), the model also incorporates variables such as government expenditure (% of GDP) and inflation.

The empirical strategy employs several panel data estimation techniques to ensure robustness and account for potential econometric issues. These include regression linear, fixed effects (FE), random effects (RE), Hausman-Taylor estimation, and the Generalised Method of Moments (GMM) estimator developed by Arellano and Bond (1991), which is particularly suited for addressing endogeneity and autocorrelation in dynamic panel models.

Table 1. Description of variables used in the econometric models

Variables	Description of variables	Data source
Dependent variable (Y)	Gross Domestic Product (annual%) GDP	Annual Reports of the BankWorld (2013-2023)
Independent variable (X1)	Domestic credit to private sector (% of GDP) DCPS	Annual Reports of the BankWorld (2013-2023)
Independent variable (X2)	Bank deposits to GDP (annual%) Deposits	Annual Reports of the BankWorld (2013-2023)
Independent variable (X3)	Bank nonperforming loans to total gross loans (%) NPL	Annual Reports of the BankWorld (2013-2023)
Independent variable (X4)	Inflation, consumer prices (annual%) INF	Annual Reports of the BankWorld (2013-2023)
Independent variable (X5)	General government final consumption expenditure (% GDP) Gov_expen	Annual Reports of the BankWorld (2013-2023)

Source: Data analyzed by the authors (2025)

The econometric model of this study is as follows:

$$\ln \text{GDP}_{it} = \beta_0 + \beta_1 \ln \text{DCPS}_{it} + \beta_2 \ln \text{Deposits}_{it} + \beta_3 \text{NPL}_{it} + \beta_4 \text{INF}_{it} + \beta_5 \text{Gov_expen}_{it} + y_{it} \quad (1)$$

4. EMPIRICAL RESULTS

THE IMPACT OF BANKING SECTOR LIQUIDITY AND STABILITY ON ECONOMIC GROWTH IN THE WESTERN BALKANS: EVIDENCE FROM 2013–2023

In this section of the paper, we will analyse the econometric analysis for Western Balkan countries. This will involve examining descriptive statistics and using various econometric models. We aim to test hypotheses and address the research questions posed in this study. To do so, we will process all results using the STATA programme, since our data are secondary. By applying rigorous statistical techniques and econometric models, we seek to generate meaningful insights into the relationship between banking sector liquidity and stability on economic growth.

Table 2. *Descriptive statistics of the variables used in the econometric model*

Variable	Observation	Mean	Std. Dev.	Min	Max
GDP	67	1.339648	.5187224	0	2.624669
DCPS	70	3.856358	.1959847	3.424263	4.222445
Deposits	67	4.01243	.1812292	3.634951	4.527209
NPL	70	7.815714	5.925201	0	22.2
INF	70	2.31	3.550797	-1.6	14.2
Gov_expen	77	16.94675	3.898231	10.2	24.8

Source: Authors' calculations in the Stata program (2025)

Based on the data obtained from descriptive statistics, we can observe that the variable with the highest mean is government expenditures. In contrast, the one with the lowest mean is economic growth. Regarding the standard deviation, the highest variability is found in non-performing loans, whereas the lowest is in credit to the private sector. In terms of minimum values, the lowest appears in economic growth, while the highest maximum value is observed in government expenditures.

Table 3. *Correlation matrix of variables included in the econometric model*

<i>Variables</i>	<i>GDP</i>	<i>DCPS</i>	<i>Deposits</i>	<i>INF</i>	<i>NPL</i>	<i>Gov_expen</i>
<i>GDP</i>	1.0000					
<i>DCPS</i>	0.1006 0.4403	1.0000				
<i>Deposits</i>	0.1152 0.3893	0.1927 0.1183	1.0000			
<i>INF</i>	-0.1420 0.2749	-0.1337 0.1183	0.1127 0.3637	1.0000		
<i>NPL</i>	-0.3666* 0.0037	0.1973 0.2700	0.3935* 0.0010	-0.3559 0.0025	1.0000	
<i>Gov_expen</i>	-0.0456 0.7139	0.7813* 0.0000	0.1778 0.1500	-0.0926 0.4459	0.2004 0.0962	1.0000

Source: Authors' calculations in the Stata program (2025)

Note: Values represent Pearson correlation coefficients. Numbers below the coefficients indicate p-values. Asterisk (*) denotes statistical significance at the 5% level.

The correlation indicates that government expenditures are strongly and positively correlated with private sector credit (0.7813), so an increase in public spending is associated with an expansion of credit to the private sector. Non-performing loans are negatively correlated with GDP (-0.3666), suggesting that an increase in problematic loans is associated with a slowdown in economic growth. Deposits and GDP exhibit a weak positive relationship (0.1152), while inflation has a weak negative relationship with both GDP (-0.1420) and private sector credit (-0.2749). Overall, the results indicate that the strongest and most significant relationships exist between government expenditures and private sector credit, as well as between non-performing loans and economic growth. The following table presents the econometric results for the statistical tests analysed. In the research and for the econometric model for Western Balkan countries.

$$\ln \text{GDP}_{it} = -6.795 \beta_0 + 0.991 \ln \text{DCPS}_{it} + 0.921 \ln \text{Deposits}_{it} - 0.0952 \text{NPL}_{it} - 0.0900 \text{INF}_{it} + 0.0971 \text{Gov_expen}_{it} + y_{it}$$

Table 4. Empirical findings and estimation results from the econometric model for Western Balkan countries

Variables	Linear Regression	Fixed-Effects Regression	Random Effects – GLS Regression	Hausman – Taylor Regression	GMM Model
Lngdp	-	-	-	-	-
lnDCPS	0.958** (0.431)	0.991 (0.601)	0.843* (0.484)	0.813 (0.580)	24.42*** (4.115)
LnDeposits	1.230*** (0.429)	0.921** (0.411)	1.244*** (0.335)	0.956** (0.401)	-19.27*** (3.628)
NPL	-0.0572*** (0.0105)	-0.0952*** (0.0128)	-0.0627*** (0.0104)	-0.0879*** (0.0120)	0.190*** (0.0358)
INF	-0.0806*** (0.0281)	-0.0900*** (0.0178)	-0.0838*** (0.0200)	-0.0903*** (0.0176)	0.317*** (0.0152)
Gov_expen	-0.0494** (0.0230)	0.0971 (0.0623)	-0.0402 (0.0257)	0.0362 (0.0468)	-0.885*** (0.174)
Const.	-5.821** (2.208)	-6.795*** (2.297)	-5.533*** (1.818)	-5.020** (2.087)	-2.815 (5.357)
Obs	58	58	58	58	58
N	7	7	7	7	7
R-squared	0.466	0.635			
VIF	2.01				
F	0.0000	0.0000			
Chi²			0.0000	0.0000	
Hausman test		0.015			
AR (1)					0.295
AR (2)					0.141
Sargan test					0.010
Hansen test					0.985

Source: Authors' calculations in the Stata program (2025)

Explanation: P-values are shown in parentheses: *** indicates statistical significance at the level of 1%; ** indicates statistical significance at 5% level, and * indicates statistical significance at 10%.

The Hausman test results ($p = 0.015$) confirm that the Fixed Effects model is more suitable for this panel data set than the Random Effects model. The Fixed Effects model also yields the highest R-squared value (0.635), indicating that it explains a larger proportion of the variation in economic growth, while controlling for country-specific effects.

The coefficient for private sector credit (DCPS) is positive and approximately 0.99, indicating that a 1% increase in private sector credit is associated with a 0.99% rise in GDP. However, in the Fixed Effects model, this coefficient is not statistically significant.

Bank deposits consistently show a positive and statistically significant relationship with economic growth. Specifically, a 1% increase in deposits results in approximately a 0.92% rise in GDP, significant at the 5% level. This supports the idea that greater bank liquidity and available funds contribute to economic expansion, thereby confirming hypothesis H1 regarding the positive impact of bank deposits on economic growth.

Non-performing loans (NPLs) have a statistically significant and negative effect on economic growth. A 1% rise in NPLs decreases GDP growth by about 0.095%, and this is significant at the 1% level. Based on this finding, we fully endorse hypothesis H2 regarding the negative impact of non-performing loans on economic growth. Inflation also consistently exhibits a statistically significant negative influence on growth.

The inflation has a negative and statistically significant impact on economic growth. If inflation increases by 1%, it will affect the decline in economic growth by 0.09%, which is significant at the 1% level. According to this result, inflation hurts investment stimulation and economic stability in the countries of the region. Government expenditure has a positive coefficient in the Fixed Effects model (approximately 0.097%), but this result is not statistically significant.

5. DISCUSSION/ CONCLUSIONS

The empirical findings of this study highlight the crucial role of the banking sector's liquidity and stability in promoting economic growth in the countries of the Western Balkans.

Bank deposits have a positive and significant impact on economic growth (Levine, 2005; Fetai, 2018), confirming the role of the financial sector in the efficient allocation of resources (Rajan & Zingales, 1998; Hasanov & Samadova, 2019).

Non-performing loans negatively affect economic growth and are statistically significant in reducing asset quality and increasing systemic risk, while inflation hinders investment and purchasing power. Stable banking systems and sound macroeconomic policies are essential for long-term economic growth (Popescu et al., 2024).

Recent regional studies provide important context for understanding these results. Empirical evidence shows that bank credit, interest rate spreads, and NPLs directly influence growth (Hajdari et al., 2024), while internal bank factors and macroeconomic conditions affect profitability and, indirectly, economic growth (Hoxha et al., 2025). Bank capital structure also determines lending capacity (Ahmeti et al., 2024), and financial deepening promotes growth depending on the level of development and EU integration (Hasani-Limani, 2025). These findings support the idea that liquidity, stability, and an efficient banking system are critical channels for promoting economic growth in the region.

Private sector credit have a positive but statistically insignificant effect, whereas bank deposits had a significant positive impact. Non-performing loans continued to hinder growth, confirming the risks from declining asset quality. Inflation also had a negative effect, while government expenditure was positive but not statistically significant.

The analysis underlines the importance of strengthening credit supervision to reduce non-performing loans and systemic risks, expanding access to finance for productive sectors, maintaining macroeconomic stability through inflation control, and improving the efficiency of public spending. Enhancing the resilience of the banking sector through effective regulation and financial intermediation mechanisms is essential to achieve sustainable and long-term growth in the Western Balkans. Among the models used, the Fixed Effects model provided the most reliable estimates, while the GMM model produced less robust results due to the small sample size. Limitations include the relatively small panel and incomplete data for some countries, which reduce statistical power and generalizability.

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INTERNATIONAL TECHNOLOGICAL COMPETITIVENESS OF POLAND AFTER TWO DECADES OF EU MEMBERSHIP

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Abstract: *The aim of the article is to assess the changes in Poland's technological development and international competitive position in the field of technology in the context of integration with the European Union. The analyzed period — 1995–2023 — was chosen in order to answer the following research questions: (1) what changes have occurred in the area of the country's technological competitiveness? and (2) what government policies support the development of innovation? The study applies a mixed-method approach, combining quantitative analysis of technological indicators with a qualitative assessment of political strategies and innovation support programs. The results indicate an improvement in Poland's technological capabilities, particularly in the IT sector and high-tech industries, supported by EU funds and international cooperation. At the same time, challenges such as insufficient commercialization of innovations and a focus on medium-tech sectors limit the full use of Poland's potential. Therefore, it remains necessary to strengthen the national innovation ecosystem so that Poland can achieve a lasting competitive advantage in the global knowledge-based economy.*

Keywords: *competitiveness, technology, international trade, Poland, European Union*

1. Introduction

The significance of technology for the modern economy — particularly its impact on broadly understood economic growth and development — continues to be a subject of academic discussion. A pioneering figure who introduced the concept (and term) of innovation — understood as the continual emergence of new technological solutions — was J. Schumpeter, whose considerations, however, primarily focused on individual entrepreneurship (Śledzik, 2013, p. 89). Nevertheless, his ideas can be regarded as the foundation for further studies by other scholars, including those whose research interests encompassed such issues as the determinants of economic growth and development, as well as the international competitiveness of nations.

The outcome of M. Porter's reflections was the identification of a new phase of economic development based on innovation, in which knowledge serves as a key determinant of economic growth. Technology influences the economy in two ways — through innovation, meaning the implementation of new inventions, and imitation, based on the transfer of technology from more developed countries as a cheaper alternative to its independent, domestic creation (Huang & Hu, 2024, p. 110–111). In many other models of economic growth, the research and development (R&D) sector is also assigned significant importance — labor productivity and the efficiency of production factors are positively correlated with a country's resources devoted to R&D activities. Furthermore, the literature provides numerous studies on growth models demonstrating a causal relationship between scientific development and economic growth (cf. Romer, 1990; Grossman, Helpman, 1991; Aghion, Howitt, 1992). Their key assumption is the diffusion of knowledge, which, through externalities, can offset the high costs of research. In addition to domestic knowledge diffusion, there also exists international technology transfer, stimulated by research expenditures in countries that are major trading partners (cf. Coe, Helpman, 1995; Engelbrecht, 1997; Frantzen, 2000).

The issue of a country's economic competitiveness is closely linked to economic growth, development, and their determinants. According to the aforementioned M. Porter (2001, p. 196–197),

national competitiveness is the effective utilization of resources in production, measured by productivity. Similarly, P. Krugman argues that “the main factor of competitiveness is the growth of productivity of production factors and technological progress” (Krugman, 1994, p. 31), while emphasizing that competitiveness is also related to export efficiency and a high standard of living (Siudek, Zawojka, 2014, p. 95). W. Bieńkowski (1995, p. 22–23) agrees with these views, identifying among the determinants of international economic competitiveness the production resources — namely, natural resources, labor, capital, and technology — as well as the efficiency of their use in production processes. Moreover, the author stresses the importance of international trade cooperation in shaping a country’s global competitiveness. As he notes, “a measure of the growth of competitive ability is (...) the preservation by a given economy of its capacity for long-term profitable development (...), resulting in such an economic structure — and consequently an export structure — that corresponds to long-term changes in the structure of global demand” (Bieńkowski, 1995, p. 34).

Trade partnerships — both at the level of countries and enterprises — can therefore also be regarded as a factor influencing economic growth and development, and consequently, competitiveness. More broadly, however, economic integration processes as a whole may likewise be considered a determinant of countries’ international competitiveness, including in the technological sphere. The relationship between these two variables remains the subject of academic research (Petrović, Antevski, 2008; Bieńkowski, Bukowski, Olszewska, 2012), the results of which confirm their existence, emphasizing in particular the benefits for technology-importing countries — whether in the form of high-tech products or foreign direct investments by transnational corporations originating from countries considered global leaders in innovation (Mostowska, 2024, p. 330–332).

In contemporary approaches to international competitiveness, the emphasis is placed on the economy’s ability to attract investment, foster innovation, and adapt to global changes. One of the determinants of a country’s competitiveness growth is technological development, which enhances the efficiency of resource utilization. Equally important are the processes of economic integration between countries, which facilitate knowledge transfer, access to larger markets, R&D collaboration, and inflows of investment that stimulate innovation. These interdependencies provide a rationale for examining the impact of EU membership on Poland’s international competitive position in the technological sphere, making such an analysis both justified and necessary.

2. Research Methodology

The main aim of the study is to characterize the changes in Poland’s international technological competitiveness between 1995 and 2023. Within this framework, three specific objectives were also formulated: to describe the changes in the areas of: trade in technology-intensive goods, domestic research and development activities, and policies supporting the country’s technological development.

The statistical data used in the study were drawn from publicly available international databases, namely UNCTAD Stat and EUROSTAT. Additionally, information from national sources (e.g., the Ministry of Development and Technology, the Polish Agency for Enterprise Development) and EU websites (e.g., Eur-Lex) was also utilized.

The study was conducted using descriptive statistical tools (structure and dynamics indicators) as well as a synthetic competitiveness measure — the revealed comparative advantage index.

3. Results

3.1. Trade in Technologically Intensive Goods

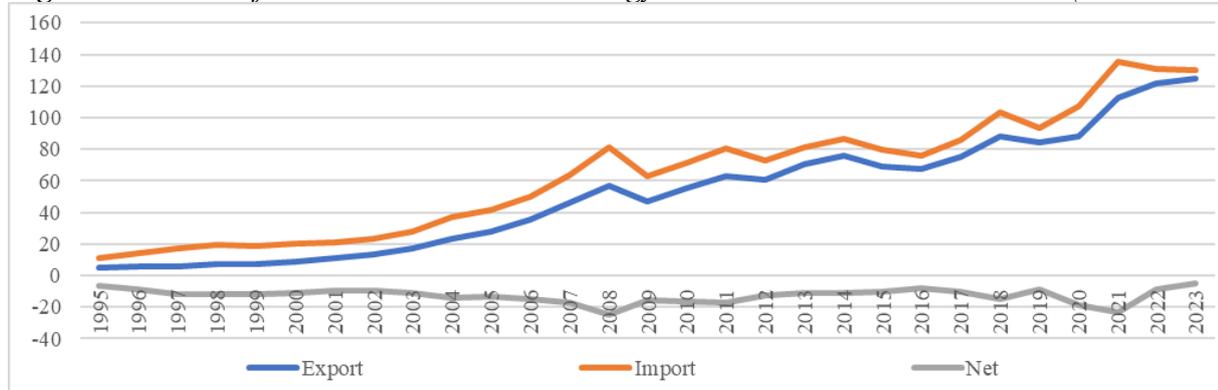
In the pre-accession decade (i.e., 1995–2004), the volume of Poland’s trade in technology-intensive goods increased steadily (with exports rising nearly fivefold and imports more than threefold). It should also be noted that this upward trend was observed slightly longer, over the first fourteen years of the analysis (i.e., 1995–2008).

The trend reversal — not only in Poland and not only in the area of high-tech goods — occurred as a result of the global economic downturn that began in the United States. In subsequent years, both

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increases and decreases in the volume of this type of trade were observed in Poland; however, throughout the entire analyzed period, Poland remained a net importer of technology-intensive products (Figure 1).

Figure 1. *Volume of Poland's Trade in Technology-Intensive Goods in 1995–2023 (billion USD)*



Source: own study based on: UNCTADstat, <https://unctadstat.unctad.org/datacentre/> [accessed 12.01.2025].

The negative trade balance in the initial years of the analysis steadily deepened (1995–2008), but in the following years showed a reverse trend — which, combined with trade volume, should be interpreted as an improvement in the country's technological competitiveness. It is, however, worth noting that the average growth rate of both exports and imports of technology-intensive goods was higher in the pre-accession period — in 1995–2004 it amounted to approximately 17%, while in 2005–2023 it was around 10%. There were certainly many reasons for this pattern, but the global economic downturn mentioned earlier should be highlighted as a major factor.

Valuable insights on this topic can also be provided by analyzing the structure of Poland's trade in technology-intensive goods (1), the share of this type of trade in the country's overall trade and in EU trade (2), as well as the development of the revealed comparative advantage index (3), which in the literature is considered a synthetic measure of a country's competitiveness (cf. Misala, 2007; Pilarska, 2017). In the first case, it is reasonable to refer to M. Weresa's classification of technology-intensive goods into easily and difficult-to-imitate products (cf. Weresa, 2007). The first group includes chemical products, pharmaceuticals, and IT and telecommunications equipment, while the second comprises metalworking machinery, specialized equipment, and precision instruments. The commodity structure of Poland's trade in technology-intensive goods is illustrated below (Figure 2).

Figure 2. *Commodity Structure of Poland's Trade in Technology-Intensive Goods in Selected Years of 1995–2023 (%)*

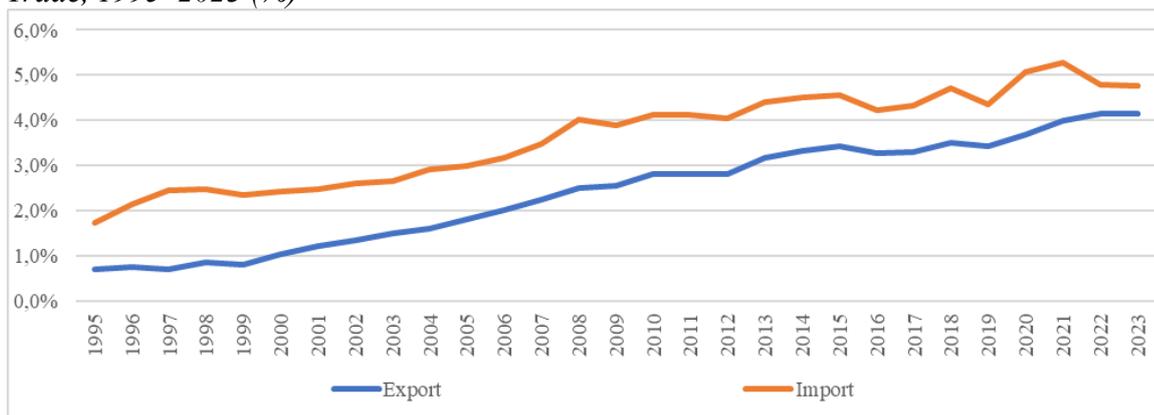


Source: own study based on: UNCTADstat, <https://unctadstat.unctad.org/datacentre/> [accessed 12.01.2025].

Based on the presented data, it can be concluded that no significant changes occurred in the commodity structure of Poland’s trade in technology-intensive goods that could be interpreted as a sign of increased international economic competitiveness. In exports, the share of difficult-to-imitate goods decreased slightly, while in imports, the share of easily imitable goods declined. It is worth noting — and can be considered an indication of the country’s growing technological competitiveness — that in the final year of the analysis, Poland recorded a positive trade balance in difficult-to-imitate technology-intensive goods (amounting to USD 4.9 billion), and products from this group accounted for over 25% of the country’s total exports. This was likely driven by exports of goods in the “Electrical apparatus, machinery, and equipment” category (41% of technology-intensive exports in 2023, compared to 27% in 1995) and “General industrial machinery and machine parts” (19% in 2023 versus 12% in 1995).

During the analyzed period, the significance of technology-intensive goods in Poland’s overall foreign trade also changed. Their share in exports increased significantly (from 22% in 1995 to 35% in 2023), while in imports it decreased slightly (from 39% to 38%, respectively). Moreover, when considering Poland’s technological competitiveness as an EU member state, it is also reasonable to highlight data illustrating the importance of the country’s trade in technology-intensive goods relative to such trade across the entire Union (Figure 3).

Figure 3. Share of Poland’s Trade in Technology-Intensive Goods in the EU’s Technology-Intensive Trade, 1995–2023 (%)



Source: own study based on: UNCTADstat, <https://unctadstat.unctad.org/datacentre/> [accessed 12.01.2025].

Consistent with the data presented so far, it should be noted that the share of imports (4,8% in 2023) of technology-intensive goods in the overall EU trade of this type was higher than that of exports (4,2%). However, a nearly uninterrupted increase in this share is clearly visible — almost a threefold rise in imports (from 1,7% in the first year of the analysis) and more than a sixfold increase in exports (from 0,7% in 1995).

Table 1. Revealed Comparative Advantage (RCA) Indicators of Poland’s International Trade in Easy to Imitate Technology-Intensive Goods in Selected Years of 1995–2023*

Specification **	1995	1997	1999	2001	2003	2005	2007	2009	2011	2013	2015	2017	2019	2021	2023
51	-0,2	-0,1	-0,1	-0,4	-0,4	-0,6	-0,4	-0,7	-0,4	-0,7	-1,0	-1,0	-0,7	-0,8	-0,9
52	0,8	0,7	0,3	0,3	0,1	0,0	-0,1	-0,3	-0,2	-0,2	-0,4	-0,3	-0,3	-0,9	-1,2
54	-1,2	-1,0	-1,8	-2,0	-2,1	-1,6	-1,3	-1,0	-0,9	-0,6	-0,6	-0,4	-0,6	-0,8	-0,7
58	-2,0	-1,4	-1,4	-0,9	-0,8	-0,6	-0,3	-0,3	-0,3	-0,2	-0,2	-0,1	0,0	0,0	0,0
59	-1,6	-1,5	-1,5	-1,2	-1,4	-1,2	-1,2	-1,2	-0,8	-0,7	-0,6	-0,4	-0,2	-0,1	-0,2
75	-3,1	-2,7	-2,4	-2,5	-2,4	-2,1	-1,6	-0,2	-0,2	-0,5	-0,3	-0,4	-0,2	-0,4	-0,3
76	-1,2	-0,4	-0,4	-0,2	0,0	-0,2	0,0	0,3	0,3	0,1	0,1	0,2	0,1	0,2	0,4

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*Calculations performed according to the formula: $RCA_i = \ln \left(\frac{x_i + m_i}{X + M} \right)$, where: x_i – value of exports of the country and within the product group, m_i – value of imports of the country and within the product group, X – total value of the country's exports, M – total value of the country's imports; the indicator is calculated using the 2-digit SITC classification, and its value oscillates between $+\infty$ and $-\infty$, with positive values indicating a relative advantage.

** Legend: 51 – organic chemicals, 52 – inorganic chemicals, 54 – medicinal and pharmaceutical products, 58 – processed plastics, 59 – chemical products and materials, 75 – office machines and computer equipment, 76 – telecommunications equipment and devices. Source: own study based on: UNCTADstat, <https://unctadstat.unctad.org/datacentre/> [accessed 12.01.2025].

Changes in Poland's international technological competitiveness in the technological sphere can also be measured using a synthetic indicator, the revealed comparative advantage (RCA) index — used to assess a country's trade specialization in selected groups of goods or services relative to other countries. It is widely applied in international analyses, particularly in studies on competitiveness and the structure of foreign trade. Its values for Poland's trade in technology-intensive goods in selected years of the analyzed period are illustrated below (Table 1).

In the area of trade in easily imitable technology-intensive goods, Poland initially held a comparative advantage only in organic chemicals, which it permanently lost in 2007. However, it gained an advantage in the trade of telecommunications equipment and devices and effectively leveraged this advantage — exports of products from this group accounted for over 8% of the country's total exports in 2023. The situation is considerably more favorable in terms of competitiveness in difficult-to-imitate technology-intensive goods.

Table 2. Revealed Comparative Advantage (RCA) Indicators of Poland's International Trade in Difficult to Imitate Technology-Intensive Goods in Selected Years of 1995–2023*

Specification **	1995	1997	1999	2001	2003	2005	2007	2009	2011	2013	2015	2017	2019	2021	2023
57	-1,2	-1,2	-1,3	-1,2	-1,4	-1,3	-0,9	-1,0	-0,9	-0,9	-0,9	-1,0	-1,1	-1,2	-1,2
71	-0,2	-0,3	-0,3	0,7	0,8	0,6	0,7	0,4	0,4	0,3	0,2	0,4	0,3	0,3	0,2
72	-0,8	-0,8	-0,7	-0,7	-0,7	-0,5	-0,6	-0,6	-0,5	-0,3	-0,4	-0,3	-0,4	-0,4	-0,3
73	-0,9	-1,0	-0,9	-0,5	-1,0	-0,8	-0,7	-0,9	-0,5	-0,6	-0,8	-0,8	-0,8	-0,8	-0,6
74	-1,1	-0,9	-0,8	-0,7	-0,6	-0,5	-0,3	-0,4	-0,3	-0,2	-0,3	-0,1	-0,1	-0,2	-0,1
77	-0,2	-0,1	0,0	0,0	0,2	0,2	0,4	0,1	0,2	0,2	0,1	0,1	0,1	0,1	0,3
79	2,9	0,4	2,1	1,1	0,6	0,6	0,8	0,5	0,5	0,3	0,2	0,3	0,1	0,7	0,1
87	-1,3	-1,2	-1,1	-1,1	-0,5	-0,5	-1,0	-1,1	-1,0	-0,5	-0,4	-0,2	-0,2	-0,2	-0,2
88	-2,5	-1,6	-2,1	-2,4	-2,0	-1,3	-1,4	-1,3	-1,0	-1,0	-0,8	-0,6	-0,6	-0,5	-0,6

*Calculations performed according to the formula: as in the previous table.

** Legend: 57 – unprocessed plastics, 71 – electrical machinery and equipment, 72 – specialist equipment for industry, 73 – metalworking machinery and equipment, 74 – general industrial equipment and machine parts, 77 – electrical machinery and equipment, 79 – other transport equipment, 87 – control equipment and instruments, 88 – photographic equipment, optical products, clocks. Source: own study based on: UNCTADstat, <https://unctadstat.unctad.org/datacentre/> [accessed 12.01.2025].

In the base year of the analysis, Poland held a competitive advantage only in the trade of transport equipment, whereas nearly three decades later, it had also gained an advantage in two additional categories of internationally traded goods: electrical apparatus, machinery, and equipment. Similar to easily imitable technology-intensive goods, the export of these products accounted for the largest share of the country's total exports, reaching 45% in 2023.

3.2. Research and Development (R&D) sector

An improvement in Poland’s international technological competitiveness over the period 1995–2023 can also be observed by analyzing data on the country’s R&D sector (Table 3). Expenditures on the R&D sector steadily increased over the analyzed period, both in absolute and relative terms. In 1995, nine years before Poland’s accession to the EU, national spending on research and development amounted to EUR 672 million, representing only 0,6% of GDP and approximately EUR 17 per capita. Nearly three decades later, in 2023, these expenditures accounted for just over 1,5% of Poland’s GDP, totaling EUR 11,7 billion, or nearly EUR 320 per capita. This represents more than a twofold increase in such investments (considering GDP dynamics), which is undoubtedly a positive indicator regarding changes in the country’s technological competitiveness.

Table 3. *Size and Structure of Poland’s Research and Development (R&D) Expenditures in Selected Years of 1995–2023*

Specification	1995	1997	1999	2001	2003	2005	2007	2009	2011	2013	2015	2017	2019	2021	2023
R&D expenditure as:															
% GDP	0,62	0,64	0,68	0,62	0,54	0,56	0,56	0,66	0,75	0,88	1,00	1,03	1,31	1,44	1,56
euro per capita	17	23	28	35	27	36	46	55	75	90	114	127	186	223	318
Financing structure (%):															
Business Sector	39	39	41	36	27	32	30	28	30	44	47	64	63	63	65
Government Sector	35	32	31	31	41	36	35	34	35	27	24	2	1	2	2
Higher Education Sector	26	29	28	33	32	32	34	37	35	29	29	33	36	35	33
Non-Profit Sector	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Source: own study based on: EUROSTAT Database, <https://ec.europa.eu/eurostat/web/main/data/database> [accessed 13/01/2025].

Positive developments were also observed in the sectoral structure of R&D financing — over the analyzed period, the share of funding for the business sector and higher education significantly increased, relative to the government sector. The growing participation of enterprises in this structure can be interpreted as an increase in the private sector’s autonomy, the development of the innovation ecosystem, and, consequently, higher efficiency of R&D spending (driven by private entities’ focus on effectiveness), as well as reduced dependence of the private sector on public funds.

Similar changes, corresponding to those previously observed, were noted in employment within Poland’s R&D sector (Table 4).

Table 4. *Size and Structure of Employment (by Occupation) in Poland’s Research and Development (R&D) Sector in Selected Years of 1995–2022**

Specification	1995	1999	2003	2007	2011	2015	2019	2022
Absolute size of employment in the R&D sector (thousands of people)	120,0	126,0	126,2	121,6	134,6	157,9	271,0	321,4
Relative size of employment in the R&D sector (in relation to all economically active people, %)	n/a.	0,87	0,95	0,81	0,91	1,02	1,65	n/a.
Employment structure by type of position held (%):								
Researchers	62	69	75	80	75	75	72	70
Technicians and equivalent Staff	21	17	13	11	16	15	18	21
Other	16	14	12	9	9	10	10	9
Employment structure by economic sector (%):								

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Business Sector	26	21	12	15	20	31	45	53
Government Sector	20	18	20	19	20	17	2	2
Higher Education Sector	54	61	68	66	60	52	52	44
Non-Profit Sector	0	0	0	0	0	0	1	0

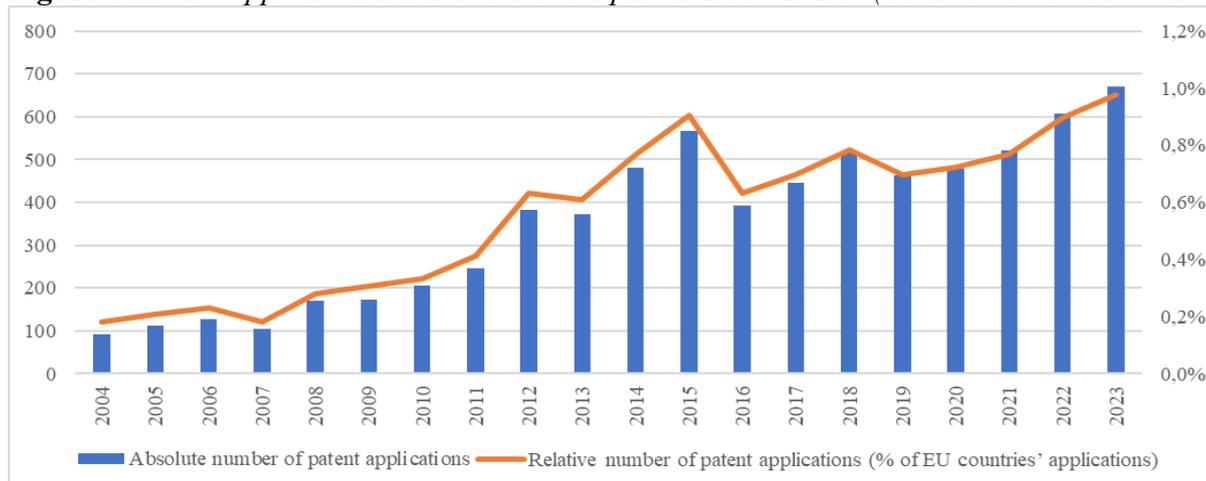
*no data for 2023.

Source: own study based on: EUROSTAT Database, <https://ec.europa.eu/eurostat/web/main/data/database> [accessed 13.01.2025].

Between 1995 and 2022, Poland’s R&D sector experienced a systematic increase in employment, nearly tripling in absolute terms and almost doubling in relative terms. Throughout the analyzed period, the employment structure by occupation was dominated by researchers (70% of the total in 2023), followed by technicians (21%). Positive changes, mirroring those observed in R&D sector financing, were also evident in the sectoral employment structure: employment in the enterprise sector increased by 27 percentage points to 50%, while government sector employment decreased by 18 percentage points to just under 2%. Additionally, the higher education sector’s share of R&D specialists remained relatively stable, declining by 10 percentage points to 44% in 2023.

Another measure of a country’s technological competitiveness is the ability of its citizens to generate knowledge, which can be tangibly reflected in patents. In this area of R&D activity, Poland also experienced positive developments during the analyzed period (Figure 4).

Figure 4. Patent applications in Poland in the period 2004–2023* (in absolute and relative terms)



* Data unavailable for 1995–2003.

Source: own study based on: UNCTADstat, <https://unctadstat.unctad.org/datacentre/> [accessed 12.01.2025].

The absolute number of patent applications in Poland during the analyzed period increased more than sevenfold (from 93 applications in 2004 to 671 applications in 2023). This growth was also reflected in relative terms, i.e., Poland’s share of total patent applications in EU countries, which rose by 0.8 percentage points. However, despite this increase, the share in 2023 remained just under 1%. It is worth supplementing this description with additional information of significant relevance for assessing changes in the area of Poland’s international technological competitiveness (Polish Patent Office, 2024):

- Poland ranks seventh among countries affiliated with the European Patent Office (EPO) in terms of the growth rate of patent applications and tenth in the world;
- in 2023, the majority of patent applications from Poland pertained to medical technologies, pharmaceuticals, and civil engineering;
- among the applicants to the EPO, Polish universities and research institutes demonstrate the highest level of activity.

3.3. Policies Supporting Technological Competitiveness

Referring to the last area of Poland's international technological competitiveness assessed in this analysis – supporting policies – it seems appropriate to point to both holistic solutions (1) and those specifically aimed at the country's technological development (2). In the first case, the primary example is the Strategy for Responsible Development, which serves as the main document defining Poland's goals and directions in social, economic, and regional development, with the overarching objective of creating conditions for increasing citizens' incomes while simultaneously enhancing social, economic, and territorial cohesion (Government of the Republic of Poland 1, 2024). Additionally, it is worth mentioning the Productivity Strategy 2030, an update and expansion of earlier strategies, focused on increasing the efficiency and innovativeness of the Polish economy through investments in modern technologies, human capital development, and support for entrepreneurship; the National Smart Specializations, which define priority R&D and innovation areas where Poland has or can achieve competitive advantages, aiming to concentrate resources and actions on key sectors to support the effective use of funds and foster innovation (Government of the Republic of Poland 2, 2024); and the State Science Policy, which sets directions and priorities for the development of science and research in Poland, including knowledge and technology transfer between academia and industry, as well as striving for technological independence through the creation of Polish "know-how" (Government of the Republic of Poland 3, 2024).

In the second case, i.e., with direct reference to the development of innovation in Poland (and consequently its competitive position in this area), it is important to mention certain initiatives implemented both at the national and EU levels. Regarding government (domestic) policies, the key examples are the Program of the Minister of Development and Technology for the Promotion and Development of Innovation and the SMART Pathway. The first program focuses on supporting innovation and promoting new ideas, technologies, and services that address key social, environmental, and economic needs in Poland (Government of the Republic of Poland 4, 2024). The second initiative provides significant financial support for consortia investing in innovative and development projects – entrepreneurs can receive funding of up to PLN 150 million for the implementation of groundbreaking projects (Government of the Republic of Poland 5, 2024).

In the area of EU policies, it is worth mentioning the European Funds for Research, Development, and Innovation, which have played a key role in financing national R&D activities since Poland joined the EU – during 2004–2021, R&D expenditures in Poland increased by over 624%, reaching 1,44% of GDP (Polish Agency for Enterprise Development 1, 2025). Another example is the European Funds for the Modern Economy Program, which introduced new forms of support for business innovation, with a budget of up to PLN 4 billion allocated to R&D and production activities (Polish Agency for Enterprise Development 2, 2025). Thanks to the synergy of these initiatives, Poland has the opportunity to achieve dynamic growth in its innovation capacity and, consequently, its international technological competitiveness.

4. Discussion

The period 1990–2004 was a time of intensive systemic transformations and dynamic economic growth for the Polish economy. The foundation of these changes was a set of groundbreaking institutional reforms prepared in the autumn of 1989, aimed at eliminating the negative effects of a centrally planned economy. An additional confirmation of the country's credibility as a candidate for a free-market, competitive economy was the signing, on 19 September 1989, of an agreement with the European Communities regulating trade and economic relations between the parties. This marked the beginning of a process—lasting just under 15 years—that ultimately led to Poland's integration into European structures. This process strongly stimulated changes in the structure of the Polish economy and, consequently, its international competitiveness.

The category of a country's international economic competitiveness is a complex and multidimensional concept, lacking a single, universally accepted definition. The reasons for this are

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certainly numerous; however, among the most frequently cited in the literature (cf. Wziątek-Kubiak, 2004; Żmuda, Molendowski, 2016; Pilarska, 2017) are primarily the following:

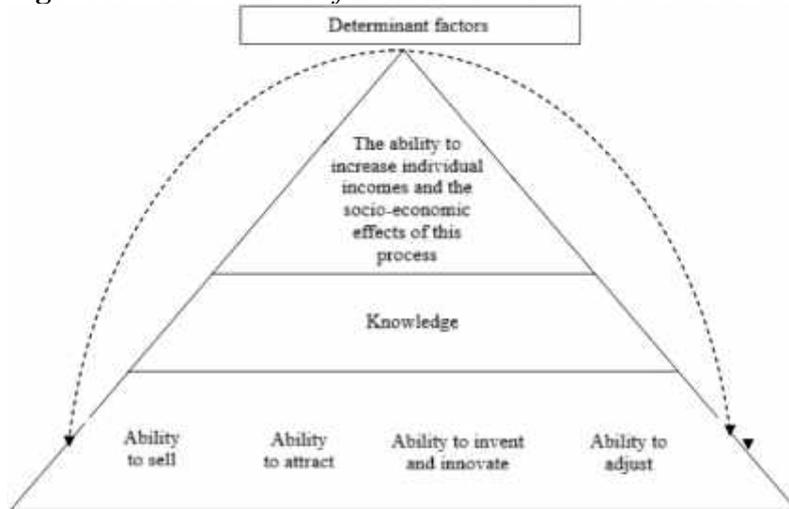
- the aforementioned multiplicity of competitiveness dimensions – encompassing economic aspects (e.g., productivity, exports), social aspects (e.g., standard of living, human capital), and technological aspects (e.g., innovation, capacity to adapt to changes);
- the diversity of theoretical approaches – researchers emphasize different elements of competitiveness, such as the ability to generate economic growth, investment attractiveness, or institutional efficiency;
- the unique characteristics of national economies – distinctive features arising from natural resources, industrial structure, technological level, or economic policy, which make it difficult to apply a single measure across all countries;
- difficulties in obtaining and interpreting relevant statistical data – measuring competitiveness involves numerous indicators, such as GDP per capita, R&D expenditures, trade balance, or level of innovation, whose precise measurement can be challenging due to methodological reasons.

Such a situation implies both the multiplicity of ways to measure a country's international competitiveness and the difficulty of formulating a single, synthetic indicator that would significantly facilitate comparisons between selected countries (cf. Mostowska, 2024, p. 68). However, it is possible to measure certain constituent elements of this competitiveness, and the basis for both identifying and applying specific measures lies in the model-based solutions systematized in the literature.

Taking into account the specificity of the Polish economy (especially during the period analyzed in this study, covering the years of economic transformation), it seems appropriate to refer to the model proposed by K. Akamatsu, which relates the economic development of a country (and thus its competitiveness) to its “openness” in foreign economic relations. According to the author, a key factor supporting economic growth is the transfer of technology. This process primarily occurs through the activities of transnational corporations, which introduce technologies via foreign investments, as well as through the export of technologically advanced products. The diffusion of technology improves the efficiency of other production resources, enabling higher levels of economic development and increasing national competitiveness. However, this model requires certain conditions to be met. Critical importance is placed on economic policies based on the liberalization of international trade, openness to foreign capital inflows, and support for exports (cf. Bożyk, Misala, Puławski, 2002). An extension of these considerations was presented by T. Ozawa, who developed the theory of dynamic comparative advantages based on M. Porter's model, describing four stages of economic development for countries. In the initial stage, based on production factors, political stability, market liberalization, and attraction of foreign investments are crucial. Economies at this stage focus on simple products, relying on technology imported from more developed countries, and their enterprises compete mainly on price and basic production processes. The next, investment-driven phase requires modernization of infrastructure and regulations to support greater integration with global markets. At this stage, firms improve production efficiency, enhance imported technologies, and participate in international value chains, although the economy remains vulnerable to crises arising from dependence on foreign capital. The transition to the innovation stage requires an active government role, support for research and development, higher education, and modern capital markets. Firms become more flexible and networked, investing in employee skill development and creating industrial clusters that promote competitiveness and globally significant innovation. However, as with many economies, challenges arise during transitions between stages, often leading to stagnation. The key challenge is understanding the need for adjustments in market organization, government policies, and business practices, which often constitutes a barrier to further economic growth (Ozawa, 1992, p. 27-54). These patterns could be observed (and can still be observed) in the case of the Polish economy..

Determinants of economic growth and development, such as technological progress, human capital, investment, and knowledge diffusion, directly influence a country's ability to compete in international markets and, consequently, to build its international competitiveness. The concept of "capability" appears crucial in this context, especially when considering one of the frequently presented models of determinants of national international competitiveness along with their indicators (Figure 5).

Figure 5. *Determinants of a nation's international economic competitiveness*



Source: Misala, 2014, p. 8.

One of the areas determining a country's international competitiveness is its capacity for invention and innovation, which shapes the country's competitive position in the technological sphere. Key indicators include the analysis of competitive standing in trade of technology-intensive goods, expenditures on science and research (both in absolute terms and relative to GDP) and their structure, the size and structure of employment in the research and development sector, as well as absolute and relative numbers of patent applications along with their structure. Analyzing changes in these indicators over time can provide insights into the direction of a country's technological international competitiveness.

The results of the analysis conducted in this study provide grounds for concluding an improvement in Poland's international technological competitiveness, which is reflected mainly through:

- a systematic increase in the volume of trade in technology-intensive goods, as well as their share in the overall structure of the country's exports (25% in 2023);
- the dominance of hard-to-imitate goods in the composition of technology-intensive trade throughout the analyzed period, and in the last year of the analysis – recording a positive trade balance (USD 4,9 billion);
- a systematic increase in the share of Poland's trade in technology-intensive goods within the EU's corresponding trade (4,8% for imports and 4,2% for exports in 2023);
- an increase in the number of categories of technology-intensive goods in which the country holds a revealed comparative advantage (two additional categories compared to 1995);
- a systematic increase in expenditures on research and development activities (from 0,6% to 1,5% of GDP) and changes in their structure (an increase in the share of enterprises and higher education at the expense of the government sector, indicating the development of the innovation ecosystem, greater efficiency of spending, and reduced dependence on public funds);

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- a threefold increase in employment in the R&D sector in absolute terms and an almost twofold increase in relative terms; in 2023, the dominant group in the employment structure were scientific researchers (70%), followed by technicians (21%); changes also affected economic sectors: employment in the business sector increased to 50% (+27 percentage points), while in the government sector it fell to just under 2% (-18 percentage points);
- more than a sevenfold increase in the number of patent applications and a corresponding rise in their share of total EU patent applications (reaching 1%); Poland ranks 7th among EPO member countries in terms of growth dynamics of patent filings and 10th globally; in 2023, most applications concerned medical technologies, pharmaceuticals, and civil engineering, with the highest activity observed among Polish universities and research institutes.

In addition, it is important to mention the policies supporting Poland's international technological competitiveness, encompassing both a holistic approach and actions specifically aimed at technological development. Key documents include the Strategy for Responsible Development (supporting cohesion and economic growth), the Productivity Strategy 2030 (focusing on innovation and modern technologies), the National Smart Specializations (which define priority research areas), and the National Science Policy (promoting knowledge transfer and technological independence). At the national level, notable initiatives are the Minister of Development and Technology's Program supporting new technologies and the SMART Path, offering significant funding for innovative projects. At the EU level, the European Funds for R&D, which have significantly increased innovation funding since 2004, and the European Funds for a Modern Economy Program, with a budget of PLN 4 billion for research and development, are key. The synergy of these initiatives has contributed (and likely continues to contribute) to the dynamic growth of Poland's innovation and international technological competitiveness.

However, there are still barriers that may limit the full potential of the country's technological development. Among the most significant are: (1) dependence on public funding (although Poland has increased its R&D expenditures, a high reliance on public resources remains, which may limit the efficiency of innovative projects), (2) difficulties in commercializing innovations (despite the growing number of patent applications, effectively bringing innovations to market and utilizing them in the private sector remains a challenge), and (3) insufficiently developed collaboration between science and industry (there is a need for closer cooperation between academic institutions and businesses, which would facilitate better implementation of new technologies)..

In light of the above, for Poland to maintain and further develop its technological competitiveness in the future, continued reforms and support for innovation are essential. The key recommendations include: (1) increasing private investment in R&D, primarily through tax incentives and other forms of encouragement; (2) enhancing public-private collaboration between universities, research institutes, and the private sector to accelerate the commercialization of innovations and strengthen knowledge transfer; (3) supporting the start-up sector and innovative enterprises by creating a favorable ecosystem, including easier access to financing and fostering international cooperation; and (4) focusing on areas critical for the future—particularly investing in technologies related to digital transformation, artificial intelligence, biotechnology, and green energy, as these will be pivotal for the country's international competitiveness.

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PARADIGMS OF PUBLIC ADMINISTRATION: CONFIGURATIONS OF THE FIELD IN OUR TIME

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Abstract: Public Administration has evolved from a relatively narrow, state-centric administrative craft into a multi-paradigmatic field drawing on economics, sociology, psychology, and governance studies. Building on Nicholas Henry's classic notion of paradigms in public administration, this article reviews how contemporary public administration science is structured around several partially competing, partially complementary paradigms, including Traditional Public Administration, New Public Management, New Public Governance, the New Public Service, public value, and digital era-oriented approaches, and Behavioral Public Administration. Using a narrative literature review, it examines their core assumptions regarding the role of the state, the image of the citizen, dominant values, and preferred instruments. The discussion shows that, rather than a linear replacement of one paradigm by another, current public administration is characterized by hybridization and contextual variation across countries and levels of government. The conclusion makes the case that this multi-paradigmatic situation is likely to continue and that future studies should concentrate on how many paradigms are selectively merged in reality, particularly in non-Western contexts and in times of polycrisis and digital transition.

Keywords: *Paradigms of Public Administration, Concept of Paradigm, Paradigms and the Evolution of Public Administration, Contemporary Paradigms of Public Administration Science*

1. INTRODUCTION

This research focused on the concept of paradigm in general and on the phases of development of the paradigms of public administration science to the present time. Chalmers defined a paradigm as "Made up of the general theoretical assumptions and laws, and techniques for their application that the members of a particular scientific community adopt" (Chalmers, 1982, p. 8). Public Administration is the discipline that studies how the public sector serves the public good through developing and implementing public policies and what is needed to conduct this business in an efficient, compelling, legitimate, and rational way to optimize serving the public good" (De Vries, 2016, p. 6). The science of public administration emerged significantly at the beginning of the twentieth century through many thinkers and researchers presenting research and studies that contributed substantially to the development of this science and the spread of its theories to be the basis on which students in universities, as well as leaders and officials in countries around the world, are taught. Some of the most prominent authors who wrote about the science of management were Frederick Taylor (*The Principles of Scientific Management*, 1911), Henry Fayol (*Administration Industrielle et Générale*, 1916), Gulick and Urwick, published their *Papers on the Science of Administration*, resulting in the still famous POSDCORB (planning, organizing, staffing, directing, coordinating, reporting, budgeting) acronym 1937; and Max Weber who wrote about bureaucracy (Bouckaert, 2022:1).

Public Administration has focused on how government might be set up and run to achieve public goals since the late nineteenth century. Early research by Weber (1978/1922), White (1926), and Goodnow (1900) centered the field on issues of hierarchy, legality, and efficiency. Over time, however, the field has experienced recurrent phases of self-reflection and redefinition (Goodnow, 1900).

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Nicholas Henry's influential 1975 article "Paradigms of Public Administration" conceptualized the evolution of the American field as a succession of paradigms defined by changing "locus" (where public administration is located institutionally) and "focus" (what it primarily studies). His analysis suggested that the discipline periodically reorganizes itself around new combinations of organizational theory, management science, and conceptions of the public interest (Henry, 1975).

Henry's usage of the term "paradigm" was subtly influenced by the larger philosophy of science literature, particularly Thomas Kuhn's idea that, up until "paradigm shifts" take place, scientific societies function within common frameworks of issues, ideas, and procedures. Such paradigm shifts in public administration seldom adhere to Kuhn's rigid incommensurable model. Instead, older approaches tend to persist alongside newer ones, creating a layered and sometimes contradictory reality (Shapere, 1964).

The primary aim of this paper is to analyze the paradigms that structure public administration sciences in our time. It addresses three guiding questions:

A. What are the main paradigms that currently shape public administration research and practice?

B. How do these paradigms differ in their views of the state, citizens, administrative values, and preferred instruments?

C. What are the implications of a multi-paradigmatic field for future research and practice?

D. How the Paradigms Shape Methods and Findings in Public Administration Research?

The paper proceeds as follows to address these questions. The literature on paradigms in public administration is reviewed in the following section, with a focus on modern methods. The process, which is based on a narrative literature review, is described in Part 3. A comparative analysis of the identified paradigms is presented in Part 4. Implications and recommendations for additional research are included in Part 5's conclusion.

2. Literature Review

The Phases Progress of Paradigms and the evolution of public administration in Public Administration Science:

2.1 Paradigms and the Evolution of Public Administration

A. The Policy/Administration Dualism(1900-1926)

At the beginning of the twentieth century, the question was whether public administration was part of political science or an independent field with its own theories and concepts. In the book "Politics and Administration," by the American writers Frank J. Goodnow and Leonard D. White, published in 1900, they specified that politics are expressions of the will of the state, while administration concerns the implementation of those policies. In addition, the authors explained that there is a separation of powers between the legislative and executive branches, with the judiciary assisting the legislature. According to Goodnow and his colleagues, public administration is situated within the bureaucracy, but in academia it is seen as a natural subfield of political science (Goodnow, 1900:10-11). At the same time, the administration implements policies in a neutral and non-political manner. The first paradigm of public administration focused on the place it should occupy within the government bureaucracy and at the center of government. Therefore, a problem, "The policy/administration Dualism," emerged among academics and practitioners in that period (Henry, 1975:378-386).

B. The Principles of Public Administration(1927-1937)

In the second paradigm, a new trend emerged: the scientific principles of public administration, with administrators as the experts in applying them. The American writer F.W. Willoughby explained this in his 1927 book "Principles of Public Administration". In the thirties and forties of the last century, management experts were in demand by industrial companies and the government for their administrative expertise. Public administrators were in great demand in both the public and private sectors. Therefore, the second paradigm of public administration focuses on scientific princi-

ples because their application concerns the organization of human work and can be studied as a state-of-the-art, free of political or constitutional issues. It appeared clearly in the writings of Luther H. Gulick and Lyndall Urwick's Papers in 1937 through an inductive study to determine its connection to the human element (Gulick & Urwick, 1937:49). In the period extending between the late thirties and the beginning of the fifties of the last century, many scholars specializing in administration wrote about the conceptual framework of the science of public administration to define its form. The major challenge was that politics could not be separated from administration and that the administration's principles needed to be more consistent and logical. However, the theory was criticized in the 1940s primarily for ignoring the environment in which public administration is practiced. According to Henry, two criticisms were made: first, that politics and administration could not be separated, and second, that the tenets of administration were illogical. Simon went on to demonstrate in 1947 that there was a counter-principle to every advanced principle, making the concept of principles debatable (Henry, 1975: 378-386).

C. Public Administration As Political Science(1950-1970)

In the 1950s, scholars tended to reconceive Public Administration as a department affiliated with Political Science, focusing on government bureaucracy, personnel management, and budgets. Scholars have been returning to the birthplace of public administration in this period. Public administration was merely a field of study or possibly a synonym for political science; particularly in America, interest in public administration declined (Henry, 1975:378-386). This generation of academics questioned Wilson's theories on the separation of politics and public administration, relativizing the distinction between the two fields (Thornhill, 2006).

D. Public Administration As Administrative Science (1956-1970)

In this paradigm, the idea was discussed that public administration is specific to organization theory and management science. That administration is administration in any institutional environment and provides the expertise and technical specialization required. Still, the problem in this paradigm is that public administration loses its identity and is reduced to a focus rather than a place. The problem with this idea is that the administrative sciences track, in that public administration shares a methodology with specific characteristics and patterns that make it difficult to choose it as a branch of political science or administrative sciences. Another area for improvement in this paradigm is the distinction between public administration and business administration. The conceptual dilemma increases the complexity of the empirical definition from an academic perspective, making it difficult to determine the nature of the institutional dimension. After all, public organizations are related to the political system. As for the normative dimension, it defines the highest value of public interest and is a fundamental pillar of the science of public administration. In contrast, the administrative sciences focus on matters other than public affairs and analyze them in this way. Therefore, this "Organization/Administration" theory received little support in political science because of the blurring of the line between private and public (Henry, 1975: 378-386).

2.2. Contemporary Paradigms: From Management to Governance and Behavior

A. Public Administration As Public Administration(1970-1980)

The distinct division between the public and private sectors was established in the 1970s. The academics identified a distinctive cognitive approach in public administration, grounded in organizational theory and management science, to create a stand-alone educational system. This development sets public administration apart from the political science and business administration departments. It is likely to foster the field's expansion, especially now that it is starting to garner significant recognition and attention, which is enough justification for its independence. Since the early seventies, universities have begun to study it as an independent specialty, free from the burden of political science and administrative science, based on a concept of methodologies that combines the terms public interest and bureaucracy to form separate academic units institutionally. This institutional trend

demonstrates that public administration has taken an educational path that distinguishes between what is "specialized" and what is "institutional," indicating the presence of intellectual maturity that confirms the identity of public administration and its independence as a science with clear foundations, principles, and methodologies. Henry called this phase in the progress of the public administration paradigm "Institutionalizing Paradigm: Toward Curricular Autonomy" (Henry, 1975: 378-386).

B. Paradigm of New Public Management (NPM) (1990-2000)

The emergence of the term new public administration dates back to the late seventies and early eighties. The first application of this term in Britain was during the period of Prime Minister Margaret Thatcher. It applied in municipalities in the United States of America, in California and some other states, which suffered greatly from the economic recession and the harshness of taxes. It has also been applied in governments. New Zealand and Australia. This success led many countries to include the new public administration on their administrative reform agendas. The researchers then started by defining the traits. The term "New Public Management" was used to refer to public reform. This paradigm is not the same as traditional management, which is criticized for its bureaucratic difficulties, restricted ideology, inefficiency, and welfare state. The new public administration model is moving towards neoliberalism, which prioritizes the private sector and market competition in delivering services. New Public Management is a method that has previously been used successfully in the private sector and has proven its effectiveness, as it focuses on changing the organization's culture so that the customer is the core concern of the organization's management (Abullraheem, 2018:1).

NPM is known to employ a variety of tenets and tactics. The downsizing strategy is the first. This principle, which calls for a reduction in the volume of public administration, holds that a new management strategy should be developed by reducing public administration costs, increasing management's efficiency, and broadening management's responsibilities. Furthermore, NPM promotes the development of a new management culture that emphasizes adaptability, creativity, problem-solving, entrepreneurship, and productivity. This new approach also enables tailoring the business management ideology to the needs of public administration. It suggests introducing specific evaluation components, such as efficiency measurement and performance management, to incorporate private-sector production and service applications into public institutions. Another approach supports the following ideas and tactics: applying the logic of entrepreneurial management to public administration, localizing, decreasing bureaucracy, privatizing, transferring authority, becoming flexible, enhancing human resource management, using information technology, and formulating a competitive strategy (Weikart, 2001:380). The New Public Management paradigm emphasizes the need to move towards market mechanisms, which contributes. In the presence of competition, the efficiency and quality of government services to citizens must be improved. In his book "Reinventing Government", published in 1993, writer David Osborne emphasized that the role of government is determined by "Entrepreneurial governments are catalytic, competitive, mission-driven, results-oriented, customer-driven, and enterprising. The other four principles are equally commonsensical. Decentralization means empowering employees and pushing decisions down from one level of government to another. Community-owned government pushes control out of bureaucracy and into the community. Anticipatory government stresses prevention rather than cure. Finally, market-driven government explores the idea of changing markets rather than always using public programs to solve problems" (Osborne, 1993:356). Despite the advantages of the new public administration paradigm, many criticisms are directed at NPM. The NPM was first criticized on economic grounds. Terrorism and global warming are problems that neither private nor public entities can tackle on their own, notwithstanding the seeming economic efficiency of public administration. As a result, it attacks a broader social context and, consistent with the new paradigm of public administration, views citizens as more than just clients. Setting precise, stable, prioritized, limited, and clear targets for public service delivery is challenging.

Additionally, it is challenging to quantify public service performance and highlight public service profitability. It is acknowledged that the strategies the private sector uses to deliver public services are occasionally appropriated. But if these methods are applied without considering the public, they will fail and face harsh criticism. The use of organizational behavior and employees' sociopsychological status in private sector performance management techniques is another critique levelled at the new public management system. These criticisms, which can be categorized as New Taylorism, contend that Taylor still represents the NPM in his understanding of what he refers to as the optimal method for carrying out a task (Hughes, 1998).

The argument that private-sector management is inappropriate in public institutions is the second main critique of the NPM method. Another critique is that, as long as there is a chance of politicization in public administration and this persists, the NPM idea cannot be fully implemented. These criticisms have significantly influenced the reduction in the size of the public sector and the shift in management perspectives. Similarly, proponents of neoliberalism said that less government and a greater emphasis on the market would have the opposite effect, restricting the expansion and autonomy of the state. The most crucial criticism of the NPM is that it views public servants as impartial individuals who avoid the political aspirations that benefit politicians. The sphere of public administration is no longer under the control of politicians and senior public bureaucrats; it is believed that NPM is the cause of functional fragmentation and privatization in public services. Theoretically, NPM proponents cannot act in concert with practice. Consequently, several novel methodologies have been created to address the theoretical shortcomings of the NPM approach and its limited applicability in real-world scenarios or as a substitute for NPM (Islam, 2015:149).

NPM has the potential to erode moral principles, breed corruption, and promote managerial autonomy, thereby muddying accountability and raising the possibility that public managers may be corrupt. The most striking objection to date is that, while the NPM reform paradigm was developed in a few wealthy nations, its application in less developed nations may be limited by differences in political cultures, practices, and other environmental factors. Developing country governments may need the requisite experience or have faulty information systems. Hence, the NPM is not appropriate for them. Developing countries need the means or managerial expertise to implement complex NPM changes. The decentralization of the NPM concept has spread from wealthy to developing nations, while centralized decision-making is still frequently utilized by developing nation governments. Prominent public managers retain the power to decide everything within their companies (Polidano, 1999:35). This concentrated decision-making process may pressure people to act arbitrarily or corruptly (World Bank, 1997).

C. Post-New Public Management Paradigm

Since the 2000s, the New Public Administration paradigm has been subject to significant criticism. A complicated, diversified, contradictory, and hybrid situation is on the agenda of the public administration major rather than a best-method approach, because different reform approaches coincide in this subject. The New Public Management approach has faced harsh criticism. Some researchers considered (NPM) to be "dead" (De Vries, 2010, p. 1). The term "Post-New Public Management" (Post-NPM) is used to characterize this paradigm change in public administration. An umbrella term (Post-NPM) combines disparate, even incompatible principles, beliefs, norms, and reform ideas. The private sector's logic, the customer's point of view, ambiguous conditions, the understanding of the market and competition, and the social context are the primary criticisms levelled at the (NPM) method (Karataş, 2019).

Post-NPM has many tendencies that impact the public administration field, such as:

- The trend of the Post-NPM approach calls for the regular use of IT, communication, and e-government tools to promote public sector transparency and guarantee citizen access and participation (Dunleavy, et al. 2006:480).

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- Post-NPM has a propensity to forge alliances and partnerships. Public institutions should cultivate diverse collaboration, cooperation, and stakeholder ties with the private and third sectors (NGOs) (Christensen & Lægheid, 2008, p. 25).
- The administrative inclination of Post-NPM is its support for creating, managing, and applying networks to generate and provide public services (Lodg & Gill, 2011, p. 160).
- The Post-NPM paradigm focuses on creating a more efficient accountability system, which citizens and the state can accomplish more skillfully using political and administrative controls. It promotes the idea that public administration should become more sensitive to and accountable to the public. Post-NPM trends include professionalizing and appreciating state employees, establishing a robust public bureaucracy, and creating a socially conscious, interdisciplinary bureaucracy. (Cavalcante, 2018).
- The Post-NPM trends in establishing public policy encourage community involvement in public administration as a source of legitimacy and value while also widening social participation channels (Pierre & Ingraham, 2010).
- Similar to the New Public Governance concept, citizens must be involved as stakeholders in creating and administering public services as well as in exercising public scrutiny via political channels. Consequently, it should be acknowledged that the citizen is more than just a client, given their democratic rights. In conclusion, a return to Weberian bureaucracy is not the primary objective of Post-NPM, despite some studies that emphasize a return to hierarchy. In actuality, this circumstance is merely comparable. Nevertheless, even though the Post-NPM approach is of academic interest, more research and development are still needed before it can be used as a general public administration theory, despite these assessments and examples from different nations (Reiter & Klenk, 2019).

D. New Public Governance Paradigm

Public administration is playing a new role in enhancing overall governance in response to challenges of survival, progress, change, and pressures across the local, national, regional, and international arenas. The primary obstacle facing governance in the coming years will be to develop a new social structure that goes beyond the current framework and moves towards a more natural and inclusive relationship among the functions of the state, the corporate sector, and civil society. A new public service model, "New Public Governance," or "NPG," was introduced in response to the changing environment. Its features include the centralization of power, the expansion of the number, function, and influence of partisan-political staff, the personalization of senior public service appointments, and the presumption that the public service is promiscuously partisan for the ruling party. NPM and governance approaches must address the intricate realities of 21st-century public service delivery, design, and management. Finally, an integrated body of knowledge about the NPG is needed to develop NPG as a conceptualization of public policy implementation and public service management. Understanding the execution of public policy and the provision of public services is complex. This method allows for a more thorough and integrated approach to the study and practice of public policy implementation and public service delivery, moving beyond the sterile dichotomy of "administration vs. management". According to some earlier authors, public administration should be an integrated science that draws on other fields while preserving those fields' unique identities (Osborne, 2010).

E. Public Administration As E-governance

The new direction for the public administration paradigm is represented by e-governance, especially given the significant development of the information and communications technology sector. E-governance is characterized by coordination among the government, citizens, stakeholders, and companies, as well as by planning, drafting, and implementing decisions and processes related to management challenges (Misuraca, 2007). E-governance has also become more established and cannot be dispensed with in government work. Despite the growing importance of the e-governance

model, a digital gap persists in the interaction between the government and citizens. Therefore, governments seek to enhance communication by using government websites and social media to reduce this gap and increase reliance on information technology in their interactions with citizens (Mukonza, 2014: 500).

F. Behavioral Public Administration

More recently, Behavioral Public Administration (BPA) has emerged as an explicitly micro-level paradigm that integrates public administration with psychology and behavioral economics. Grimmelikhuijsen defines BPA as the analysis of public administration from the perspective of individual behavior and attitudes, using experimental and quasi-experimental methods. BPA focuses on how cognitive biases, heuristics, and social norms influence public managers, street-level bureaucrats, and citizens. It has informed the design of "nudges," transparency initiatives, and behavioral interventions aimed at improving compliance, trust, and service uptake. At the same time, it raises normative questions about paternalism, consent, and the limits of technocratic expertise (Grimmelikhuijsen et al, 2017).

G. Neo-Weberian State Paradigm

(NWS) continued to be an essential ideal type, at least for Western European practice, as ingrained in Weberian public administration (PA). Whether NWS is resilient and sustainable in redefining and reevaluating "bureaucracy" in the twenty-first century is a theoretical and empirical question. This contribution argues that public sector reforms in the second half of the 20th century gave rise to the first empirical observation of neo-Weberian public administration, at least in continental Europe. It was then "upgraded" to an NWS ideal type model for theoretical reasons. Within the hierarchy-market-network space, NWS operates as a hierarchy-driven system. After that, this hierarchy-based NWS switched to a normative reform model. It is also claimed and assumed in this contribution that, in contrast to NPM (market-driven) and NPG (network-driven), NWS will make sure the three core functions of a whole-of-government strategy within an entire society context are inclusive and equitable service delivery, resilient crisis governance, and effective government and society innovation. The foundations of the modern ideal type are the uniqueness of public services and the requirement to fortify rather than weaken or dilute the state. The perfect type is in two Neo-Weberian States (NWS) variations. The first emphasizes the need for professional, performance-oriented management, on the assumption that public servants are often full of initiative and will improve their operations once freed from heavy bureaucratic regulation at higher levels of the traditional hierarchy (Bouckaert, 2022).

In contrast, the second emphasizes that involving citizens and service users in various participatory processes is the most effective way to modernize. It places greater trust in the influence of civil society from the "bottom up," while the first variant is more focused on reducing regulation from the "top down". In summary, Bouckaert found that the 'hierarchy' driving principle leads to a Weberian state at first and then to a neo-Weberian state (NWS). Second, New Public Management (NPM) is the outcome of the guiding concept of "market". Third, New Public Governance (NPG) is the outcome of the guiding concept of "networks". This working paper's central premise is that, compared to NPM and NPG, NWS is far better at guaranteeing and integrating equitable and inclusive performance with resilience and sustainability. The terms "crisis governance," "innovation," and "service delivery." Because of this, (NWS) as the "pure" or ideal type seems to materialize and evolve into a desirable model of reform and governance, which is necessary for the long run from the perspective of the entire society (Bouckaert, 2022).

3 . The Paradigms and How it Shape Methods and Findings in Public Administration Research:

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In public administration (PA), a research paradigm is a worldview that connects particular designs and analytical choices to ontological and epistemological assumptions. Choosing between positivism, constructivism, and pragmatism influences the questions you ask, the evidence you believe to be trustworthy, the rigor criteria you use, and ultimately the kinds of answers you can defend. Because these worldviews influence the choice of strategies (e.g., experiments, ethnographies, mixed methods) and particular methods (e.g., instruments, interviews, integration procedures), scholars are encouraged to make them explicit in commonly used design frameworks. Research paradigms are significant because they serve as the intellectual foundation for a research undertaking. Research paradigms shape how various academic disciplines, such as the sciences and the humanities, conduct their research. An acceptable approach can be selected after a research philosophy has been established. Knowing the philosophical underpinnings of your research can also help you do better in any analysis you may need to do, and your research will be of higher quality. Ontology, epistemology, and research methods make up a research paradigm (Creswell & Creswell, 2018).

Research philosophy consists of ontological and epistemological considerations. A research paradigm results from combining research methodology and research philosophy. There are three examples of research paradigms:

3.1 Positivism

It refers to the fact that there is just one reality that can be quantified and comprehended. It makes use of quantitative technique study. A theory established via positivism can be verified or disproven by statistical data analysis. Positivism frequently looks at whether a relationship exists between two variables rather than concentrating on the source of a correlation. Since reality exists but is poorly understood, post-positivism aligns positivist research with critical realism, which maintains that objectivity is a regulatory ideal realized through design elements such as controls and critical community examination. In terms of methodology, experimental and quasi-experimental designs, hypothesis testing, replication, and triangulation, also known as "Critical Multiplism," are highlighted (Guba & Lincoln, 1994). Typical outcomes include generalizable estimates (e.g., program effects on service delivery or citizen outcomes) and theory testing of causal mechanisms in administrative contexts. (Cook et al., 2002).

3.2 Constructivists

There are several realities rather than a single reality or truth. They commit themselves to deciphering and analyzing the significance of an action. Because of this, constructivists frequently employ qualitative research techniques that offer multiple viewpoints, such as case studies and interviews (Proofed 2022:1-5). Constructivism holds that social reality is multifaceted, context-dependent, and jointly created by researchers and actors; methods are dialogic and hermeneutical; and epistemology is transactional/subjectivist. Typical results highlight plausibility, coherence, and utility in similar contexts; contextually rich explanations of administrative practice, the logics of actors' views, and how policies gain meaning in situ (Lincoln & Guba, 1985).

3.3 Pragmatists

The new and unpredictable circumstances constantly shape how reality is understood and renegotiated. As a result, the research question itself determines the philosophy they use. In a single research project, pragmatics frequently integrates constructivist and positivist ideas, employing qualitative and quantitative methodologies to examine various aspects of a research problem (Proofed 2022:1-5). Typical outcomes combine stakeholder insights with effect estimates and provide managers and policymakers with helpful information (e.g., whether an invention "works," for whom, and under what circumstances). (Mele & Belardinelli, 2019).

4. Methodology

4.1. Research design

This study adopts a qualitative, interpretive research design based on a narrative literature review. The objective is not to provide an exhaustive, systematic review of all publications in public administration, but to synthesize representative and influential works that define and elaborate on key paradigms.

Following guidelines for narrative reviews in social sciences, the approach privileges conceptual depth and historical contextualization over exhaustive coverage. The article therefore focuses on “classic” contributions (e.g., Henry, Hood, Moore, Denhardt & Denhardt) and widely cited recent works (e.g., Grimmelikhuijsen et al., Dunleavy et al.) that are recognized as shaping contemporary debates.

4.2. Data Sources and Selection

Sources were identified through a combination of:

- Keyword searches in academic databases and publishers’ platforms (e.g., “paradigms of public administration,” “New Public Management,” “New Public Governance,” “New Public Service,” “public value,” “digital-era governance,” “behavioral public administration”),
- Backward and forward citation tracking of seminal works, and consultation of reference textbooks and comparative reform studies.

The selection criteria emphasized:

A . Conceptual clarity in articulating a paradigm or framework.

B . Substantial influence, operationalized through citation counts and presence in subsequent debates.

C . Coverage of different regions and administrative traditions, where possible. The analysis is limited to published secondary literature and does not involve original empirical data collection.

4.3. Analytical Framework

To compare paradigms, an analytical framework was constructed around four dimensions, derived from Henry’s locus/focus distinction and contemporary governance scholarship:

A . Role of the State and Locus of Administration (hierarchy, market, network, digital platform).

B . Image of the Citizen (subject, client/customer, partner/co-producer, democratic citizen, behavioral decision-maker).

C . Core Administrative Values (legality, efficiency, effectiveness, responsiveness, equity, participation, public value).

D . Dominant Instruments and Knowledge Base (rules and procedures, performance management, contracting and competition, networks and partnerships, deliberative practices, data analytics, behavioral interventions) (Henry,1975).

5. Discussion: Comparing Contemporary Paradigms

5.1. Role of the State and Governance Modes

Traditional Public Administration conceives the state as a sovereign authority exercising hierarchical control through a professional bureaucracy. Weberian legality and formal rules ensure predictability and equal treatment (Weber, 1978).

New Public Management partially de-centers the state by introducing market-like mechanisms and quasi-autonomous agencies. The state becomes a purchaser and regulator rather than a direct provider, with competition and contracts as key mechanisms for coordination (Hood, 1991).

New Public Governance moves further toward a polycentric view of the state embedded in networks of public, private, and civil society actors. The state steers, negotiates, and facilitates rather than commands or buys services(Osborne, 2006).

The New Public Service and public value approaches re-emphasize the state as a guarantor of democratic processes and collective values, but do so within a context that acknowledges networks and partnerships (Denhardt & Denhardt, 2000). Digital-era governance highlights how states increasingly act as platforms, providing digital infrastructures that enable other actors to transact and co-produce services (Dunleavy et al., 2006).

Behavioral Public Administration, while less explicit about macro-structures, generally takes existing institutional settings as given and concentrates on micro-level behavior within them. In practice, BPA tools (e.g., nudges) can be applied within hierarchical, market-based, or networked governance arrangements (Grimmelikhuijsen et al., 2017).

5.2. Image of the Citizen

Each paradigm constructs a characteristic image of the citizen:

- **TPA:** Citizens are rights-bearing subjects and beneficiaries who are entitled to equal treatment under the law.
- **NPM:** Citizens are customers whose preferences should be satisfied through choice, competition, and service quality (Hood, 1991).
- **NPG:** Citizens are stakeholders and partners engaged in collaborative governance and co-production (Osborne, 2006).
- **NPS:** Citizens are democratic owners of the polity, whose voices should shape the definition of the public interest; the emphasis is on citizenship rather than consumption (Denhardt & Denhardt, 2000).
- **Public Value/DEG:** Citizens are both co-producers and evaluators of public value, often interacting with government via digital channels and performance platforms (Moore, 1995).
- **BPA:** Citizens are boundedly rational decision-makers whose behavior is shaped by cognitive and contextual factors; policy design must account for these regularities (Grimmelikhuijsen et al., 2017).

These different images have implications for the design of participation mechanisms, accountability structures, and service delivery channels. For example, customer-oriented reforms may prioritize satisfaction surveys and service charters, whereas NPS-inspired reforms emphasize deliberative forums and co-governance arrangements.

5.3. Core Administrative Values

The paradigms also differ in their dominant values:

- **TPA** prioritizes legality, neutrality, and procedural fairness.
- **NPM** elevates efficiency, performance, and fiscal discipline (Hood, 1991).
- **NPG** emphasizes collaboration, trust, and the capacity to manage interdependence (Osborne, 2006).
- **NPS** stresses democratic participation, social equity, and serving rather than steering (Denhardt, R., & Denhardt, J., 2000).
- **Public value/DEG** focuses on substantive outcomes and collectively valued results, often measured through performance indicators and citizen feedback (Moore, 1995).
- **BPA** values effectiveness and evidence-based design, assessed through rigorous empirical methods such as experiments (Grimmelikhuijsen et al., 2017).

In practice, public organizations must often balance several of these values simultaneously, for instance, ensuring due process (TPA) while meeting performance targets (NPM) and engaging stakeholders (NPG/NPS). Conflicts among values (e.g., efficiency vs. equity) are a central theme in contemporary research.

5.4. Instruments and Knowledge Bases

Traditional public administration relies on instruments such as laws, regulations, standardized procedures, and hierarchical supervision, supported by legal and organizational theory (Weber, 1978).

NPM introduced performance measurement, management by objectives, contracting-out, and quasi-markets, drawing heavily on economics and management science (Hood, 1991).

NPG and NPS favor tools for network and partnership management, collaborative planning, and public deliberation, informed by governance theory, policy networks, and democratic theory (Osborne, 2006).

Public value and DEG stress strategic management, cross-boundary coordination, and digital tools such as integrated platforms, open data, and user-centered design (Moore, 1995). Behavioral Public Administration adds experimental methods, randomized controlled trials, and psychologically informed interventions to this toolbox (Grimmelikhuijsen et al., 2017).

5.5. Coexistence, Hybridization, and Context

One of the key findings of comparative reform studies is that paradigms rarely succeed one another in a simple linear sequence; instead, they layer and hybridize. Pollitt and Bouckaert show that many OECD countries combine elements of TPA, NPM, and newer governance approaches, with patterns shaped by administrative traditions and political systems (Pollitt & Bouckaert, 2017).

Dunleavy et al. similarly argue that although digital-era governance has supplanted some NPM practices, NPM doctrines continue to influence organizational structures and performance regimes (Dunleavy et al., 2006). In many jurisdictions, especially in the Global South, reforms are layered on top of existing bureaucratic structures, producing complex hybrids that mix patronage, Weberian bureaucracy, managerialism, and donor-driven governance models.

This multi-paradigmatic condition has at least three implications:

A. Analytical Complexity: Researchers must be cautious when labeling a country or sector as “NPM” or “governance-oriented,” as empirical realities often involve multiple, overlapping logics.

B. Normative Ambiguity: Competing paradigms offer different answers to questions about what public administration ought to do, e.g., maximize efficiency, deepen democracy, or create public value, leading to contested reform agendas.

C. Contextual Dependence: The viability and desirability of particular paradigmatic elements depend on legal traditions, state capacity, political culture, and socio-economic conditions. A reform that works in a high-capacity OECD country may fail or have unintended consequences in a fragile state.

Overall, contemporary public administration science is best seen as a pluralistic field in which paradigms serve as lenses rather than exclusive doctrines.

6. Conclusion

This paper has examined how public administration sciences of our time are structured around a set of interrelated paradigms. Building on Henry's concept of paradigms and subsequent developments, it has identified Traditional Public Administration, New Public Management, New Public Governance, the New Public Service, public value, and digital-era governance as particularly salient. The analysis shows that these paradigms differ systematically in their conceptions of the state, the image of the citizen, core values, and preferred instruments. Traditional Public Administration emphasizes legality and hierarchy; NPM focuses on efficiency, competition, and performance; NPG highlights networks and collaboration; NPS foregrounds democracy and citizenship; public value and DEG stress outcomes and digital infrastructures; and BPA brings micro-level behavioral insights and experimental methods to the field. Rather than replacing one another in a clean sequence, these paradigms coexist and hybridize. Contemporary public administration is characterized by multi-layered governance arrangements in which different paradigmatic logics are activated in other sectors, levels of government, and policy problems. This multi-paradigmatic reality poses challenges for both theory and practice, but also offers opportunities for creative combinations of tools and values.

Future research could usefully focus on:

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- Mapping hybrid configurations of paradigms in specific countries and sectoral contexts;
- Examining how public officials navigate conflicting normative and instrumental demands arising from different paradigms;
- Exploring the implications of digital transformation and polycrisis (e.g., climate change, pandemics) for the balance between hierarchy, markets, networks, and behavioral tools;
- Expanding empirical work beyond OECD countries to understand better how paradigms travel, adapt, and are resisted across diverse administrative traditions.

For practitioners, awareness of these paradigms can foster reflexivity about the implicit assumptions that guide administrative reforms and everyday decision-making. Recognizing the plurality of paradigms encourages a pragmatic, context-sensitive approach that combines legal safeguards, managerial competence, collaborative governance, democratic engagement, and evidence-based behavioral insights in the pursuit of public value.

To sum up, our world is witnessing many developments. With these developments, the need to keep pace increases, especially in public administration, which implements the government's public policies through various agencies. Therefore, public administration paradigms are developed and practical subjects, not static, and thus, governments resort to applying a model that suits the nature of the phase. It is flexible and deals with problems and shocks better due to the many international challenges, whether political, economic, security, or environmental, and develops appropriate solutions. Contemporary public administration cannot survive in a political, financial, and social vacuum. This implies that the discipline will continue to change as societal circumstances evolve. Public administration in the contemporary world will face increasingly sophisticated problems and demands as a result of changing trends in liberalization, privatization, and globalization. Given the existing problems in public administration, general research in the field remains relatively underdeveloped. It is a practice area that remains extremely important, even today. The study of public administration is a real subject of life. It is gaining increasing importance globally and is slowly but surely occupying its rightful place, taking a logically central position in the family of social sciences. Nevertheless, we cannot fully understand today's public administration, or predict tomorrow's, without understanding yesterday's. (Dhameja, 2003:8).

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ORGANIZATIONAL CULTURE AS THE FOUNDATION OF TRANSPARENCY AND ACCOUNTABILITY IN THE BUSINESS ENVIRONMENT

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Abstract: *Contemporary geopolitical trends, such as globalization, changes in international relations, political instability, and economic sanctions, have a profound impact on national and international socioeconomic development. In this context, organizational cultures within enterprises and institutions become key factors in their resilience and adaptability. Transparency and accountability in business processes not only enable effective management of risks arising from geopolitical changes, but also strengthen trust among actors in the global marketplace. This paper analyzes how different models of organizational culture, drawing on the Competing Values Framework, can help organizations better cope with geopolitical challenges and contribute to sustainable socioeconomic development. Special focus is placed on the role of leadership, innovation, and communication in establishing a culture of resilience that supports long-term strategic goals at the national and international levels. An overview of recommendations is also presented for developing an organizational culture aligned with dynamic geopolitical circumstances, thereby contributing to the stability and prosperity of society.*

Keywords: *geopolitical trends, organizational culture, transparency, accountability, socioeconomic development, organizational resilience.*

1. Organizational culture, transparency and accountability

Organizational culture represents a set of shared values, beliefs, norms, behaviors, and practices that shape how members of an organization communicate, make decisions, and develop mutual relationships (Abdalla et al., 2020; Ashkanasy, Wilderom and Peterson, 2000; Colquitt, LePine and Wesson, 2015; Engelen et al., 2016).

This culture affects the work atmosphere, organizational structure, management style, as well as relationships within the organization. According to Schein, it encompasses “the basic assumptions that are embedded in the organization and that shape the way its members think and behave.” Organizational culture is continuously developed through employee interactions, and it is the foundation for building trust and accountability within the organization. Through culture, the organization not only reflects internal values, but also directs the behavior of its members toward common goals.

Transparency in an organization entails openness in communication, availability of information, clarity in decision-making, and accountability for actions. In a business context, transparency denotes the organization’s ability to communicate clearly and honestly its actions,

decisions, strategies, and results to all relevant stakeholders, both within the organization and to external entities. This approach contributes to building trust, reducing uncertainty, and preventing the abuse of power. A key characteristic of transparency is enabling access to information for all relevant actors, as well as explaining the reasons and criteria that guided decision-making (Christensen and Cornelissen 2015; Tapscott and Ticoll 2003; Karim and Mursalim, 2019; Khoiriyah and Rahayu, 2021).

Accountability in an organization can be viewed in two aspects: personal and organizational. Personal accountability refers to the individual obligation of employees to answer for their actions, decisions, and results, and to respect the organization's ethical norms and rules. This form of accountability implies recognizing mistakes, a readiness to learn from them, and the consistent execution of assigned tasks and goals. The organization also bears accountability as a whole, including management, for maintaining ethical business conduct, transparency in operations, and achieving set objectives. An organization that demonstrates accountability toward employees, customers, and society creates the foundations for sustainable development and a positive market reputation. The combination of personal and organizational accountability forms the basis for sound business that strives for sustainability, integrity, and long-term success (Robbins and Coulter 2021; Carroll and Buchholtz 2015; Adyaksana and Alqurani, 2020).

2. The significance of building a culture of transparency and accountability

Building a culture of transparency and accountability is a key element in creating a healthy business environment that contributes to the sustainable development of the organization. This culture not only ensures effective governance and decision-making, but also has a significant impact on interpersonal relations within the organization, as well as on its reputation and competitive advantage (Fisher et al., 2016).

A culture of transparency and accountability brings numerous benefits to the organization. First, it enables increased trust among employees, management, and external partners. Transparency in communication and accountability for actions contribute to the creation of trust, because employees and partners can rely on accurate information and predictable decisions that do not involve hidden interests or uncertainty (Heimstädt and Dobusch, 2020). The second benefit is employee loyalty, achieved by respecting their rights and interests, as well as by providing clear and fair criteria for reward and advancement. When employees recognize that rules are applied equally to everyone, they are more likely to remain in the organization, reducing staff turnover and increasing productivity (O'Regan, King and Smith, 2022). Finally, transparency and accountability directly affect the organization's reputation, which is important for attracting new investment and for building positive relationships with consumers, suppliers, and the broader society (Heimstädt and Dobusch, 2020; Alom, 2018).

Therefore, a culture of transparency and accountability has a profound impact on the behavior of employees and management. Employees who work in organizations that practice transparency and accountability feel greater security and motivation. When it is clear what is expected of them and what the consequences of their actions are, it is easier to achieve high performance. Transparency enables greater employee involvement in decision-making, which gives them a sense of importance and value within the organization. On the other hand, management that demonstrates accountability and transparency earns the authority and trust of its teams. Such management is open to feedback, which allows for a faster response to changes in the business environment and reduces the risk of poor decisions (Alom, 2018; O'Regan, King and Smith, 2022).

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2.1. Key elements for the improvement of a culture of transparency and accountability

Developing a culture of transparency and accountability in an organization requires a comprehensive approach that includes a range of factors that can significantly shape and enhance this culture. The key factors that influence its development include leadership, communication, the rights and obligations of employees, clear procedures and rules, as well as the system of rewards and sanctions. Together, these factors create a work environment that encourages transparency and accountability at all levels of the organization (Leonard, 2019). Leaders in the organization play a key role in shaping and maintaining a culture of transparency and accountability. The management style they apply has a profound impact on employee behavior and on shaping organizational values. Leaders who cultivate openness, honesty, and responsibility toward employees set standards of behavior that are passed on to all members of the organization. Transformational leaders stand out in particular, as they inspire employees by example and actively motivate them to achieve common goals, thereby contributing to building a culture of transparency and accountability (Wagner and Hollenbeck, 2020; Northouse, 2025). Their ability to stimulate dialogue, provide clear guidance, and maintain open communication with employees significantly contributes to reducing uncertainty and strengthening mutual trust.

Effective and open communication is the foundation on which transparency in modern organizations rests. Those organizations that successfully establish clearly defined channels of communication and cultivate a culture of information sharing are more likely to achieve a high degree of transparency and accountability. Employees who have access to relevant information, both at the strategic and operational levels, show a greater readiness to act in accordance with the organization's values (Lencioni, 2002). Transparent communication enables better understanding of managerial decisions, reduces the possibility of misunderstandings, and fosters participatory decision-making. At the same time, openness to feedback becomes an important factor in the continuous development and adaptation to changes in the business environment.

A further contribution to building a culture of accountability is reflected in the clear definition and consistent respect for the rights and obligations of employees. It is essential that employees are familiar with their responsibilities, but also with the rights that belong to them within the organization. A culture of accountability cannot be developed in organizations that do not ensure respect for the basic rights of employees, such as fairness, equality, and transparency in procedures (Kaptein, 2017). Organizations that clearly define and communicate rights and obligations create a work environment in which employees understand the importance of their roles and act responsibly, while reducing the risk of misunderstandings and conflicts.

In addition, establishing clearly defined procedures and rules is of essential importance for creating an organization in which transparency and accountability are the norm, not the exception. When rules are clearly formulated and adequately communicated to employees, expectations and responsibilities become more understandable, which reduces uncertainty and increases organizational efficiency. Well-designed procedures not only facilitate the organization's daily functioning, but also direct employees toward achieving goals in accordance with the organization's core values (Robbins and Judge, 2023). In addition, clearly defined processes for decision-making, task execution, and performance evaluation contribute to the establishment of a high degree of transparency in business practices.

No less important is the system of rewards and sanctions, which plays a key role in shaping and maintaining a culture of accountability. Fair and transparent rewarding of responsible behavior and the achievement of goals in line with the organization's ethical standards stimulates desired behaviors among employees. At the same time, consistent sanctioning of irresponsible behavior

sends a clear message about the organization's unwavering commitment to preserving its values (Hanadelansa, 2023). The system of rewards and sanctions must be carefully designed to be fair, clear, and predictable, thereby contributing to employee motivation, the maintenance of discipline, and the overall stable development of the organization. The development of a culture of transparency and accountability is a complex and continuous process that requires the coordinated action of all the factors mentioned. An organization that succeeds in embedding these principles in its daily operations not only improves its operational and strategic performance, but also contributes to building a positive working environment, strengthening mutual trust, and achieving long-term goals (Kaptein, 2017; Robbins and Judge, 2023; HogoNext, 2024).

2.2 The Role of Teamwork in Strengthening a Culture of Transparency and Accountability

Teamwork represents one of the most influential social mechanisms through which transparency and accountability become embedded in everyday organizational practice. Unlike formal rules or control systems, teamwork operates through continuous interaction, shared responsibility, and mutual dependence among organizational members. When work is organized around teams rather than isolated individual tasks, processes and decisions become more visible, which naturally reduces information asymmetry and limits opportunities for concealment or opportunistic behavior. Within effective teams, information sharing is not merely encouraged but functionally necessary. Team members depend on timely and accurate information from one another in order to coordinate tasks, solve problems, and meet collective objectives. This interdependence fosters transparency as a practical requirement rather than a normative ideal. Decisions, rationales, and outcomes are openly discussed, allowing members to understand not only what has been decided, but why. Over time, such practices cultivate a shared expectation that actions and decisions should be explainable and accessible to others.

Accountability within teams is reinforced through collective ownership of results. While individual roles remain important, performance is evaluated in relation to shared goals, which creates peer-based accountability mechanisms. Team members monitor one another's contributions informally, providing feedback and correcting deviations before they escalate into significant failures. This form of horizontal accountability is often more immediate and effective than hierarchical oversight, as it is grounded in daily cooperation and professional respect.

Moreover, teamwork contributes to psychological safety, which is essential for transparent behavior. When employees feel secure in expressing concerns, admitting mistakes, or questioning decisions without fear of reprisal, transparency becomes sustainable. Teams characterized by trust and mutual respect are more likely to surface problems early, acknowledge errors openly, and engage in collective learning. In this sense, teamwork does not merely support transparency and accountability; it transforms them into shared social norms that guide behavior beyond formal organizational structures.

3. Transparency and accountability in the context of the typology of organizational culture

Different types of organizational culture shape the level of transparency and accountability within the organization in specific ways. For example, organizations with an open and participatory culture naturally encourage open communication, information exchange, and clearly defined responsibilities. On the other hand, in organizations with an authoritarian or hierarchical culture, the flow of information is often limited and accountability is concentrated in the hands of

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management, which can be an obstacle to the development of a culture of transparency and personal accountability among employees.

In this context, it is useful to consider different typologies of organizational culture that allow a deeper understanding of how culture affects these dimensions. Based on the degree of risk and the time needed to obtain feedback on the results of measures taken in the market, Deal and Kennedy (1982) identify a “macho” culture or culture of strong individuals, a “work hard, play hard” culture, a bet-your-company culture, and a process culture. Cameron and Quinn (2011), starting from the external and internal orientation of the organization and its flexibility, distinguish clan, adhocracy, market, and hierarchy cultures. Handy (1995) introduces a typology based on the distribution of power and a people or task orientation, identifying a power culture, a role culture, a task culture, and a support culture. Hartnell et al. (2016) contribute to the classification through criteria such as adaptability, mission, employee engagement, and consistency, thereby defining a mission culture, engagement culture, task culture, and relationship culture. Sonnenfeld and Ward (2008) also propose a typology based on employee behavior, distinguishing an academic culture, a baseball-team culture, a club culture, and a fortress culture. These typologies provide a theoretical framework that enables a deeper understanding of the impact of different cultural patterns on transparency and accountability in organizations. Different cultural models not only shape employee behavior, but also establish norms that define how information is shared and how responsibilities are distributed within organizational structures.

For the analysis of the relationship between organizational culture, transparency, and accountability, we opted for the Cameron and Quinn model, known as the Competing Values Framework. This model, one of the most recognized and most commonly applied in contemporary management theory, allows a comprehensive view of the key dimensions of organizational culture – from the way the organization functions and the leadership style, to interpersonal relations and decision-making mechanisms (Figure 1).

Figure 1. Adapted based on Cameron and Quinn (2011)



A particular advantage of this model lies in the ability to identify the values and behaviors that directly affect openness of communication, information exchange, and the distribution of responsibilities. Through four basic types of culture – clan, adhocracy, market, and hierarchy – the model helps to understand how, in different organizational contexts, a culture based on trust, clarity, and accountability is either developed or constrained. In this sense, organizational culture is classified into 4 types:

- *Clan culture* – based on the values of teamwork, mutual trust, respect, and close relationships among employees. In this culture, transparency is built through open communication, participatory decision-making, and the encouragement of collaboration, while accountability develops as a shared value and part of the collective consciousness.
- *Adhocracy culture* – promotes innovation, creativity, and a high degree of flexibility. Transparency in this context is reflected in the encouragement of idea and innovation exchange, while accountability is viewed through individual initiative and the taking of risks in order to develop new solutions.
- *Market culture* – characterized by an orientation toward results, competition, and the achievement of goals. Transparency here is reflected through clearly defined goals and measurable results, while accountability is most often expressed through individual performance and contributions to achieving business outcomes.
- *Hierarchy culture* – emphasis is placed on formalized procedures, rules, standards, and control. Transparency in this type of culture is achieved through clearly established protocols and communication guided by procedures, while accountability is strictly institutionalized and tied to hierarchical levels and roles.

Additionally, thanks to diagnostic tools such as the OCAI, this model also offers a solid methodological basis for analyzing existing practice. It thus provides managers with concrete guidelines for identifying areas that need improvement and for strategically directing the development of organizational culture toward greater transparency and accountability, in line with the organization's goals.

3.1 Ethical Leadership in Reinforcing a Culture of Accountability

Ethical leadership plays a decisive role in shaping how accountability is understood and practiced within organizations. Leaders do not only define goals and allocate resources; they also signal which behaviors are acceptable, expected, and rewarded. Through consistent ethical conduct, leaders establish credibility and moral authority, which are essential for fostering genuine accountability rather than compliance driven by fear or external pressure. A key dimension of ethical leadership lies in role modeling. When leaders demonstrate integrity, accept responsibility for their decisions, and openly acknowledge mistakes, they legitimize accountability as a core organizational value. Such behavior sends a clear message that accountability applies across hierarchical levels and is not selectively enforced. Employees are more likely to take responsibility for their actions when they observe leaders doing the same, particularly in situations involving uncertainty or adverse outcomes.

Ethical leaders also contribute to accountability by ensuring fairness and consistency in decision-making processes. Transparent criteria for evaluation, promotion, and disciplinary actions reduce perceptions of arbitrariness and favoritism. When employees perceive organizational systems as fair, they are more willing to accept responsibility for outcomes, even when results are unfavorable. Accountability, in this context, is experienced as a constructive mechanism for improvement rather than a punitive instrument. Ethical leadership encourages moral reflection and dialogue within the organization. By inviting discussion about ethical dilemmas and encouraging employees to voice concerns, leaders expand accountability beyond formal performance metrics to include responsibility toward colleagues, stakeholders, and society. Accountability thus becomes multidimensional, encompassing not only what is achieved, but also how outcomes are produced. Through sustained ethical leadership, accountability evolves into a shared moral commitment that supports long-term organizational legitimacy and trust.

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3.2 Ethical Behavior of Employees as a Foundation of Organizational Responsibility

While leadership sets the tone for accountability, the ethical behavior of employees determines whether accountability is effectively realized in practice. Organizational responsibility cannot be sustained solely through policies or managerial oversight; it depends on the everyday choices and judgments made by employees across all levels. Ethical behavior functions as a bridge between formal accountability frameworks and actual conduct in the workplace.

Ethical employees demonstrate responsibility by adhering to professional standards, respecting organizational values, and considering the broader consequences of their actions. This form of responsibility extends beyond task completion to include honesty in reporting, respect for procedures, and willingness to disclose errors or irregularities. When employees act ethically, transparency emerges organically, as information is not deliberately distorted or withheld for personal advantage. Peer influence further amplifies ethical behavior within organizations. Employees continuously observe and interpret the behavior of their colleagues, adjusting their own actions accordingly. In environments where ethical conduct is visible and socially reinforced, deviations from responsible behavior become more noticeable and less socially acceptable. This creates an informal regulatory mechanism that complements formal accountability systems and reduces reliance on external control. Importantly, ethical behavior is closely linked to professional identity. Employees who perceive themselves as responsible professionals are more inclined to take ownership of outcomes and to align personal values with organizational objectives. Such alignment strengthens organizational responsibility as a collective phenomenon rather than a managerial imposition. In this sense, ethical employee behavior does not merely support accountability structures; it constitutes their operational core.

4. Digital Transformation and Transparency

Digital transformation has fundamentally altered the conditions under which organizational transparency is created and maintained. The introduction of digital technologies into organizational processes increases the volume, speed, and accessibility of information, reshaping how decisions are documented, communicated, and evaluated. As a result, transparency becomes both more attainable and more demanding. Digital systems enable real-time data collection and automated reporting, which enhances visibility across organizational activities. Processes that were once opaque or fragmented become traceable through digital records, dashboards, and integrated platforms. This heightened visibility reduces information gaps between hierarchical levels and allows stakeholders to monitor performance, compliance, and resource allocation with greater precision.

At the same time, digital transformation redefines accountability by creating durable informational traces of actions and decisions. Digital footprints make it more difficult to obscure responsibility, as actions are recorded and can be retrospectively examined. This shifts accountability from a largely reactive practice to a continuous condition embedded in everyday operations. Employees and managers alike operate with the awareness that decisions are observable and auditable, which influences behavior toward greater responsibility. However, transparency enabled by digital technologies is not value-neutral. Without ethical governance and clear norms, increased data availability may lead to surveillance, information overload, or selective disclosure. Meaningful transparency requires interpretive frameworks that explain data, contextualize decisions, and respect individual rights. When digital transformation is aligned with ethical principles and organizational values, it strengthens transparency as a mechanism for trust, learning, and responsible governance rather than mere control.

5. Concluding considerations with recommendations

An organizational culture based on transparency and accountability represents the foundation of modern and sustainable business. These values not only contribute to internal stability and trust among employees, but at the same time strengthen the organization's reputation in the external environment. Transparency enables open information exchange, facilitates high-quality decision-making, and reduces room for unethical practices, while accountability fosters individual and collective commitment to achieving organizational goals. In order for these values to be fully integrated into the organizational culture, the following is recommended:

- Clearly define and institutionalize the values of transparency and accountability through strategic documents, internal policies, and everyday practice;
- Develop leadership styles based on ethical behavior, trust, and open communication;
- Establish mechanisms for evaluating and monitoring respect for the principles of transparency and accountability at all organizational levels;
- Encourage a culture of dialogue and cooperation, where information is accessible and employees are involved in decision-making;
- Align the reward and sanction system with organizational values, so that responsible behavior is affirmed and irregularities are sanctioned.
- It is recommended to carry out diagnostics using the Organizational Culture Assessment Instrument (OCAI) to determine the current state of organizational culture and define the desired directions of its development in line with business objectives and contemporary managerial standards. Particular focus should be placed on encouraging clan and adhocracy cultures in organizations that strive for a higher degree of transparency, employee participation in decision-making, and the development of accountability based on trust and shared values.

Through the consistent application of these recommendations, organizations can build a stable and ethical business environment that fosters trust, motivation, and innovation. In this way, transparency and accountability become not only declarative values, but also operational standards that contribute to the long-term success and competitiveness of the organization.

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ELECTRONIC COMMERCE AND DIGITAL COMMUNICATION AS A PILLAR IN THE TRANSFORMATION PROCESS OF BUSINESSES IN ALBANIA

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Abstract: *Electronic commerce nowadays is offering and developing more and more opportunities, fundamentally changing the way business is developed. The job market in E-commerce is expanding rapidly, driving equally large changes in the global economy. One of the areas most affected in business by internet and mobile platform technologies is marketing and marketing communications. The paper presented by the authors aims to highlight the importance of E-commerce in the conditions of a digital market as an opportunity to change a significant part of industries in terms of their structure, processes and strategies and as an opportunity to expand in the international market. The process of reviewing scientific literature at the national and international levels, as well as the analysis of the cases of the development of electronic commerce offer the opportunity to address the way in which the business fields in Albania are approaching this transformation process and at the same time every difficulty encountered during the development of electronic commerce (Qurtubi, 2022). The findings presented in the paper evidence the fact that investment in Internet technologies and mobile platforms in the development of businesses, adapting to them and improving the customer experience, remain the main elements for a stable and growing presence of Albanian businesses in the digital market.*

Keywords: *E-commerce, Digitalization, Albania, SME, Digital Strategy, Literature Review.*

1. INTRODUCTION

The technological developments of recent decades and the global expansion of Internet access have fundamentally transformed the way businesses operate and interact with consumers. In this context, E-commerce (Wikipedia, 2025) has turned into a key element of digital transformation and a strategic instrument for the inclusion of businesses in a new global economy, it is characterized by the speed, flexibility and adaptability of the offer. The ability to offer products and services through digital platforms is no longer a competitive advantage, but a necessity to survive in an increasingly digitized market (Laudon, 2020). Digitization has not only affected the information technology sector, but has spread widely in the areas of production, services, logistics and finance, reformatting traditional business models. As a result, companies are forced to redefine their marketing, operations and product development strategies, to be closer to customers and meet their expectations in real time (Chaffey, 2022). E-commerce provides businesses with access to new markets, reduces operational costs, increases transparency and improves the consumer experience – essential elements in a digital economy. For developing countries such as Albania, the adoption of E-commerce represents an extraordinary opportunity for economic development and increased competitiveness, but at the same time it faces significant challenges related to the technological infrastructure, the legal framework and the digital culture of businesses and consumers (UNCTAD, 2023). Especially over the last ten years, various studies show a progressive increase in interest from economic entities in relation to online platforms, an increase in electronic payments and the emergence of new digital enterprise formats in

the Albanian market as well (INSTAT, 2024). In this background, this paper aims to analyze in depth the role of E-commerce in the Albanian context, as part of a wider regional and global development. Through a systematic review of the scientific literature of recent years and a sectoral analysis of the commercial activity of Albanian businesses, it aims to highlight the impact of E-commerce in transforming business models, improving access to consumers and facilitating entry into new markets. Businesses are redesigning their operations to make the most of E-commerce, pursuing alternative approaches to reach their objectives. SMEs are key drivers of economic growth, encouraging private enterprise and enhancing management capabilities (Gadenne, 2009).

SMEs today face increasing pressures due to globalization and technological advances, which force them to adapt to long-term challenges. In most developed and developing countries, they account for over 90% of enterprises and generate more than 70% of new jobs (UNCTAD, 2006). The use of technology and connected information networks has reshaped how businesses operate, making processes more efficient and opening the door to new ways of organizing and managing economic activities. This study also helps fill gaps in the existing research for Albania and the region, offering insights that can guide policymakers and support strategies for inclusive digital transformation. In accordance with this goal, the article is structured in five parts: first, the theoretical framework and methodology used are presented, then an analysis of the Albanian context as a case study is presented, followed by a discussion of the results and conclusions, closing with recommendations for public and private actors.

The main purpose of this study is to analyze the role, impact and development potential of E-commerce in the Albanian context, as part of a broader dynamic of digitalization of operational processes in the economic entities of our country, especially in businesses that aim to maximize profit. Essentially, the study aims to highlight the way in which E-commerce is affecting:

- Interaction between businesses and consumers.
- Expanding access to new markets.
- Increasing the operational efficiency of businesses.
- Adapting marketing and sales strategies to the digital reality of modern times.

This study also aims to contribute to the scientific literature on developing countries, by providing a contextualized analysis for Albania, where despite increasing internet access and the advancement of Digital Infrastructure.

The study presented by the authors aims to: through the review of the national and international literature and the analysis of data of a mainly secondary nature in relation to the commercial activity of the economic subjects operating in our country.

- Identify international best practices in the development of E-commerce platforms and examine the possibility of adapting them to the Albanian reality.
- Analyze the challenges and obstacles faced by Albanian businesses, especially small and medium-sized enterprises (SMEs), in adopting online platforms.
- Assess the economic potential of E-commerce as a means of increasing the competitiveness of Albanian businesses, through entering foreign markets and diversifying sales channels.
- Suggest strategic directions for policymakers and the private sector, to build a sustainable E-commerce ecosystem in Albania, in line with global trends and sustainable development objectives.

Research Question: How does E-commerce affect the performance and strategic development of businesses in Albania in the context of economic digitalization and market globalization?

Hypothesis: The adoption of E-commerce in Albania positively impacts market expansion, improving business efficiency, and bringing consumers closer, despite infrastructure challenges and regulatory aspects.

2. LITERATURE REVIEW

2.1 Literature Review

E-commerce has become one of the most defining phenomena of the economic and digital transformation of modern times, bringing profound changes to the way enterprises interact with customers, partners and markets. In academic literature, its impact on empowering businesses, especially small and medium-sized businesses (SMEs), by providing them with new tools to compete in wider and more dynamic markets, has been widely highlighted (Kolsaker, 2002). According to various authors, electronic commerce cannot be defined solely as a technical tool for carrying out transactions over the internet, but represents a contemporary methodology of doing business, which addresses the needs of reducing costs, improving the quality of services and accelerating processes, (Turban, 2008; Lawrence, 2003). Referred Turban (2008), E-commerce involves the electronic process of buying and selling products, services and information via the Internet. This concept has been further expanded by other authors Lawrence (2003) and Lewis (2002) who see E-commerce as a tool to improve operational efficiency and increase the speed of service delivery. It involves not only the exchange of products and services, but also communication, collaboration, and integration of information digitally, creating a more efficient and transparent environment for business operations. From different perspectives, authors have highlighted specific dimensions of E-commerce:

- As a communication process, it enables the digital distribution of information, products, and payments (Zwass, 1996) and (Wigand, 1997).
- As a business function, it means the automation of transactions and workflows through information technologies (Lewis, 2002).
- As a service, it improves interaction with customers, increasing the quality and speed of product and service delivery (Turban, 2008).
- As an online environment, it creates a new platform for conducting exchanges and developing new business relationships (Rayport, 2001).

In recent literature, the importance of integrating advanced technologies, such as artificial intelligence (AI), into E-commerce platforms to improve customer experience and optimize business processes has been emphasized (Fonseka, 2022). This integration helps enterprises better adapt to market demands and increase their competitiveness. Essentially, E-commerce represents a symbiosis between technology and business strategy, which helps organizations restructure the way they operate, reach new customers, and build more sustainable competitive models. In developing countries, such as Albania, this approach has the potential to serve as a catalyst for economic development and broader inclusion in international markets – a topic that this study further explores in detail.

2.2 The impact of Electronic Commerce on the increase of performance and efficiency in small and medium economic entities

The spread and development of Electronic Commerce has shown that it affects the growth of the economic and financial performance of small and medium-sized economic subjects. A recent study (Setiawan, Adhariani, & Harymawan, 2023) shows that the use of E-commerce helps increase revenue, profits and return on assets for small and medium-sized enterprises. Also, the integration of innovative culture and competitive pressure Salah (2024) are factors that drive E-commerce adoption and improve the marketing performance of SMEs. During the COVID-19 pandemic, E-commerce proved crucial for the survival and growth of small and medium-sized enterprises (SMEs). Using digital platforms and online marketing strategies (Gao, 2023) allowed these businesses to continue operating and even improve their financial results. Still, SMEs face several challenges in promoting E-commerce, such're as limited coffers, lack of technological moxie, and inadequate structure. Research suggests that firm size and entrepreneurial skills play a key role in how successfully E-commerce is implemented (Hussain, 2022). Contrarily, E-commerce also offers significant opportunities, especially through leveraging multiple platforms and innovating customer value propositions (Weng, 2025). This approach can help SMEs expand their market presence and strengthen their competitive position. In the paper published by the scientific researcher Pjetri (2025), it is said that the level of use of fintech financial instruments has increased particularly during the last 5 years in Albania.

2.3 Factors influencing E-commerce adoption

Adopting E-commerce is a complex process for SMEs, shaped by a mix of internal and external factors that affect their readiness and decision-making regarding digital technologies. A key element is the technological maturity of the enterprise, including aspects such as information security, network connectivity, compatibility of software and hardware, and the level of integration between internal systems (Curtis, 2006). In particular, internet availability and quality often prove insufficient, especially in non-central areas, becoming a structural obstacle to digital development (Scupola, 2009). On the other hand, financial issues play a crucial role. As an organization adopts new technologies, it faces the need for significant investments in infrastructure, training, and maintenance. However, previous studies suggest that cost is not always a decisive factor in decision-making; for example, Scientific researcher (Simpson & Docherty, 2004) found that British SMEs often do not consider costs as a critical barrier to digitalization. Rather, it is the commitment of senior management that matters, not only setting strategic priorities but also cultivating an organizational culture open to innovation (Grover, 1993; Thong, 1999). In this context, the culture of collaboration, staff dedication, and managerial style directly impact the success of the digital transition (Montazemi, 2006). Another aspect that cannot be overlooked is the level of staff training and qualifications. Investing in education and human resource development constitutes one of the highest costs in the process of adopting E-commerce (Curtis, 2006), but it is also one of the fundamental prerequisites for a sustainable transition. Larger enterprises, in this sense, have the advantage of increased resources and a more developed infrastructure, which allows them to more easily integrate digital platforms. Beyond internal factors, the external environment also has a significant impact. Pressure from competitors, especially in industries where E-commerce has become the market standard, forces SMEs to adapt in order to maintain their positions (Tabor, 2003). An additional factor is the increasing demands from consumers, who expect easier access, but also more personalized and faster services through online channels. Supporting policies, such as standardization, legislation on digital security, and investment in infrastructure, have helped enhance the digital capabilities of the private sector (Ranganathan, 2004; Stoneman, 1986). Many studies highlight the role of institutional intervention as a key driver for E-commerce adoption, particularly in small developing economies (Southern, 2000; Martinsons, 2008). In summary, adopting E-commerce for SMEs is a complex process influenced by technological readiness, financial and human resources, organizational culture, market pressures, and institutional support. Understanding how these factors interact is crucial for designing effective policies and developing sustainable strategies for the digital growth of small and medium-sized enterprises.

In the Albanian context, institutional support and policy initiatives are vital for accelerating E-commerce adoption. The government can act as a catalyst by introducing supportive legislation, providing subsidies and training programs for businesses, and creating public platforms that facilitate integration into the digital economy.

2.4 E-commerce and communication as a strategic process

Communication is a fundamental pillar of successful E-commerce, as it establishes trust, interaction, and value between parties involved in a transaction. In an E-commerce environment, communication takes place in multiple forms: between customers and platforms, between buyers and sellers, and between automated systems and the content delivered in real time. According to Turban (2018), electronic communication is critical for building long-term customer relationships, providing transparency, personalization, and prompt responses to customer needs. It includes not only product or offers notifications, but also the ability to respond to customer concerns and questions, thus improving the user's experience and increasing the likelihood of repeat purchases.

Digital communication also contributes to creating trust, which is crucial for online environments where physical contact is lacking. Various studies, such as that of Pavlou (2004), show that transparency in communication and information exchange are key factors in building trust in digital platforms. From an organizational perspective, internal communication between departments

(Marketing, IT, Logistics) is equally important to ensure efficient order fulfillment and uninterrupted supply chain operation. According to Laudon (2020) the lack of integrated cross-functional communication can lead to delays, misunderstandings, and customer loss. So, communication in E-commerce is more than an information tool - it is a strategic interactive process that impacts overall business performance, brand building, and customer retention.

2.5 The importance of E-commerce in the Albanian context

In Albania, the adoption of E-commerce is still in its early stages, but it has great potential to help SMEs expand their markets and improve operational efficiency. The integration of digital technologies and the development of the necessary structure is an important way to take advantage of the advantages E-commerce offers. This study aims to analyze the impact of E-commerce on the performance of Albanian SMEs and to identify the best strategies for the successful adoption of this new way of doing business.

3. METHODOLOGY

The model applied by the authors in relation to this is based on qualitative data. events over a specific time interval, through multiple sources of information, and makes descriptions or interpretations (Creswell, 2012). Unlike other types of research, case studies (Stake, 1978), which defines what the study is about, are often preferred in the social sciences. In accordance with the exploratory and analytical nature of this study, the method of systematic literature review was applied Systematic Literature Review - SLR as a basis for theoretical as a basis to be used for our theoretically based analysis and conceptual analysis regarding the development and impact of electronic commerce on economies, with a primary focus on our country. This methodology enables a structured, transparent and reproducible approach to identifying, evaluating and synthesizing the most important scientific contributions in the field of E-commerce, in the context of digitalization and business model transformation (Kitchenham, 2007;Tranfield, 2003). The paper compiled by the authors is based on four methodological pillars:

- Identification of appropriate literature: A systematic search was applied in internationally recognized scientific databases - Scopus, Elsevier (ScienceDirect), SAGE Journals and ERIC. Structured keywords were used such as: E-commerce, Digital transformation, Developing countries, SMEs and online business, Albania and E-commerce, Electronic trade barriers, etc.
- Determination of inclusion and exclusion criteria: Only peer-reviewed articles, in English or Albanian, that had a primary focus on electronic commerce and its impact on the economic, social or institutional aspects were included. Non-academic technical reports, editorial comments and materials without reliable scientific references were excluded.
- Thematic analysis of the literature: The selected articles were analyzed thematically, classifying the main contributions according to the following categories: (a) Development of E-commerce platforms, (b) Impact on business performance, (c) Infrastructural and regulatory challenges, (d) Digital transformation of small and medium-sized enterprises (SMEs), and (e) Empirical cases from countries with similar characteristics to Albania.
- Extending the analysis to the local context: To contextualize the theoretical findings, a comparative and sectoral analysis of trade activity in Albania was included, based on secondary data from national level institutions such as the Institute of Statistics in Albania, such as the Bank of Albania, as well as reports from international organizations such as UNCTAD and data provided by the World Bank.

4. RESULTS AND ANALYSIS: THE CASE OF ALBANIA

4.1 Current state of E-commerce in Albania

E-commerce in Albania has taken a significant leap forward, especially over the last decade, driven by increased internet access, the growing use of mobile devices, and the need for digital

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transformation of traditional business models. Data from INSTAT and reports from the Bank of Albania show a gradual increase in the use of electronic payments and online platforms, especially after 2020, when the COVID-19 pandemic served as a catalyst for the migration of many services to digital channels, more specifically:

- According to Statistical Institution of the Republic of Albania (INSTAT, 2024), 96.7% of Albanian households had access to the internet in 2023, showing a slight increase compared to the previous year.
- Bank of Albania Report (BankofAlbania, 2023) highlights the increasing use of digital payment instruments and developments in the electronic payment system in Albania.

According to reports, around 55% of small and medium-sized enterprises have created an online presence through social networks or websites, but only 20% use genuine E-commerce platforms for direct sales. This shows a clear gap between awareness of the importance of digitalization and the real capacities to implement it functionally.

Among the main sectors in which electronic commerce has had an impact, especially during the last five years, we can say:

- The retail sector, especially in the field of technology, clothing and cosmetics.
- Food services, with a significant increase in online ordering platforms.
- Tourism and accommodation, through the use of international platforms such as Booking and Airbnb.
- Education Education, with the creation and development of technology platforms specialized in the field of education and e-learning.

The application of E-commerce to SMEs helps them create a competitive advantage with large companies. It serves as a strategic tool for increasing competitiveness, especially in an environment where technology and low cost of information and communication directly affect the efficiency of operations. However, it should be noted that many businesses still operate informally on social platforms, without integrating full E-commerce solutions such as online payments, inventory management or automated deliveries. This indicates an intermediate stage of digital transformation, where participation exists, but support structures and sufficient education to maximize benefits are lacking.

4.2. Technological developments and digitalization in Albanian businesses

In the last decade, Albania has experienced a significant increase in the diffusion and use of information and communication technologies (ICT), which have created a favorable basis for the development of E-commerce and the digitalization of business processes. The push towards digitalization has been reflected both in public policies and in the strategic approach of businesses seeking to expand their presence in new markets and increase operational efficiency. According to data from INSTAT (2024), a chance of 99.3 of enterprises with 10 or further workers used computers with internet access for professional purposes during 2024, marking a modest increase in the value of 99.1 of SMEs who reported that they used this type of service during 2023. The use of cloud services, customer management software (CRM), and electronic payment systems is gaining ground, although still limited. However, the level of digitalization varies significantly according to business size, location, and sector of activity. A positive development to highlight is the intervention of the Albanian government through initiatives such as “Digital Albania 2030” through AI, which aims to increase the digital skills of the population and modernize public administration and services to citizens and businesses. Through this strategic vision, the creation of an innovative ecosystem that helps in the adoption of new technologies by enterprises is also encouraged. On the other hand, according to a World Bank Report (W.B.Report, 2020), despite the high potential, structural barriers such as the lack of digital infrastructure in rural areas, the high cost of technology, the lack of digital skills and the skepticism of businesses towards digital transformation remain significant challenges for the private

sector in Albania. The services and trade sector appears to be more advanced in the adoption of digital technologies, using online platforms for marketing, sales and interaction with customers. In contrast, sectors such as agriculture and industrial production remain poorly digitalized, highlighting a significant gap that needs to be addressed through targeted policies as well as technical and financial support. In this light, digitalization is not merely a technological option but a critical strategy for enhancing competitiveness, fostering innovation, and expanding market reach for Albanian businesses. Addressing these challenges is essential to fully realize the benefits of transitioning to E-commerce-driven business models.

4.3 Challenges and opportunities for Albanian businesses in E-commerce

Although Albania has made notable progress in digitalization and the adoption of information technologies, several structural obstacles continue to limit the development of E-commerce. Key challenges include inadequate logistics infrastructure, low consumer trust, incomplete legal and regulatory frameworks, limited digital literacy, and slow uptake of advanced platforms by small and medium-sized enterprises. The World Bank (2020) reports that many Albanian businesses operating online struggle to access international markets due to high shipping costs, complex external bureaucracies, and the absence of sustainable logistics partnerships. Furthermore, internal challenges such as lack of experience in managing digital channels, as well as limited financial capacities, limit the potential of digital transformation into a sustainable growth tool. On the other hand, the opportunities that arise are numerous and tangible. Albania enjoys a high level of internet use among the population and a growing penetration of mobile telephony, which creates a favorable terrain for the development of mobile platforms and E-commerce. Referred Statistical Institution of the Republic of Albania (2024), the high percentage of enterprises that used the internet for business purposes indicates a continuous increase in digitalization in daily business practice. Furthermore, the support of state institutions through platforms such as e-Albania, as well as efforts to engage in new markets through participation in regional and global trade networks, are positive indicators for the further development of this sector. However, the long-term success of E-commerce in Albania will depend on structural interventions that address existing shortcomings, as well as on the ability of the private sector to build capacity in line with global digital trade standards. Investing in technology education, building functional logistics networks, and a more comprehensive legal framework remain key elements for a competitive future for Albanian businesses in e-markets.

Challenges for Albanian SMEs:

- Digital and technological infrastructure: According to a 2024 study made by Hasa (2024) on technology adoption in the retail sector in Albania, factors such as the lack of stable internet connectivity and the lack of integrated information systems have been identified as key barriers to the adoption of new technologies by small and medium-sized enterprises.
- Limited financial resources: The Investment Council of Albania's 2024 report highlights that SMEs face difficulties in accessing finance to invest in new technologies, including E-commerce (IC, 2024).
- Human and managerial capacities: The lack of qualified staff and adequate training for the use of new technologies is another challenge identified by small and medium-sized enterprises in Albania (Hasa, 2024).
- Organizational culture and resistance to change: Some Albanian SMEs show a tendency to stick to traditional business practices, being wary of technological changes and the adoption of E-commerce.
- Lack of institutional support: While there are efforts to improve the digital infrastructure in Albania, the lack of clear policies and consistent support from state institutions is a factor that slows down the adoption of E-commerce by SMEs.

In recent years, Albania has witnessed a gradual increase in the number of businesses adopting digital technologies as a means to extend the economic life of a product and increase market presence. Despite Albania lacking a largely advanced structure compared to more advanced countries, some

small and medium-sized enterprises have demonstrated that outsourcing E-commerce can lead to measurable advancements in profit, request reach, and functional effectiveness.

4.4 The impact of policies and legislation

State programs and legislation are among the most important factors in promoting or hindering the relinquishment of E-commerce, especially in developing agriculture similar to Albania. Clear legislation, supporting measures and nonsupervisory structure are essential rudiments to insure a favorable climate for the development of E-commerce. The legal framework applied by the Albanian state regarding electronic commerce has been improved and adapted, including the repeal of Law No. 10 128, dated 11.5.2009 on Electronic Commerce and updates in line with EU directives on consumer protection, electronic hand and online deals. Sub-legal acts have also been created that end to regulate digital payment practices and data storehouse. Still, the perpetration of these rules faces practical difficulties. According to the World Bank Report (2020), the lack of effective enforcement of laws, the lack of information to businesses on the scores and openings offered by the law, and the lack of supporting institutions for resolving digital controversies constitute significant obstacles to the further development of E-commerce in the country. Likewise, the lack of a public strategy specifically concentrated on the digital metamorphosis of SMEs highlights a gap between legal perspectives and request reality. Transnational studies Ranganathan (2004) and Martinsons (2008) emphasize that government intervention with sustainable programs and profitable impulses is vital to support technological invention and make trust in E-commerce. Accordingly, while Albania has made efforts to ameliorate the legal frame for E-commerce, the impact of these programs in practice remains limited due to institutional challenges and the limited capacity of businesses to borrow and apply these regulations.

4.5. Compatibility of Albanian reality with conclusions from international literature

Through the analysis of factors influencing the adoption of E-commerce in Albania, a significant agreement is observed with the conclusions provided by the international literature on SMEs. Foreign studies Scupola (2009) and Montazemi (2006) consistently emphasize the role of technological infrastructure, managerial support, staff capacities and external pressures as key factors in the success or failure of E-commerce adoption.

In the Albanian case, factors such as internet availability, human resource preparation and access to finance have been identified by INSTAT, BoA and WB reports as real obstacles for domestic businesses. For example, as in the literature, it is observed in Albania that small enterprises face more challenges to invest in technology due to lack of financial resources and internal expertise Simpson (2004) and Grover (1993). In his scientific paper, researcher Thong (1999), says that, international literature considers organizational culture and the level of management commitment as important determinants of the success of digital transformation which coincides with the Albanian reality where the success of certain businesses is directly linked to the entrepreneur's vision and willingness to embrace technology. Market pressure and growing consumer demands for easy and fast access to products or services constitute another point of convergence. In both contexts – domestic and international – these factors have driven the reorientation towards digital sales channels Tabor (2003) and Allen (2000). On the other hand, discrepancy emerges in the level of institutional support. In many countries governments have played a catalytic role in promoting E-commerce (Ranganathan, 2004; Martinsons, 2008), in Albania this support still remains sporadic and fragmented, without a coordinated and long-term strategy for SMEs. In conclusion, the Albanian reality confirms many of the factors identified by the international literature as obstacles or drivers of E-commerce adoption but also highlights the need for a more structured and sustainable approach by public institutions to support this transformation.

5. DISCUSSION AND CONCLUSION

Based on the findings from the international literature and the case analysis of Albania, some important recommendations for improving the E-commerce climate and increasing the participation of SMEs in this sector are:

- To create and develop a national strategy regarding the digital transformation, especially of small and medium-sized enterprises, considering that these entities make up over 95% of economic entities operating in our country. A comprehensive strategy is needed that directly addresses the needs and capacities of small and medium-sized businesses, with measurable objectives and monitoring mechanisms. This strategy should include digital education, access to financing and the promotion of technological tools suitable for the Albanian market.
- One of the difficulties observed has to do with the lack of information at the level of trust on the part of the economic subjects. For this reason, national information campaigns and dedicated training for entrepreneurs should be developed, including partnerships with universities and technological incubators (OECD, 2023).
- Investment in digital and technological infrastructure. The expansion of the fast internet and the creation of accessible platforms for online sales are prerequisites for the success of E-commerce.
- Effective implementation of existing laws and their improvement in line with international technological developments is essential. Simplified mechanisms should be created for resolving digital disputes and guaranteeing online consumer right (W.B.Report, 2020).
- The government and financial institutions should offer grant schemes or fiscal incentives for SMEs that invest in digital transformation, including technology, consulting, training or online marketing.
- Promoting and increasing the level of cooperation between the state as entities and private economic subjects in relation to the development of Electronic Trade. Creating cooperation networks between market actors, state institutions, business organizations and technology providers will facilitate the exchange of knowledge and best practices in this area.

This study contributes to the academic literature on E-commerce in the Albanian context, combining a theoretical approach with the analysis of local empirical data. In the absence of in-depth studies addressing the adoption of E-commerce by SMEs in Albania, this paper provides a clear and structured overview of the influencing factors, highlighting the existing gaps and specific needs of this sector. It also encourages reflection on the importance of institutional intervention to improve the digital business climate. For future research, it is suggested to develop quantitative and comparative studies between different economic sectors, as well as to assess the impact of specific E-commerce platforms on the performance of SMEs. This paper aimed to examine the factors influencing the adoption of E-commerce by small and medium-sized enterprises (SMEs) in Albania, relying on a combined approach between a literature review and an analysis of the specific Albanian context. In line with the research question, key factors that constitute obstacles or opportunities for the full integration of SMEs in digital commerce were identified and analyzed.

The findings from the literature highlight those internal factors such as the level of technological development, staff training, organizational culture and managerial support, as well as external factors such as market pressure, state policies and digital infrastructure play a key role in the process of E-commerce adoption. Similarly, in Albania, businesses are gradually expanding their participation in E-commerce, yet they face notable challenges such as limited IT investments, low digital skills, and the absence of coordinated strategies. This situation aligns closely with international research on the factors affecting E-commerce adoption among SMEs, including technological infrastructure, employee expertise, and management support. The main obstacles in Albania are related to the lack of financing, expertise and a stable internet, while organizational culture and market pressure have a similar impact to international cases. A striking difference is the weak institutional support in Albania, in contrast to countries where governments play a catalytic role. This indicates the need for a coordinated and long-term strategy to help Albanian SMEs in their digital transformation.

As a result of the increase in the number of economic transactions in number and value that have been carried out by individuals, small and medium category entities on the Internet, more

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investments are needed in consumer protection, information and transparency on the conditions included in financial products and services (Pjetri, 2025).

However, concrete examples from practice show that the transition to digital formats has brought real benefits to some Albanian businesses - such as increased turnover, access to new markets and improved communication with customers. This proves that, when the supporting factors are present, the potential for development is considerable. Digital transformation should not be seen as an option, but as a necessity for the long-term sustainability and growth of businesses.

Consequently, to further stimulate the adoption of E-commerce in Albania: investments in technological capacities, raising the digital competences of the workforce and creating a supportive legal and strategic framework; are essential to ensure that Albanian SMEs really benefit from the opportunities offered by E-commerce in the digital age.

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CONSUMER PREFERENCES AND PURCHASING DETERMINANTS FOR OLIVE OIL IN ALBANIA: EVIDENCE FROM TIRANA

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Abstract: *This study aims to analyze market developments and consumer preferences for olive oil in Tirana with a particular focus on how sociodemographic factors influence consumer behavior in the choice of olive oil. The growth of the Albanian economy and increased health concerns after Covid-19, have led to a rise in demand for higher quality products such as olive oil. Therefore, this study is relevant as it analyzes the importance of product's origin and investigates whether consumer uses olive oil for aesthetic and health care purposes. The study is based on data collected from 150 respondents in Tirana through a structured questionnaire distributed via Google Forms and analyzed using descriptive statistical method and chi-square tests in Microsoft Excel. The findings indicate that while educational status and gender do not significantly influence the importance consumers attribute to olive oil origin, age and, occupation have a significant effect. The findings reveal that 70% of consumers use olive oil for both aesthetic and health purposes, primarily applying it to the skin for cosmetic care and using it to address digestive issues for health treatment. The paper provides valuable insights that may be used to develop more effective marketing strategies and also policy recommendations.*

Keyword: *Olive oil, Consumer preferences, Tirana, Health concerns, Sociodemographic factors*

1. Introduction

Olive oil is one of the most traditional and valuable products in Mediterranean diets and global agri-food markets. Its cultural and economic significance has increased research interest in understanding the factors that influence consumer choices and their willingness to pay for it. Among the most significant product related factors influencing consumer preference towards olive oil are origin, method of production, labelling, and certification (Sgroi et al., 2023).

Organic and quality indicators of olive oil are highly valued. According to Casini et al. (2014), organic certification is one of the most important factors when consumers choose olive oil. The demand for high-quality products, especially organic ones, is consistently increasing, along with a larger willingness among consumers to pay for these attributes (Chinnici, Bracco, & La Via, 2016). As buying motivations, it is indicated in the literature that organic products are purchased by consumers because they are considered safe and healthy (Hamzaoui-Essoussi & Zahaf, 2012). Sandalidou et al. (2002) emphasized that the health benefits are a primary competitive advantage of organic olive oil. In countries that cultivate olive, consumers have more knowledge of its values and show a more positive attitude toward organic olive oil (Pardo et al., 2018).

Consumers are willing to spend more on olive oil, that display specific certification which show quality and origin. Aprile et al. (2012) found that the organic production method and Protected Designation of Origin (PDO) certification positively influence consumer preference. Products with a PDO label are seen as premium products, and consumers are willing to pay more for these products (de-Magistris & Gracia, 2016). This suggests that certification and production methods are one of primary factors driving consumer preferences for olive oil.

Panico et al. (2014) found that consumers have a stronger preference for domestic olive oil. Furthermore, recent studies by Pérez y Pérez and Gracia (2023) and Chan-Halbrendt et al. (2010), indicate that price and origin are important factors influencing consumer choices. According to Dekhili et al. (2011), the importance of the organic label varies across consumer groups, with some placing significantly greater value on it than others.

Olive cultivation and olive oil production are one of the major agricultural activities in Albania. Olives are cultivated in nine out of the twelve prefectures of the country (INSTAT, 2025). Consequently, Albania provides a relevant context for studying consumer preferences for olive oil, given its long history of cultivating olives. Despite the increase of domestic production, which largely satisfies national demand, consumer demand continues to evolve. Recent evidence shows that younger, more educated, and higher-income consumers assign greater emphasis on health and environmental attributes, whereas older and lower-income individuals priorities price and traditional options (Ahmadi Kaliji et al., 2025). Furthermore, findings from Muça et al. (2016), indicate that Albanian consumers demonstrate a preference for domestically produced olive oil, because they are familiar with its taste and trust its quality, and often relying on personal connection with vendors when assessing product attributes. This study aims to evaluate the key factors influencing consumer purchasing decisions regarding olive oil, with a particular focus on the relationship between product origin and sociodemographic factors. The main research question is: Which sociodemographic factors significantly influence the importance consumers in Tirana attribute to olive oil origin?

Understanding these factors is important for agribusiness and farmers in the olive oil sector in Albania to successfully market their product to meet the demands of the European market. Although many studies have examined consumer behavior toward olive oil in Mediterranean and EU countries, empirical evidence from Albania remains limited. This limited information is particularly essential in view of the increase in olive production and motivation of farmers for adoption into organic farming. The findings will help to strengthen marketing strategies, support local producers' competitiveness, and inform future agricultural policies promoting value-added and origin-based products in Albania.

2. Olive Oil Production and Market Context in Albania

Agriculture remained one of the significant sectors of Albania economy representing about one-fifth of the country's GDP in 2022 and employs roughly one third of the workforce, the highest percentage among Western Balkan countries (INSTAT, 2023b). Agriculture in Albania is primarily small-scale and self-sufficient, characterized by fragmented land, limited modern technology usage, restricted financial resources, and occasionally high input costs (Kullaj, 2007). The result is low productivity and low value added per worker (World Bank, 2021).

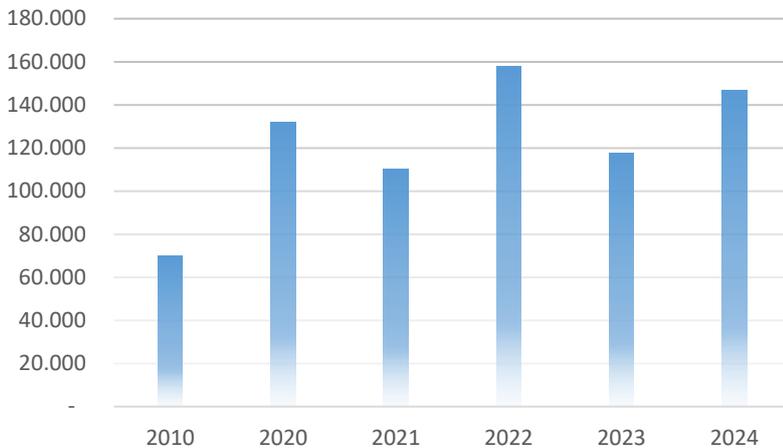
Albania is still a country that primarily imports rather than exports of products, although in recent years Albania have seen improvements in the agricultural trade deficit. Appropriate government policies and a more proactive perspective among Albanian youth generation could lead to even greater development for the sector and for the Albanian economy as a whole. In the past few years, olive production in Albania has been increased considerably. As it shown in Figure 1, from 70,010 tons in 2010, the production was reached 146,726 tons in 2024 (INSTAT, 2025). Despite this considerable growth in olive production, the sector remains far from having its production potential fully exploited.

In recent years, organic farming has developed in Albania, with a mainly focus on medicinal and aromatic plants. Furthermore, there has been a significant increase in the area of certified agricultural land for olive cultivation. As it presented in Figure 2, the data illustrated the trend of organic land certified or in certification over the last 5 years (2020-2024). In 2020, only 46 hectares of land were under certification, reaching 109.6 hectares in 2024. This steady growth indicates a rising interest and commitment among farmers toward organic production. This trend is also reflected in organic olive production, which shows an increase of approximately 346% from 2020 to 2024, rising from 142.7 tons in 2020 to 637.4 tons in 2024.

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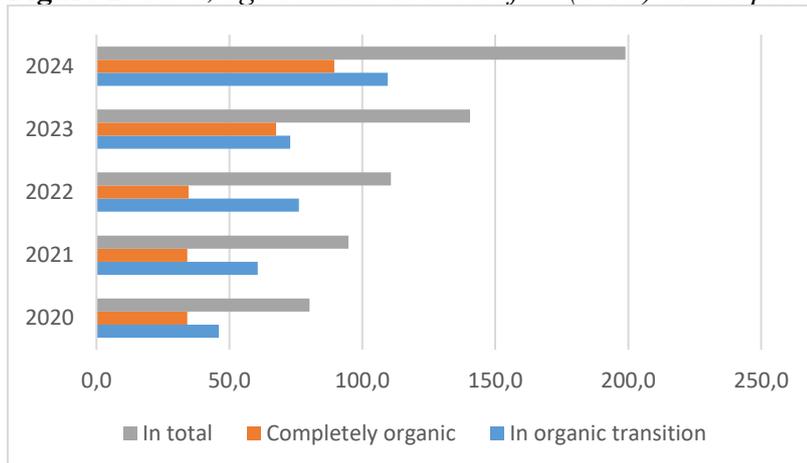
In both cases, the rising trend is highly marked, reflecting increase interest on organic olive farming but also an indicator of enhanced regulatory compliance and market demand.

Figure 1. *Olive production (in ton) in Albania, 2010-2024*



Source: INSTAT, 2025

Figure 2. *Olive, agricultural land certified (in ha) and in process in Albania, 2020-2024*



Source: INSTAT, 2025

The southern parts of the Albania are the primary producers of olives. In 2024, Fier prefecture is the leading olive-growing area in Albania, with a supply of 30% of the total production at country level. Together with Berat prefecture, these two regions provide 50%, half of the country's olive production and are thus the major contributors to this sector in Albania.

Regarding the Balkan region, Greece dominates in terms of production volume of olive by exceeding 3 million tons of production, demonstrating dominant role on the Europe olive market. Albania experienced a notable high in 2022 with 157,710 tons of olive production, suggesting an upward trend in growth. North Macedonia maintains a rather stable level of annual production of around 11,800 tons. Such differences between Western Balkan countries are linked with the market condition and, probably, other investment efforts, along with climatic conditions influencing olive cultivation in these countries.

As further illustrated in Table 1, Greece also leads in olive oil production, contributing over 313,000 tons and reinforcing its regional dominance. Albania has maintained a consistent production cycle with an average of 12,500 tons over the past five years. Production in North Macedonia and Montenegro is inexistent in comparison with Greece and Albania.

Table 1. *Production of olive oil (in a thousand tons) in Wester Balkan countries 2018-2022*

	2018	2019	2020	2021	2022
Albania	12.5	11.5	13.0	16.5	15.50
Greece	327.7	290.5	276.0	255.0	313
North Macedonia	1.325	1.3	1.904	1.887	1.89
Montenegro	0.018	0.02	0.020	0.028	0.02

Source: FAOSTAT,2025

Albania primarily imports olive oil from neighboring countries such as Italy and Greece. Import values fluctuate across years, with Italy consistently representing the largest import country with over USD 6 million in 2024 while Greece and Spain which is the largest country for production of olive oil contribute in smaller amounts (UN Comtrade, 2025). These dynamics indicate that while Greece and Italy remain stable major suppliers of olive oil, the amounts differ yearly, suggesting changes in the market and probably, consumer preference shifts within Albania consumers.

Overall, the olive oil sector in Albania is characterized by steady production growth, increasing interest in organic certification, and continued reliance on imports from neighboring countries. These dynamics highlight the need to better understand consumer behavior in the domestic market, particularly in urban centers such as Tirana, where purchasing trends and preferences play a crucial role in shaping future market development.

3. Methodology

This study is based on a structured online survey conducted with a convenience sample of 150 respondents during June 2022. The survey targeted residents in the region of Tirana, the capital city of Albania and with the most density of population. Tirana was selected as the study area because it represents the country's largest urban market including a heterogeneous population with varied income levels and purchasing habits, thus providing a suitable setting for examining consumer preferences toward olive oil. Data were collected through a structured questionnaire designed to capture both product-related attributes and sociodemographic characteristics, including age, gender, education, family size, income level, and occupation. The questionnaire was created using Google Forms and distributed through online platforms. It included multiple-choice questions, Likert-scale items as well as open-ended questions. A total of 150 valid responses were obtained, and descriptive statistical method along with chi-square test were applied using Microsoft Excel. These methods were chosen to summarize consumer trends and to identify significant associations between sociodemographic variables and purchasing behavior. This analytical approach enables a deeper understanding of how consumer profiles influence preferences for olive oil, providing valuable insights for producers, marketers, and policymakers aiming to align supply strategies with market demand.

4. Results

The sociodemographic characteristics of the sample are presented in Table 2. The respondents were mostly females with 75% of the respondents. The sample is dominated by young and middle-aged adults (76% aged 18–45) with relatively high education (71% with at least a bachelor's degree). 76% of the responded were employed, living in a family with 3-5 members with medium income level.

Table 2 *Sociodemographic Characteristics of Survey Respondents*

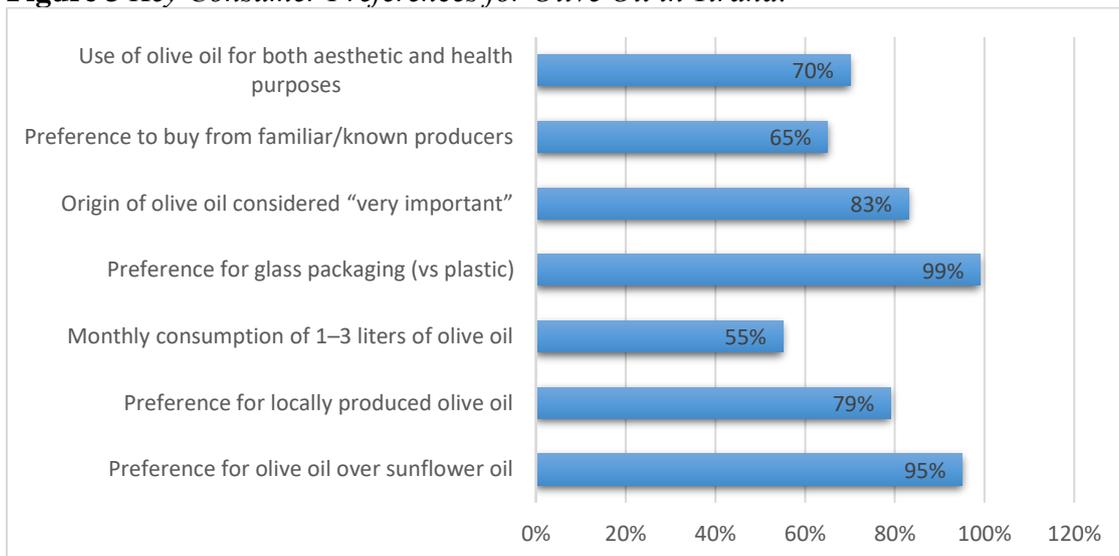
	Category	N	%
Age	18-29	57	38
	30-45	57	38
	46-60	29	19
	>60	7	5

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Gender	Female	113	75
	Male	37	25
Education	Elementary	2	1
	High School	42	28
	Bachelor	57	38
	Master/PhD	49	33
Nr of family members	2	5	3
	3	117	78
	>5	28	19
Income Level	Low	2	1
	Medium	137	91
	High	8	5
	Very High	3	3
Occupation	Employed	113	76
	Unemployed	5	3
	Student	27	18
	Pension	5	3

As illustrated in Figure 3, the survey results reveal a strong preference for olive oil, with 95% of respondents selecting it over sunflower oil. A total of 79% of the respondents favored local production of olive oil over imported one. Quality is the most significant attribute for the consumer to buy olive oil. The data on whether consumers use olive oil for aesthetic care and health treatment showed that 70% use it for both purposes. In the field of aesthetics, major uses of olive oil by the respondents applied to the skin, and for health treatment, it was mainly used to address digestive problems.

Figure 3 *Key Consumer Preferences for Olive Oil in Tirana.*



The consumption pattern showed a majority of 55% consuming 1-3 liters of olive oil per month. Results further revealed that 45% were already using plastic packaging for olive oil, although that 99% of the preference was on glass bottles of packaging. 83% of the respondents believed that the origin of the olive oil is very important, and 65% of consumer would rather buy among family members involved in olive cultivation.

Table 3 Chi-square Results for Sociodemographic Factors Influencing Olive Oil Origin Preference

Sociodemographic factors	value	P-value	Significance
Gender	0.238	>0.05	Not significant
Education	0.102	> 0.05	Not significant
Age	0.01	< 0.05	Significant
Occupation	0.04	< 0.05	Significant

Then was tested and examined the importance of origin of olive oil regarding the sociodemographic factor such as age, gender, occupation and, education. It was used chi square analysis and the result presented in table 3, showed that gender ($X^2 = 0.238$; $p > 0.05$) and education ($X^2 = 0.102$; $p > 0.05$) are irrelevant in the importance of origin of buying olive oil unlike age ($X^2 = 0.01$; $p < 0.05$) and occupation ($X^2 = 0.04$; $p < 0.05$) which are relevant in explaining the importance of origin of buying olive oil.

5. Conclusion

This study analyzes market developments and consumer preferences for olive oil in Tirana with a particular focus on how sociodemographic factors influence consumer behavior in the choice of olive oil. The results indicate that, although gender and educational do not significantly influence the importance consumers attribute to olive oil origin, age, and occupation have a significant effect. Tirana's consumers show a high level of awareness regarding quality characteristics, demonstrating a clear preference for domestically produced olive oil presented in glass containers, alongside an increasing recognition of its health and aesthetic advantages. The growing demand for high quality products, origin verified, and health-conscious olive oil, reflects a shift in patterns of Albanian consumer following COVID-19 pandemic. These results align with the worldwide shift of consumers towards authenticity, sustainability, and product traceability of olive oil. The findings indicate that olive oil goes beyond its status as a basic food item, emerging as a lifestyle product, appreciated for its contributions to nutrition, well-being, and self-care routines.

Producers and government agencies should reinforce the "Made in Albania" brand from a marketing and policy-oriented perspective. Producers should focus more on emphasizing the place of origin in packaging and product certification, while government agencies should prioritize strategies that highlight the cultural value and quality attributes of Albanian olive oil. Targeted marketing efforts on social media, influencer partnerships, and gastronomic events, could increase emotional connections between consumers and local production. At the same time, policy interventions should prioritize the expansion of certification capabilities and strengthening of market transparency. Furthermore, improved cooperation among producers, local governmental, and research institutions will be crucial for improving competitiveness, and reaching new export prospects for Albanian olive oil within regional and European markets.

The study has certain limitations. The use of a convenience sample of 150 respondents only from Tirana constrains the generalizability of the results, and the analysis relies only on descriptive statistics and chi-square tests. This analysis provides only basic insight on consumer behavior choosing olive oil. Future research should incorporate a larger and more diverse sample representing various Albanian regions and utilize more sophisticated statistical techniques as logistic regression, factor analysis, or structural equation modelling to identify the factors influencing consumer decision-making.

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Furthermore, exploring producer perspectives, supply chain dynamics, and the influences of certification schemes (PDO, PGI, organic) would provide a more comprehensive understanding of the potential development of the olive oil sector in Albania. In conclusion, this study gives some basic strategic recommendations on marketing strategies and policy initiatives, which can facilitate the sustainable expansion of Albania's olive oil sector and its integration into wider agri-food value chains.

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THE IMPACT OF TIKTOK CONTENT STRATEGIES ON USER ENGAGEMENT: FINDINGS FROM SLOVENIA

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Abstract: *Social media has significantly transformed the ways in which consumers make decisions, enabling companies to influence users at every stage of the purchasing process. Among the fastest-growing platforms is TikTok, which is based on the creation and sharing of short videos, often enhanced with music, filters, and special effects. This study aims to examine the relationship between content types and user engagement on TikTok. A quantitative research methodology was employed, using a survey questionnaire with closed-ended questions that focused on users' perceptions and preferences regarding different content types. The research took place in Slovenia, the sample was random and responders were voluntary. Social media channels (Instagram and Facebook) were used to disseminate link to survey. Following the social media paradigm of immediate response, the time available to complete the survey was short (three days). The survey reached 201 respondents from which 70 surveys were finally fully completed. The results indicate that users most frequently engage with entertaining, creative, and educational content, whereas promotional posts that merely present a product or service achieve lower levels of responsiveness. The findings further suggest that influencers' presence alone does not guarantee higher engagement. These insights contribute to a better understanding of user interaction dynamics on TikTok and provide a basis for developing effective content strategies. The study has certain limitations, as the sample was convenient and relatively small, and the data relied on self-reports, which may affect validity. Nevertheless, it offers an empirical contribution to the study of user engagement on social media and opens opportunities for further research, particularly in comparative and longitudinal contexts.*

Keywords: *social media, TikTok, user engagement, content strategies, digital marketing.*

1 Introduction

In the last two decades, social networks have become a key part of individuals' everyday lives and represent an important communication and marketing tool for companies (Wiguna, Mulyana & Wardoyo, 2023; Vukasović, Weis & Kramar, 2025). One of the most popular platforms today is TikTok. The platform allows users to create and share short videos, often accompanied by music, filters and special effects. The central feature of the TikTok platform is the "For You Page" (FYP) algorithm, which is based on the analysis of user behaviour and enables the individualised display of content (Boeker & Urman, 2022; Wang, 2022), distinguishing TikTok from other similar platforms.

The platform is extremely popular among different generations and is considered one of the fastest growing apps in the world (Lin, 2023; Guo, 2022). In 2022, more than half of users were between the ages of 13 and 24 (Rimadias, Alvionita & Amelia, 2021), but recently the age has been rising and more and more representatives of older generations can be found among active users. The average user visits the app eight times a day and spends approximately 46–52 minutes on it (Fan, Luo

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& Wang, 2023; Mink & Szymanski, 2022). TikTok is an important space for digital marketing, self-expression, social activism and shaping public opinion (Compte & Klug, 2021; Simões, Baeta & Costa, 2023). Due to its effective and engaging algorithm, which allows content to go viral quickly, the platform is also used as a tool for visual culture, news consumption and political mobilisation (Ibrahim et al., 2025; Nie, 2023).

While research has mostly focused on user behaviour and analysis of the TikTok platform, the complex relationship between different content characteristics and measurable indicators of user engagement remains under-researched (Boeker & Urman, 2022). We assume that this connection is not random, and through our research we want to determine how different types of content influence user engagement/responses on the TikTok platform. We anticipate that not all types of content are equally successful, as users experience them differently and respond to them differently. In our research, we analysed different types of content – educational, entertaining, informative, sales-oriented, and trending – and based on our findings, we developed proposals for effective content creation strategies. The results of the study offer useful insights for optimising content creation and marketing strategies for companies present on the TikTok platform and have stimulated academic debate about content in the rapidly evolving digital environment.

2 Tik Tok

The development of social networks dates back to 2002, when Friendster (in 2002) and MySpace (in 2003) appeared and were among the first to gain widespread popularity (Boyd & Ellison, 2007). Facebook was launched in 2004, initially for Harvard students, and then opened to the wider public in 2006 (Boyd & Ellison, 2007). YouTube (2005) and Twitter (2006) began to transform the way videos and short messages are shared (Kaplan & Haenlein, 2010; Twitter, n.d.; YouTube, n.d.). Social networks have been booming since 2007, when they became part of everyday life. In 2010, Instagram joined the fray and quickly became popular for sharing photos and short videos (Kaplan & Haenlein, 2010; Kuss & Griffiths, 2017).

Social networks have completely changed the way consumers make decisions (Vukasović, Weis & Kramar, 2025). They enable companies to influence consumers from the initial stage of considering a purchase to the purchase itself and beyond (Fuchs, 2014). The digital space enables direct and cost-effective connections between businesses and consumers, providing marketers with invaluable data on various target demographic groups (Pietro & Pantano, 2012). The ability of social networks to encourage interactive dialogue and communication between peers has a significant impact on consumer attitudes and purchasing behaviour (Begum et al., 2020). The influence of user-generated content, such as reviews and recommendations, on purchasing decisions is significant. Due to its authenticity, this content is often perceived as more credible than traditional advertising (Pourkabirian et al., 2021). The influence of peers, which is further amplified by social media, plays a key role in shaping perceptions and driving purchase intentions (Martini et al., 2022). The shift towards promotion on digital networks has transformed consumers from passive recipients of information into active participants and even creators in the market ecosystem, leading to a redistribution of power (Madzunya et al., 2021).

The TikTok platform evolved from the Douyin app, which was launched in China in 2016. TikTok entered the global market with an international version in 2017 (Genoveva, 2022). Its global expansion accelerated in 2018 when ByteDance integrated TikTok with the highly popular app Musical.ly. This was a strategic merger that significantly increased the user base, especially among younger demographic groups (Montag et al., 2021). The platform's early success was driven by its targeted focus on user segments not previously covered by existing video hosting services, combined with its intuitive design (Rimadias et al., 2021). The platform's usage began to grow rapidly as it attracted significant public interest due to its short, algorithmically selected videos (Schellewald,

2021). The rapid growth of the platform, which has reached over 2 billion downloads since its international launch in 2017, highlights its significant impact on digital communication (Schellewald, 2021). This growth can largely be attributed to the recommendation algorithm, which creates a personalised "For You Page" for each user, encouraging high engagement and virality of content (Boeker & Urman, 2022).

It can be said that TikTok is now one of the most important social platforms in the world, with around 1.59 billion monthly active users (February 2025), placing it alongside the biggest apps such as WhatsApp, Instagram and Facebook (We Are Social & Meltwater, 2025). This significant reach highlights the importance of understanding the effectiveness of content on the platform, especially given its highly viral dynamics and emphasis on user participation (Allué & Cárđaba, 2024). TikTok has become a participatory platform where users personally engage and express their opinions and personal interests (Mingyin, 2021). The unique characteristics of the platform require an in-depth understanding of what types of content drive measurable user engagement and go beyond passive viewing.

TikTok is currently a powerful marketing tool that enables closer contact and greater engagement with the target audience. Its effectiveness is based on a combination of the following characteristics: individualisation, virality and two-way communication. For companies that decide to actively market themselves on TikTok, it is essential to understand the demographics, create interesting content and know how the algorithm works. Its growing popularity among individuals and the increasing presence of companies indicate that TikTok is becoming one of the most important platforms for modern digital marketing.

2.1 Growth in popularity of the TikTok app

According to data, the number of users of the platform increased significantly during the Covid-19 pandemic, especially among young people who used it to maintain social contacts while in isolation (Massie, 2020). TikTok became the most downloaded app in 2020 and 2021, a unique achievement with 318 million downloads in the first quarter of 2020 alone (Jacome Guerrero, 2023). Its exponential growth was driven by lockdowns and restrictions, which led to rapid digital transformation and virtual connectivity (Jacome Guerrero, 2023).

Even after the end of the global pandemic, TikTok's virality and cultural integration continued, as evidenced by its significant user base, which stood at 1.39 billion in 2022, including more than 1 billion monthly active users and 600 million daily active users (Jacome Guerrero, 2023) (Brooks et al., 2022) and grew to 1.59 billion monthly active users by February 2025 (We Are Social & Meltwater, 2025). In terms of user numbers, TikTok even surpassed Google in 2021, becoming the most popular online platform (Ebert et al., 2023). It has established itself as a new form of digital interaction that does not require perfection and encourages spontaneity, creativity and easy content production. It is available in 154 markets and 75 languages, demonstrating its broad global reach and adaptability (Jacome Guerrero, 2023).

2.2 Users of the TikTok social network

Knowing the demographic structure of TikTok users is important for understanding its social and cultural impact, as it gives us insight into the prevailing trends and communication strategies that are consistent with them. TikTok is most popular among the younger population. More than 62% of users are between the ages of 10 and 29, meaning that Generations Z and Alpha dominate the platform (Lin, 2023). According to data, 41% of TikTok users are between the ages of 16 and 24, highlighting its strong presence among the younger demographic (Mink & Szymanski, 2022). Approximately 22.4% of users in the United States are between the ages of 20 and 29, further confirming the dominance of younger adults on this platform (Sun, 2021). Research has shown that users on the TikTok platform are evenly represented across genders and ethnic groups, demonstrating the platform's broad reach (Mingyin, 2021). The ratio of men to women is roughly equal (53% men, 47%

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women) (Ibrahim et al., 2025). Understanding user behaviour and preferences is essential for optimising content visibility, which requires testing different styles and themes of videos (Can & Portela, 2024).

Based on user demographics, companies on TikTok mainly target:

- young consumers with high digital literacy;
- trend-conscious individuals who are quick to respond to pop culture;
- users who value authenticity and humour over more professionally produced content.

When creating content, companies must take into account that TikTok has a target audience that is extremely sensitive to authenticity and transparency, which requires a thoughtful and ethical approach to marketing strategies (Can & Portela, 2024). Due to the young age of its users, companies must consider ethical challenges – from data use to the impact of ads on body image and mental health. As a result, TikTok has already committed to restricting content that promotes unrealistic beauty standards or unhealthy habits.

3 Method

The research, conducted in Slovenia, is based on a quantitative method. We asked TikTok users about their preferences – what type of content they most enjoy watching on TikTok, what they think about more commercial content, etc. We conducted an online survey. We invited respondents to complete the survey via social media, and the sample was random – we shared the link to the survey using the snowball method, and anyone who wanted to could complete it.

The survey sample included 201 volunteers of all ages. Since the condition for participation in the survey was an active user account on the platform and regular monitoring of published content, we ultimately recorded 70 valid surveys. The collected data were processed using SPSS.

Women accounted for 66% of the survey participants, while men accounted for 34%. In terms of age, the majority of respondents (44%) were between 27 and 34 years old, confirming the assumption that TikTok is no longer just a platform for younger generations. A good quarter (26%) belong to the 18-26 age group, while 20% of respondents fall into the 35-44 age group. Relatively few respondents are younger than 18 (1%), older than 45 to 54 (7%) and older than 55 to 64 (1%).

Based on the assumption that TikTok users are mainly representatives of the younger generation, we conclude that the trend is reversing and that TikTok is no longer a platform exclusively for young people. More and more older people are deciding to create a profile on TikTok, even if only to follow content and not to post regularly. The highest percentage of users are in the 27-34 age group, followed by the 18-26 and 35-44 age groups, which represent approximately the same percentage. The age structure confirms that the adult population is also an important segment of TikTok users.

None of the respondents have primary education, 37% have completed secondary education, while half have higher or tertiary education. Thirteen percent of respondents have a master's degree, and none have a doctorate. The results among respondents indicate a relatively high level of education among users of the platform.

4 Results

4.1 Presentation of data and results

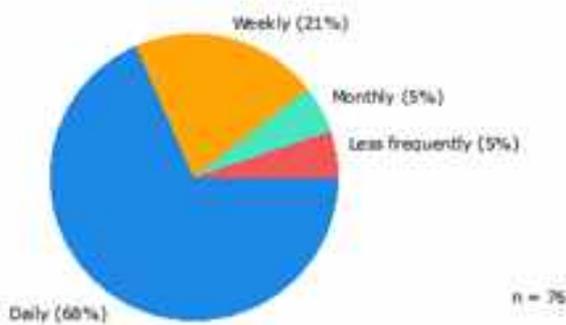
4.1.1 Inclusion/exclusion questions and general questions about the use of the TikTok platform

At the beginning of the survey, respondents were asked whether they had a TikTok profile. 80% of respondents confirmed that they had a profile, while 20% did not have a profile and completed the survey. This data indicates the high prevalence of the platform among respondents, which is an important starting point for further analysis of user behaviour. 86% actively use TikTok, while 14% have a profile but do not actively use the TikTok platform, which is why they completed the survey. The responses show that a significant percentage of respondents, despite having an active profile on

the platform, are not present. For the purposes of the study, we needed participants who regularly follow content on the platform.

The results show that 68% of respondents use TikTok daily, indicating a strong attachment to the platform. A further 21% of respondents use the platform on a weekly basis, indicating a medium level of engagement. The platform is used less frequently by 5% of respondents who use it monthly and an additional 5% who use it even less frequently. The results show that the majority of users are not just casual visitors, but are regular users of the platform and therefore represent a suitable sample for our research.

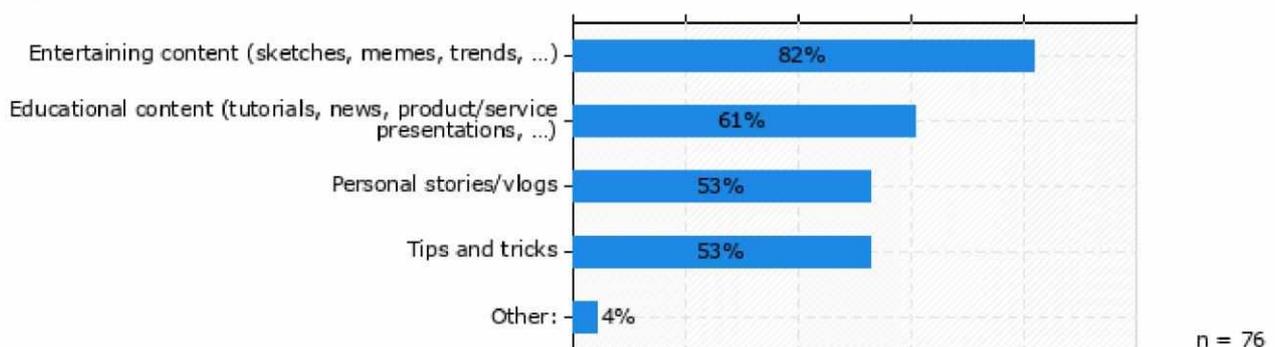
Figure 1. *How often do you use TikTok?*



4.1.2 User preferences regarding TikTok content

We then asked respondents about their preferences regarding the types of content that attract their attention, allowing them to select multiple answers. 82% of users responded that they are attracted to entertaining content. Educational content is interesting to 61% of respondents, followed by personal stories and vlogs, which attract 53% of users. The same percentage of respondents are looking for tips and tricks (53%). Four percent of respondents said they were attracted by other content, such as cooking, recipes and politics. The results confirm that users are most attracted to entertaining and educational content, as well as content in which they find added value or benefit.

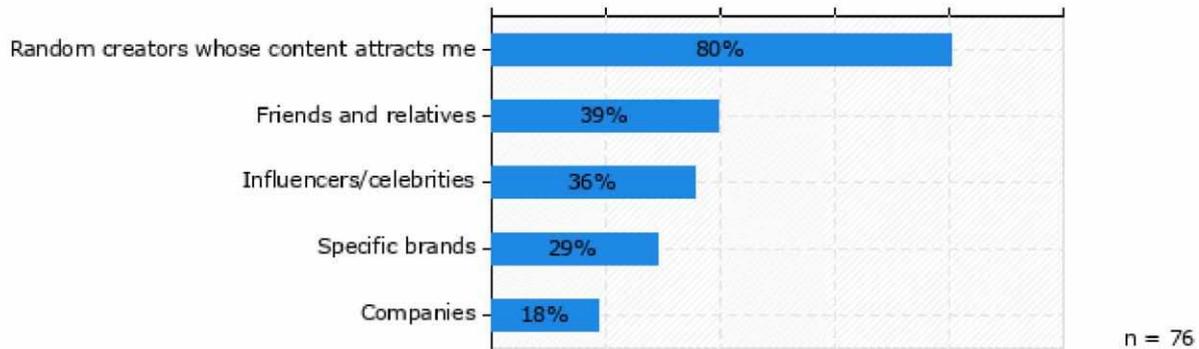
Figure 2. *What content attracts your attention the most?*



Most respondents (80%) said they follow random creators whose content attracts them, which emphasises the importance of content quality. Approximately 39% follow friends and relatives, while 36% follow influencers and famous people. A smaller proportion of respondents follow specific brands (29%) and companies (18%). The responses confirm the assumption that content itself is the most important factor on the TikTok platform. If the content attracts the user, they will follow the creator regardless of who they are or whether they know them, whether they are an individual or a company.

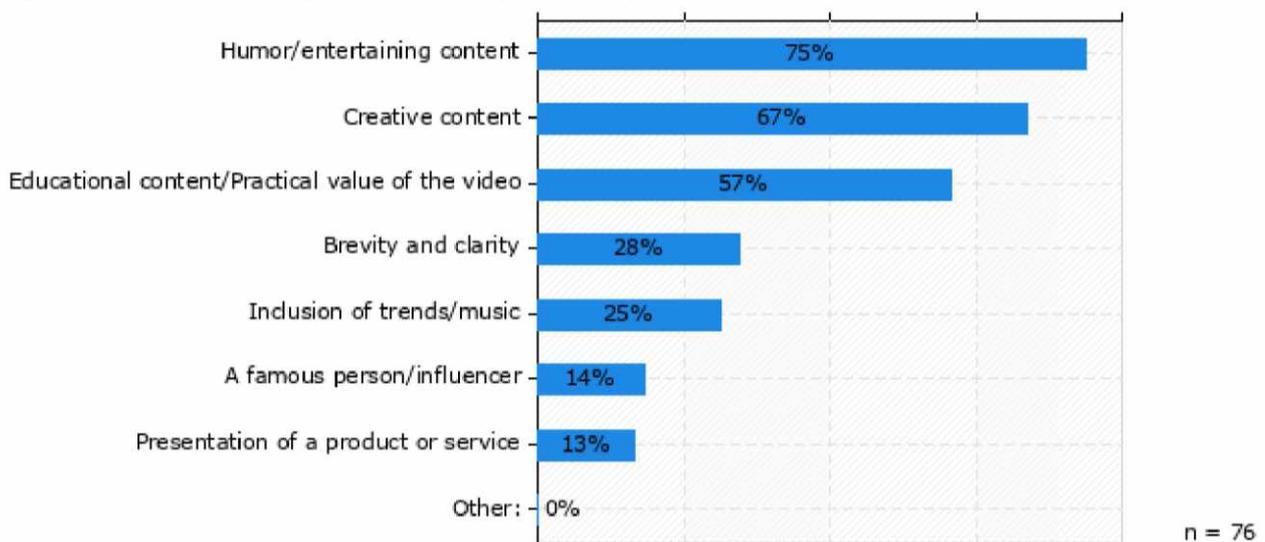
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Figure 3. Who do you follow on TikTok?



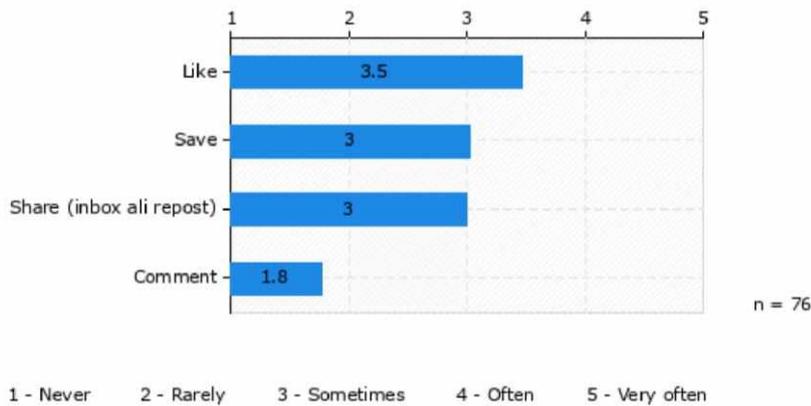
When asked about the reasons that attract users to respond to a post, 75% of respondents said that they most often react to entertaining content that contains humour. Creative content attracts 67% of respondents, while just over half (57%) are also influenced by the educational or useful aspect of the content. Shorter and clearer content attracts 28% of users, while 25% of respondents react to posts that include trends and music. Content featuring influencers and famous people attracts only 14% of respondents, while content showcasing products or services attracts 13%, indicating that promotional content alone does not generate much response unless it is placed in an entertaining or creative context. The findings suggest that successful content must be both entertaining and creative. In addition, it must have added value that users recognise as useful or beneficial in order for them to respond to it. The fewest users respond to posts that only show a product or service, and surprisingly few are attracted by famous faces.

Figure 4. What attracts you most to respond to a post (like, comment, save, share)?



We then investigated how often they respond to posts that attract their attention. We combined the answers into an average, which shows us how often users on the platform respond to content that attracts them and which method they choose most often. Respondents most often respond to posts by liking them, which they do between rarely and often. Saving, sharing and commenting rank lower on the frequency scale – rarely or very rarely. This means that attention does not necessarily translate into high user engagement or response. The results indicate that users seldom engage with posts, even when they find the content appealing. To posts on the TikTok platform, even if they find the content appealing. They most often respond with a like, and least often with a comment.

Figure 5. How often do you respond to a post that catches your attention?

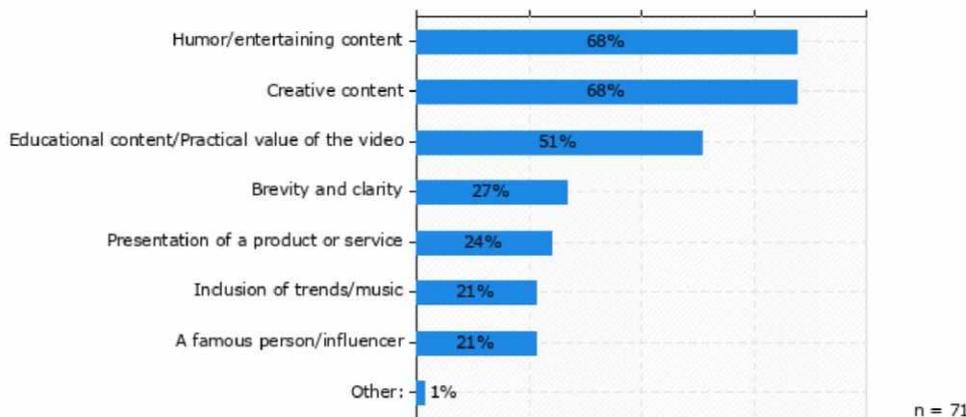


4.1.3 Users' attitudes towards sales content

We investigated whether users actively follow posts by companies they are interested in on the TikTok platform. The responses showed that 41% of respondents do not actively follow posts by companies they are interested in. Almost the same proportion follow this content occasionally (39%), while only 20% follow it regularly. The responses indicate that users are not actively engaged in following company posts on the TikTok platform. Companies could turn this trend to their advantage by creating more content that interests and attracts users. This would make it easier to build a community of active users who would regularly follow their activities on the profile.

We asked survey participants what attracts them to view a random company post on the "For you page". Multiple answers were possible. Two answers prevailed among the respondents – entertaining content and creative content, which were chosen by 68% of users. The useful and educational value of a post attracts slightly more than half (51%), while shorter and clearer content attracts approximately 27% of respondents. Fewer respondents are attracted by product or service displays (25%), current trends or music (21%) and the presence of influencers or famous people (21%). 1% of respondents chose the option "Other" and stated: "Nothing attracts me, I scroll past in the first second." Judging by the responses, most users are attracted to posts that are entertaining, creative and contain an educational component that users perceive as useful.

Figure 6. What attracts you to view a random post on the "For you page"?

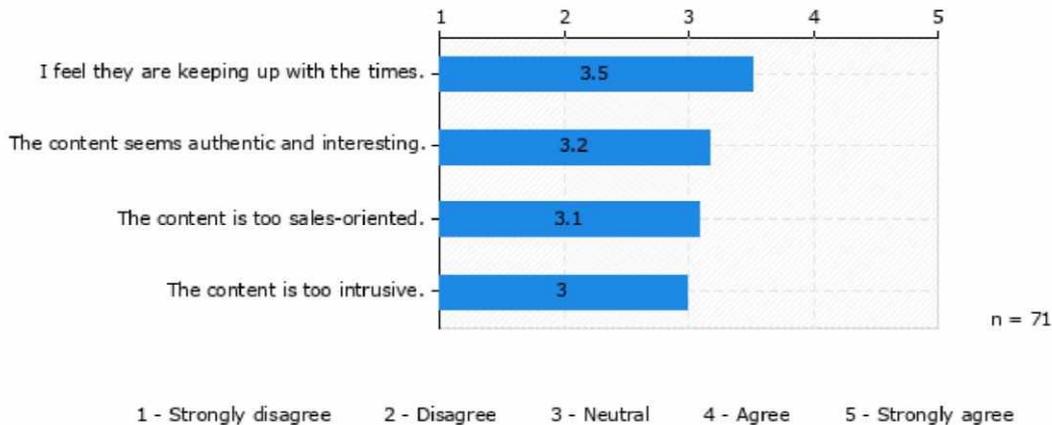


We surveyed respondents' opinions about companies that regularly post on TikTok. For each statement, they responded on a scale from "1 – Strongly disagree" to "5 – Strongly agree." Respondents partially agree or agree that companies are keeping up with the times with their presence and that the content is authentic and interesting. At the same time, opinions on the sales orientation of the content are mixed, as many partially agree that the content is too sales-oriented and sometimes even intrusive.

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This indicates a need for a subtle balance between marketing and authenticity, which is crucial for users. There were no drastic differences in the responses to this question, from which we can conclude that users find it important for companies to be present on the TikTok platform, but they are not particularly attracted to their content, nor do they find it overly intrusive or sales-oriented.

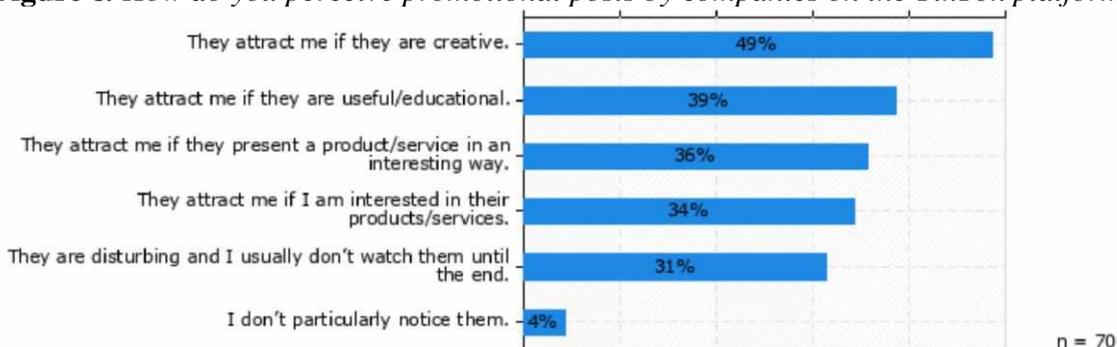
Figure 7. *What is your opinion of companies that regularly post on the TikTok platform?*



This was followed by a question about trust in brands that create creative content on the TikTok platform. 44% of respondents believe that this content does not significantly increase trust, while 41% note that it depends on their personal perception of the content. Only 11% believe that creative content increases their trust in a brand, which shows that creativity is important, but not enough on its own to build trust; it must also have concrete value and relevance for the user. Four per cent of respondents said that it depends on how close they feel to the company. Judging by the responses, creative content does not significantly influence the building of trust in a brand, or rather, it depends on whether the content attracts the user. For the user to notice the content, several conditions must be met, which lead to the building of trust in the brand.

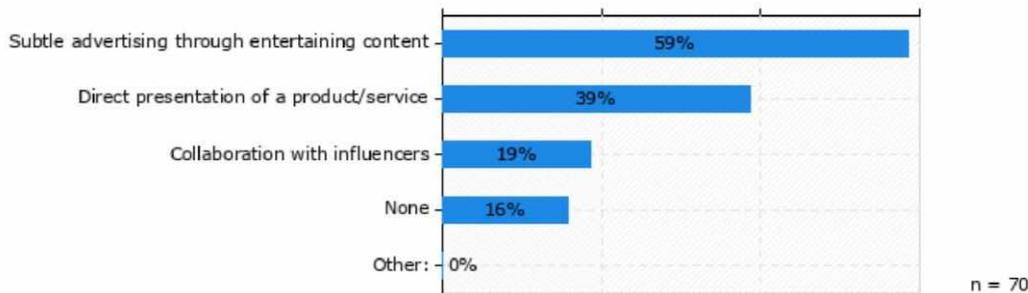
When it comes to companies' promotional posts, almost half of respondents (49%) confirm that they are attracted by creative content. 39% of respondents are attracted by posts if they are useful or informative, 36% are attracted by an interesting presentation of a product or service, while 31% find promotional posts annoying and therefore do not follow them to the end. Four per cent of respondents said they do not particularly notice such posts. This is important information for companies, as the results reveal key user preferences that should be understood and taken into account when creating promotional content and strategies for the TikTok platform. From the responses, we can conclude that promotional posts are interesting to users if they have added value – they are creative, teach them something new or present products/services in an interesting way.

Figure 8. *How do you perceive promotional posts by companies on the TikTok platform?*



When it comes to the types of promotional content that most attract users on TikTok, 59% of respondents expressed a preference for subtle advertising through entertaining content, while 39% are attracted by content that directly presents a product or service. Influencers are considered a less important factor, with only 19%, indicating a shift towards authenticity of content as such and a decline in the influence of famous personalities. 16% of respondents chose none of the above, and no one chose the option "other". Based on the responses, we can conclude that users are most attracted to promotional content that is presented as entertaining and therefore not perceived as typical sales content.

Figure 9. Which forms of promotional content on TikTok appeal to you the most?



Do companies motivate you to visit their website or purchase their products/services through their presence and posts on TikTok?

We then investigated whether companies motivate respondents to visit their website or purchase their products/services through their presence and posts on the TikTok platform. 61% responded that they are mainly motivated by interesting content. 19% said that companies motivate them to visit their website or make a purchase through their posts, while the same percentage said the opposite. A smaller percentage (1%) pointed out that motivation depends on whether the product is interesting or whether they had already intended to buy it. Therefore, if the content published by a company is interesting enough for the user, it will encourage them to visit the website or purchase the product/service promoted in the post.

4.2 Testing hypotheses

The study set out three hypotheses.

H1: The type of content (e.g. informative, entertaining, promotional) has a significant impact on the level of user response (measured by likes, comments, shares, etc.).

The results of the study confirm the link between these two factors. Users most often respond to entertaining content (75%), followed by creative content (67%) and educational content that they perceive as useful (57%) (Figure 4). Content that merely displays a product or service is significantly less effective in encouraging user response. This indicates that content containing emotional or informative elements generates a higher level of engagement and response. Users choose media based on their needs – whether for entertainment, information or social connection. In practice, this means that brands seeking to increase engagement need to tailor their content to satisfy multiple needs simultaneously, rather than focusing exclusively on the sales message. Based on the results of the study, we confirm the hypothesis.

H2: Content in which users are addressed by recognisable representatives (e.g. brand ambassadors, employees or influencers) achieves a higher level of user response than content without such individuals.

The results of the study reject this hypothesis. Only 14% of users respond to content featuring famous personalities (Figure 6), influencers attract only 19% of respondents to promotional posts (Figure 9), and influencers attract 21% of users to view random posts on the "For you page" (Figure 4). (Figure 4). These results indicate that individual recognition alone is not a sufficient factor for generating high levels of engagement. Usability, creativity and content quality remain key elements,

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with influencers only able to increase the effect if they are connected to brand values and their presence adds authenticity or additional informative value to the message. In line with influence models in marketing, recognition has limited impact if it is not supported by a high level of credibility and expertise on the part of the representative.

H3: Companies' promotional content on TikTok achieves a higher level of engagement when it includes elements of entertainment, creativity or useful information than when it merely displays a product or service.

The results of the study confirm the hypothesis. Users respond least to posts that merely display a product or service (Figure 4, Figure 8), while promotional posts that are creative or entertaining receive significantly more attention. 59% of respondents said they were attracted by direct advertising through entertaining content, while 39% were motivated by the usefulness or educational value of the post (Figure 9). This means that a sales message alone is not a sufficient trigger for engagement. Companies must therefore tailor their promotional content to the expectations of users, who demand a combination of authenticity, creativity and added value. When interpreting the results, it is important to emphasise the difference between H1 and H3. H1 refers to general content on the TikTok platform (entertaining, creative, educational, promotional), where it was found that the type of content significantly influences the level of user responsiveness. H3, on the other hand, refers exclusively to promotional content from companies and points out that this only achieves a higher level of engagement when it is designed in a creative, entertaining or user-friendly way. H3 thus complements the findings of H1 by highlighting the specific requirements that users have when accepting advertising content.

5 Conclusion

The results of the study confirm that the types of content on the TikTok platform have a significant impact on the level of user engagement. It was found that entertaining, creative, and educational content that offers users perceived added value encourages the highest level of engagement, while purely sales-oriented posts are significantly less effective. This is supported by Xiao, Lin, Li, and Zhang (2022), who identified performance expectancy, entertainment value, and tie strength as strong positive predictors of engagement, while the sales approach is negatively related to user responses. A large meta-analysis by Pan, Blut, Ghiassaleh, and Lee (2024) reinforces this, showing that content features with informational or hedonic value (e.g., fun, novelty, useful information) exert some of the strongest effects on attitudes and engagement, more so than the presence of a famous creator. The study further rejects the hypothesis that content featuring influencers or celebrities is inherently more effective, as it was found that the creator's recognition alone does not necessarily lead to a higher response rate. Authenticity and relevance of content remain key factors in building trust and long-term engagement. Research on authenticity strategies demonstrates that influencer recognition yields significantly higher engagement only when authenticity is managed effectively (Munnukka, Uusitalo, & Karjaluoto, 2024). Similarly, multimodal analyses indicate that visual and speech/text features are the most significant drivers of engagement, exceeding the impact of celebrity status or follower numbers (Zhao, Zhang, & Wu, 2024; Zhang, Li, & Chen, 2025). Finally, experimental work shows that creative use of visual-audio features—such as varied image complexity and speech rate—further enhances engagement levels, particularly when the content is authentic and relatable (Xiao, Li, & Mou, 2024; Yu, Chen, & Sun, 2024). The contribution of the research is that it provides an empirical basis for understanding the link between content and user behaviour on TikTok, highlighting the importance of adapting communication strategies to the specific dynamics of the platform. It provides guidelines for companies and content creators to develop more effective digital marketing strategies based on a combination of entertainment, education and authenticity.

Despite its important findings, the study also has certain limitations. The sample was opportunistic and relatively small, which limits the possibility of generalising the results to the entire population of TikTok users. In addition, the data was collected through self-reporting, which may affect the objectivity of the responses due to socially desirable responses. The study focused on only one platform and did not include comparisons with other social networks, which could have provided broader insight into the specific characteristics of user engagement. Furthermore, the study did not examine the long-term effects of content strategies, but focused on current user preferences and perceptions. In addition, the characteristics of the TikTok platform itself, which is highly dynamic and subject to rapid changes in algorithms, trends and user practices, must also be taken into account. As a result, user behaviour patterns can change in very short periods of time, which may affect the sustainability and generalisability of the findings.

The study contributes to the existing literature on social media use by providing empirical insights into differences in user responses to different types of content on TikTok. This opens up space for further scientific debate on the factors influencing user engagement and provides a starting point for comparative studies between different platforms. For further research, it would be useful to expand the sample to a more representative population, include longitudinal studies to track long-term trends, and compare user engagement across different platforms. A particularly interesting direction would also be to analyse the interactions between algorithmic recommendations, content design and user responses. As a rapidly evolving platform, TikTok offers rich opportunities for understanding consumer behaviour and designing innovative marketing strategies.

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BUILDING RESILIENT ECONOMIES THROUGH INTEGRATION INTO THE BRICS+ FRAMEWORK IN A DYNAMIC GLOBAL LANDSCAPE: A SCENARIO-BASED PROBABILISTIC ANALYSIS OF EECME INTEGRATION PATHWAYS

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Abstract: *This paper investigates the strategic prospects for Eastern European countries to recalibrate their global alignments by engaging more deeply with the BRICS bloc. While historically integrated with the EU, many Eastern European economies face vulnerabilities stemming from over-dependence on Western markets, limited diversification, and geopolitical volatility. Through a scenario-based analysis, this study evaluates four potential pathways with BRICS engagement: full integration, limited engagement, selective strategic partnerships, and geopolitical realignment under crisis. Findings suggest that a selective partnership approach offers the highest probability of success, allowing Eastern Europe to diversify economically while maintaining stability within existing Western alliances. Ultimately, the paper argues that a balanced engagement with BRICS could position the region as a strategic intermediary between East and West, fostering growth, resilience, and contributing to an emerging multipolar global order.*

Keywords: BRICS, Scenario Analysis, Eastern Europe Geopolitics

1. Introduction

“We have no eternal allies, and we have no perpetual enemies. Our interests are eternal and perpetual, and those interests it is our duty to follow.” Lord Palmerson, J.H. Temple, United Kingdom prime minister (1859-1865, 1855-1858).

In the face of an increasingly interconnected yet volatile global economy, the need for resilient economic frameworks has never been more pressing. The BRICS+ framework, an extension of the Brazil, Russia, India, China, and South Africa (BRICS) to include additional emerging economies, has emerged as a significant catalyst for fostering economic stability, cooperation, and growth in a rapidly evolving global landscape. By incorporating countries from diverse regions and with varying economic strengths, the BRICS+ initiative aims to promote sustainable development, enhance global trade, and reduce dependency on traditional economic powers.

Joining BRICS+ could offer countries increased influence on the global stage, as it aims to counterbalance the dominance of Western powers. However, BRICS itself has yet to fully materialize its goals. While the BRICS nations have made strides in collaboration, they still face challenges like differing political systems, economic structures, and development priorities. The BRICS+ expansion reflects a desire for greater representation and cooperation, but without a solid foundation within BRICS, its success remains uncertain, posing risks for new members seeking tangible benefits.

This paper explores the role of the BRICS+ framework in building resilient economies, examining its potential to foster economic stability, promote sustainable development, and enhance the global influence of emerging economies. Delving into the opportunities and challenges of integration into this dynamic framework helps to understand its transformative impact on the future of global economic governance.

1.1. Purpose and Context

The global economic landscape is constantly changing, driven by geopolitical tensions, technological advances, and shifting trade dynamics. This creates uncertainty, making it difficult to predict the future. Scenario building helps navigate these complexities by exploring potential futures and preparing for a range of outcomes.

Policymakers in BRICS+ countries need strategies for long-term economic outcomes. Scenario building allows testing different policy options in hypothetical futures, considering factors like global trade, regional cooperation, or technological advancements such as AI. This helps identify the most adaptive strategies, fostering resilience. Scenarios also uncover potential risks and opportunities, such as changes in supply chains or environmental crises, and help identify new avenues for collaboration within BRICS+, like shared technological innovations or trade agreements.

1.2. Scope of the Paper

This paper focuses on concepts, frameworks, or models to explore possible future outcomes, and it is based on literature, expert opinion, or projections. The paper presents four thought experiment scenarios to assess the outcomes of Eastern European integration into the BRICS framework, focusing on economic diversification, political integration, and strategic security. Hence, the research question formulated to investigate is: What are the various scenarios in which Eastern European countries could integrate with the BRICS framework to help diversify their economic partnerships?

2. Theoretical Framework

Unlike traditional forecasting methods that predict a single future outcome, scenario planning is a strategic tool that helps organizations or policymakers explore multiple potential futures to develop more flexible strategies and respond effectively to uncertainty (Schwartz, 1991). The theoretical foundation for scenario planning is often based on understanding key drivers of change and identifying uncertainties in a given context. The Schwartz (1991) model of scenario planning advocates for creating scenarios that consider both "predictable" elements (such as demographic trends) and "unpredictable" elements (such as technological disruptions or geopolitical shifts). This helps organizations or countries prepare for several alternative futures rather than one fixed projection. Wack (1985) outlined the importance of using scenarios to manage uncertainty in strategic decision-making, especially in international contexts where global trends and market volatility create high uncertainty.

Scenario building in political and economic contexts helps to explore how different geopolitical alliances like BRICS could impact regional and global economic stability. Godet (2000) argues that scenario planning can help policymakers understand the long-term consequences of their decisions, especially in volatile political climates like those experienced in Eastern Europe. Schoemaker (1995) highlights how organizations and countries can develop strategic plans that prepare them for a variety of economic disruptions, such as financial crises, technological shifts, or political upheavals.

A significant body of literature has focused on the growing influence of BRICS in reshaping global power dynamics. Studies by Armijo (2007) and Sokol (2019) argue that BRICS nations, through economic integration and cooperative initiatives like the Development Bank (NDB). The NDB, in the context of BRICS, functions as a multilateral development bank designed to support sustainable projects that contribute to long-term economic growth. Unlike traditional institutions such as the World Bank or the IMF, the NDB seeks to offer an alternative to Western-dominated financial institutions by focusing on providing financing for infrastructure, energy, and development projects in BRICS and other developing nations, thereby fostering economic growth and reducing inequality. The NDB is a key component of BRICS' broader goal to challenge the existing global economic order and provide more inclusive and equitable solutions for development. By creating this bank, BRICS members aim to promote a more balanced international financial system, where the influence of emerging economies is more pronounced, and access to capital for infrastructure development in these regions is enhanced. Literature on large-scale infrastructure and technological initiatives, particularly in the context of BRICS, emphasizes the role of scenario planning in shaping future investments. Studies by Morris &

James (2017) highlight how initiatives like the Belt and Road Initiative (BRI) have the potential to transform regions by providing infrastructure financing, technological advances, and increased connectivity. Scenario planning, in this context, helps decision-makers assess the risks and benefits of engaging in these large-scale projects. This theoretical framework lays the foundation for understanding how scenario planning can be a valuable tool for analyzing the future of Eastern European countries as an alternative to consider deeper integration into the BRICS framework.

3. Methodology

The qualitative Scenario Analysis approach involves the use of narrative storytelling and expert opinions to create rich, detailed scenarios that explore possible futures based on subjective interpretation of uncertainties. It is often used when there is a lack of quantitative data or when the situation involves complex, human-driven factors like political or social dynamics. The goal is to construct a range of potential scenarios based on theoretical models, conceptual frameworks, and expert judgment, rather than data-driven analysis. This approach is intended to provide a strategic exploration of possibilities rather than definitive forecasts. This study employs a qualitative scenario analysis approach grounded in logical truth tree notations to systematically explore possible future outcomes. Initially, assumptions are translated into structured scenarios using truth trees, a formal method that visually represents branching logical pathways based on key decision points or uncertainties. Each branch in the truth tree corresponds to a potential outcome or scenario, reflecting different combinations of assumptions and conditions.

To quantify the relative likelihood of these scenarios, weights are assigned to each branch based on expert judgment and the assessed impact of uncertainties. These weights reflect the plausibility or significance of each pathway and are then normalized to convert them into probabilities. This process transforms a qualitative narrative framework into a semi-quantitative model, enabling a probabilistic interpretation of the scenario space. The qualitative nature of this methodology is particularly suited for contexts characterized by limited quantitative data and complex, human-driven factors such as political or social dynamics—where purely data-driven models may fall short. By combining logical rigor through truth trees with expert-driven weighting, the approach facilitates a strategic exploration of plausible futures rather than definitive predictions, providing valuable insights for decision-making under uncertainty.

In this theoretical exercise, assumptions and key variables were identified based on existing theories and conceptual frameworks. The central assumptions include:

- Unified entity EECME¹: the EECME region is considered as one entity
- EECME needs for Economic Diversification, reducing dependency on Western markets.
- Geopolitical Shifts leading to the potential for political realignment and integration with BRICS nations.
- A trade-off between the European Union (EU) and BRICS².

4. Identifying Key Drivers:

In constructing the scenarios for potential integration of EECME into the BRICS framework, several key drivers were identified. These drivers, rooted in both theoretical insights and expert commentary, encompass economic conditions, geopolitical shifts, technological advancements, and political factors.

This section explain how these drivers were selected based on existing literature and political discourse. As noted by scholars such as Armijo (2007) and O'Neill (2001), the rise of BRICS nations,

¹ Albania, Armenia, Azerbaijan, Belarus, Bosnia and Herzegovina, Bulgaria, Croatia, Cyprus, Czech Republic, Estonia, Georgia, Greece, Hungary, Kazakhstan, Kyrgyzstan, Latvia, Lithuania, Montenegro, North Macedonia, Poland, Republic of Moldova, Romania, Serbia, Slovakia, and Slovenia

² 11 are members of the EU Bulgaria, Croatia, Cyprus, Czech Republic, Estonia, Greece, Hungary, Latvia, Lithuania, Poland, and Romania.

particularly China and India, has led to a significant redistribution of global economic power. Politicians like Andrzej Duda, President of Poland, have acknowledged the need for diversification of trade partners beyond the EU and NATO, emphasizing the potential of the role of the NDB and the BRI has been highlighted by scholars such as Li (2020) and Zhao (2018), who argue that these initiatives present opportunities for infrastructure investment in developing regions, including Eastern Europe. The digital divide between the West and emerging economies is shrinking, with BRICS nations leading in sectors like renewable energy, artificial intelligence (AI), and telecommunications. According to authors such as Moyo (2015) and Xu (2020), these nations' investments in digital infrastructure could provide Eastern Europe with much-needed technological upgrades, improving competitiveness in a rapidly changing global economy. Central and Eastern European countries (CEE) are particularly vulnerable to the technological gap, as emphasized by political leaders like Czech President Miloš Zeman, who advocates for stronger technological and digital collaboration with China (Zeman, 2019). As digitalization reshapes economies, Eastern Europe's integration into BRICS would allow the region to engage more fully with global innovation networks. Experts like Nuno (2019) have stressed that such technological cooperation can enhance Eastern Europe's infrastructure, particularly in energy and smart city projects, areas where BRICS countries are heavily invested.

As global power dynamics shift, many political analysts argue that the growing influence of BRICS countries poses a challenge to the traditional Western order. According to Mearsheimer (2014) and Buzan (2004), the rise of BRICS could push Eastern European countries to rethink their longstanding alliances with NATO and the EU as they seek to balance between Western and Eastern spheres of influence. Polish political figures, such as former Prime Minister Donald Tusk, have expressed concerns that an overreliance on the West may prevent the region from capitalizing on opportunities presented by BRICS nations (Tusk, 2017). Political figures like Lithuania's President Dalia Grybauskaitė have emphasized the importance of maintaining a strong European orientation, but she also recognizes the necessity of expanding ties with emerging economies like China (Grybauskaitė, 2016).

4.1. Assumptions and Variables

Several core assumptions are made while developing the scenarios, which are based on both existing political analysis and global economic trends. Eastern European countries are expected to seek greater economic diversification, as political leaders like Romania's President Iohannis advocate for reduced dependence on Western markets (Iohannis, 2018). This is supported by concerns about the region's over-reliance on the EU and NATO (Havránek & Jančík, 2020). With the rise of BRICS as a collective economic force, these nations are likely to continue influencing global trade, offering Eastern Europe alternative partners (Goldstein, 2019).

Key variables shaping scenarios include:

- The potential for deeper political and economic ties with BRICS has been discussed by experts like Armijo (2007) and Mahbubani (2018).
- Relations with NATO and the EU, with figures like Orbán (2020) advocating for a reevaluation of these alliances.
- The region's ability to attract investment, particularly in energy and infrastructure, is influenced by BRICS-led initiatives (Yu, 2017).
- Eastern Europe's ability to withstand global economic shifts is shaped by internal stability and external conditions (Becker, 2020).

To start with, it is important to check the current global integration of the EECME countries. The global integration is typically indicated by trade share with other countries, which is facilitated by the trade agreements. Assuming the trade off between the EU and BRICS, Table 1 provides an overview of the current trade agreements among the EECME countries and the EU that showing a diversity of economic alliances in the EECME, a mix of both multilateral and bilateral trade agreements.

Table 1. *Current Trade Agreements of EECME within Europe*

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Agreement Name	Year Established	Countries/Regions Involved
Central European Free Trade Agreement (CEFTA)	1992	Albania, Bosnia and Herzegovina, North Macedonia, Moldova, Montenegro, Serbia, Kosovo, and the European Union (signatories include many Eastern European countries)
Visegrad Group (V4) Cooperation	1991	Czech Republic, Hungary, Poland, Slovakia
European Union (EU) Membership	2004-2007	Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia, Slovenia
European Economic Area (EEA)	1994	Iceland, Liechtenstein, Norway, and EU countries (including many Eastern European countries)
Customs Union between Belarus, Kazakhstan, and Russia (Eurasian Customs Union)	2010	Belarus, Kazakhstan, Russia
Eurasian Economic Union (EAEU)	2015	Armenia, Belarus, Kazakhstan, Kyrgyzstan, Russia
Southeast European Cooperative Initiative (SECI)	1996	Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Greece, Hungary, Romania, Serbia, Turkey, and others
Eurasian Economic Union (EAEU) - Free Trade Agreement with Vietnam	2016	EAEU countries (including Armenia, Belarus, Kazakhstan, Kyrgyzstan, and Russia) and Vietnam
Free Trade Agreement with the European Union (EU) for Ukraine	2016	Ukraine, European Union
Free Trade Agreement between Turkey and Central and Eastern European Countries	2000-2010s	Turkey, Poland, Romania, Bulgaria, Hungary, and others
Bilateral Trade Agreements with Russia	Ongoing since 1990s	Various Eastern European countries and Russia

Source: Author, based on WTO database

Table 2 shows the agreements of EECME countries with the members of the BRICS countries. It shows that China is the most active BRICS country in terms of engagement with EECME members. Brazil appears to be the least active BRICS country in terms of its formal engagement. The majority of the trade agreements mentioned revolve around energy, industrial goods, and agriculture. These sectors reflect both the natural resources of the BRICS nations and the industrial and agricultural strengths of the EECME countries, facilitating mutually beneficial trade.

Table 2. Current Trade Agreements of EECME with BRICS

Agreement Name	Year Established	Eastern European Countries Involved	BRICS Country Involved	Purpose/Details
Russia-EU Partnership and Cooperation Agreement	1997	EU countries (e.g., Poland, Hungary, the Czech Republic, etc.)	Russia	focusing on trade, political relations, and economic cooperation between the EU and Russia.
Russia-Serbia Free Trade Agreement	2000 (revised 2019)	Serbia	Russia	allowing trade in energy, industrial goods, and agriculture between Russia and Serbia.
16+1 Initiative	2012	Poland, Hungary, the Czech Republic, Slovakia, etc.	China	A cooperation initiative enhancing trade, investment, and infrastructure cooperation between China and Eastern Europe.
China-Serbia Free Trade Agreement	2009	Serbia	China	focusing on exports like agricultural products, machinery, and other industrial goods.
India-Bulgaria Bilateral Agreement	1990s	Bulgaria	India	focusing on information technology, pharmaceuticals, and industrial machinery.
India-Poland Bilateral Agreement	2009	Poland	India	enhancing trade in IT, pharmaceuticals, and machinery.
Brazil-Ukraine Trade Agreement	2004	Ukraine	Brazil	Focusing on agriculture, industrial products, and machinery between Brazil and Ukraine.
Brazil-Serbia Free Trade Agreement	2000 (revised 2015)	Serbia	Brazil	promoting agricultural, machinery, and industrial trade between Brazil and Serbia.
South Africa-Eastern Europe Cooperation	Ongoing	Poland, the Czech Republic, Hungary, etc.	South Africa	Growing trade and investment ties focusing on minerals, energy, and technology between South Africa and Eastern Europe.

Source: author, based on WTO database

A quick comparison between Table 1 and Table 2 shows that the EECME region is more integrated with the EU than BRICS. Hence, in this context may be necessary to mention a few differences. The EU represents a deeply integrated political and economic union characterized by shared institutions, regulations, and governance frameworks, while BRICS functions as a flexible coalition of emerging economies focused on trade, development, and geopolitical cooperation. The EU’s objectives emphasize regional stability, peace, democracy, and the rule of law, whereas BRICS seeks to promote a multipolar world order and strengthen the influence of developing nations in global institutions. The EU’s formal institutional structure supports coordinated policymaking, in contrast to BRICS’s consensus-based approach during summits. Economically, the EU consists mainly of developed, high-income economies with aligned standards of living, while BRICS prioritizes reducing inequality and advancing development among its members. Moreover, EU membership requires meeting stringent political and economic criteria, whereas BRICS expansion remains informal and largely driven by geopolitical considerations.

Table 3. *The macro indicators of EECME*

Country	Population	GDP (Nominal in billions)	Exports to BRICS (USD)	Imports from BRICS (USD)	FDI Inflows from BRICS (USD)	Year
Albania	~2.9 million	\$18.35 billion	\$150 million	\$180 million	\$60 million	2022
Armenia	~3 million	\$15.5 billion	\$320 million	\$220 million	\$100 million	2022
Azerbaijan	~10 million	\$51.68 billion	\$1.3 billion	\$800 million	\$300 million	2022
Belarus	~9.3 million	\$66.4 billion	\$1.1 billion	\$2.5 billion	\$500 million	2022
Bosnia and Herzegovina	~3.3 million	\$24.9 billion	\$300 million	\$500 million	\$150 million	2022
Bulgaria	~6.5 million	\$96.6 billion	\$3 billion	\$5 billion	\$1.8 billion	2022
Croatia	~4 million	\$79.7 billion	\$1.5 billion	\$2 billion	\$500 million	2022
Czech Republic (Czechia)	~10.7 million	\$373.9 billion	\$6 billion	\$4 billion	\$3 billion	2022
Estonia	~1.3 million	\$40.9 billion	\$1.4 billion	\$1.2 billion	\$200 million	2022
Georgia	~3.7 million	\$22.6 billion	\$500 million	\$1.2 billion	\$150 million	2022
Hungary	~9.7 million	\$233.5 billion	\$5 billion	\$7 billion	\$2.4 billion	2022
Kazakhstan	~19 million	\$214.3 billion	\$2 billion	\$3 billion	\$1.5 billion	2022
Kosovo	~1.8 million	\$9.3 billion	\$200 million	\$300 million	\$50 million	2022
Latvia	~1.9 million	\$39.8 billion	\$1.2 billion	\$1.1 billion	\$300 million	2022
Lithuania	~2.7 million	\$60.4 billion	\$2.5 billion	\$3.1 billion	\$700 million	2022
Moldova	~2.7 million	\$15.8 billion	\$250 million	\$350 million	\$60 million	2022
Montenegro	~620,000	\$5.9 billion	\$100 million	\$150 million	\$30 million	2022
North Macedonia	~2.1 million	\$14.3 billion	\$250 million	\$400 million	\$120 million	2022
Poland	~38 million	\$762.7 billion	\$10 billion	\$15 billion	\$5 billion	2022
Romania	~19 million	\$364.5 billion	\$4.5 billion	\$7 billion	\$1.2 billion	2022
Russia	~144 million	\$1.78 trillion	\$1.4 billion	\$2.3 billion	\$400 million	2022
Serbia	~7 million	\$65.7 billion	\$2 billion	\$3 billion	\$1 billion	2022
Slovakia	~5.4 million	\$98.9 billion	\$2.3 billion	\$3.1 billion	\$600 million	2022
Slovenia	~2.1 million	\$70.5 billion	\$4 billion	\$8 billion	\$1 billion	2022
Ukraine	~39 million	\$78.5 billion	N.Available	N.Available	N.Available	2022

(Author, based on data sources UNCTA and World Bank, 2025)

Table 3 shows that formal treaties are also reflected in trade. Poland has the largest exports to BRICS, amounting to \$10 billion, and Russia is a significant trading partner, with exports reaching \$1.4 billion from Russia to the region. Trade and investment with BRICS are highly uneven across the EECME region. Larger economies such as Poland, the Czech Republic, Hungary, Romania, and Bulgaria dominate trade and FDI flows with BRICS. EU member states within EECME account for the

majority of trade and investment with BRICS. Poland, Hungary, the Czech Republic, Romania, and Bulgaria show higher trade volumes and FDI inflows due to stronger institutional frameworks and diversified economic bases, underscoring the EU’s structural advantage in global economic integration even in relations with BRICS.

For most EECME states, especially EU members, relations with BRICS serve as a diversification strategy to reduce dependency on Western markets and strengthen geopolitical flexibility, rather than as an alternative economic alignment.

4.2. Creating Scenarios

The process of building the scenarios involved organising them by the likelihood and impact of various developments, based on key drivers and assumptions. These scenarios reflect different levels of engagement with BRICS, ranging from complete integration to minimal interaction. The process of designing scenarios involved applying conceptual models from scenario planning to envision plausible future pathways for EECME. Scenarios were constructed by combining key uncertainties (e.g., the level of political integration, economic diversification, geopolitical shifts, etc.) with long-term trends (e.g., technological advancement, changing security dynamics). These combinations created four distinct, but plausible, scenarios:

Scenario 1: Full Integration with BRICS

In this scenario, Eastern European countries fully integrate with BRICS, moving away from EU and NATO influence. They benefit from BRI infrastructure projects and NDB financial support, aligning with BRICS’ vision of multipolarity. This reflects the ideal future envisioned by Russia’s Foreign Minister Sergey Lavrov (2021).

Scenario 2: Limited Engagement with BRICS

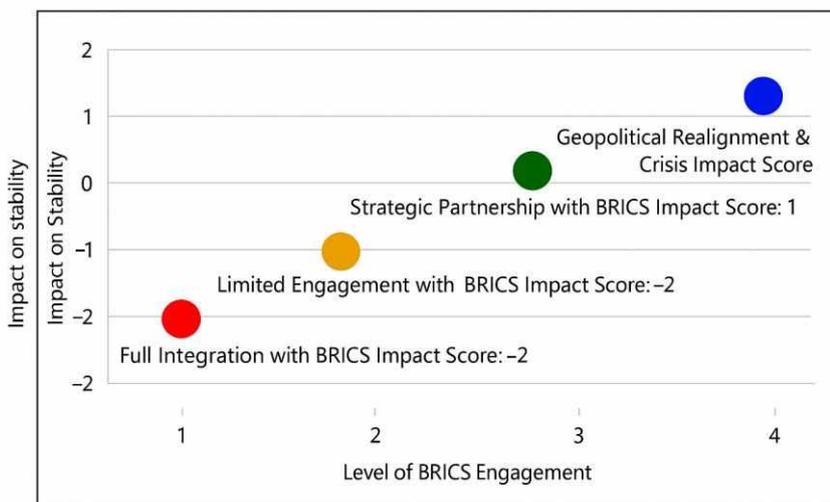
Eastern Europe remains dependent on the EU and NATO, with minimal BRICS engagement. Tensions with Russia and China limit cooperation, leading to missed economic opportunities and stagnation, as argued by Kaldor (2020).

Scenario 3: Strategic Partnership with BRICS

Eastern European countries engage selectively with BRICS on trade, energy, and infrastructure while maintaining EU and NATO ties. Leaders like Hungary’s Orbán pursue flexible policies, balancing dual geopolitical alignments, as suggested by Pomeranz (2015).

Scenario 4: Crisis Scenario

Figure 1. *Overview of Scenario Matrix*



Source: Author 2025

A breakdown of the EU and NATO causes political and economic instability in Eastern Europe. Countries, disillusioned with the West, turn to BRICS but face internal instability and external pressures, leading to stagnation and missed opportunities, as predicted by Ziegler (2019).

A scenario matrix is used to map the four scenarios (Full Integration, Limited Engagement, Strategic Partnership, and Geopolitical Realignment) based on two axes:

Axis X: Level of Engagement with BRICS (ranging from low to high).

Axis Y: Impact on Economic and Political Stability (ranging from negative to positive).

5. Risk and Uncertainty Assessment

Each of the presented scenarios provides a distinct potential future for Eastern European countries' integration into the BRICS framework. The outcomes of these scenarios would have significant implications for both Eastern Europe itself and the global political and economic landscape³. To express each scenario as a truth tree starting from its assumption (root), and logically branching to implications (consequences).

The primary risk in scenario 1 with full integration is the potential for political backlash from the West. Full integration with BRICS could lead to tensions with the EU and NATO, creating diplomatic friction and economic sanctions. However, the economic rewards of infrastructure investments and trade could mitigate some of these risks. Trade-offs between BRICS and EU/NATO are real. Full integration with BRICS would allow Eastern Europe to diversify its economic relations beyond the EU and NATO. Increased trade with BRICS countries could stimulate regional economic growth, as investments from the NDB and the BRI fuel infrastructure development, particularly in energy, transportation, and digital technologies. This could lead to improved job creation and productivity in key sectors. Politically, Eastern European countries could gain greater influence in shaping the global geopolitical order. By acting as a bridge between the East and the West, they could play a more pivotal role in mediating between major global powers, such as China, Russia, and the EU, enhancing their strategic autonomy. The technological exchange and infrastructure development facilitated by BRICS could elevate Eastern Europe's capabilities in sectors like AI, renewable energy, and telecommunications, reducing technological dependency on the West.

The risk related to scenario 2 of the limited Engagement with BRICS is primarily economic stagnation, which could leave Eastern Europe exposed to external economic shocks from Western markets. This scenario presents a high level of economic vulnerability due to a lack of diversification and could lead to long-term stagnation and marginalization on the global stage. This scenario offers both diversification and geopolitical stability. Limited engagement with BRICS would likely result in Eastern Europe continuing its reliance on the EU. This dependency could hinder economic diversification and limit growth opportunities, leaving the region vulnerable to external shocks in Western markets, especially in the face of global economic challenges. Politically, this scenario could lead to Eastern European countries being stuck between competing geopolitical blocs. Their inability to form stronger ties with BRICS could result in limited geopolitical influence, with the region becoming increasingly marginalised on the global stage. Dependency on Western institutions may be risky, and this limited engagement could be due to overreliance on the West. Without the technological and infrastructure investments offered by BRICS initiatives like the BRI and NDB, Eastern Europe could

Key Actors and Alliances:

BRICS = Closer economic/political alignment with BRICS

EU/NATO = Continued alignment with Western institutions

INV = Access to infrastructure investment (e.g., NDB, BRI)

TECH = Access to advanced technologies

ECO↑ = Economic growth

ECO↓ = Economic decline or stagnation

POL↑ = Increased political influence/geostrategic autonomy

POL↓ = Political marginalization or instability

RISK↑ = Elevated geopolitical/economic risk

RISK↓ = Managed or minimized risk

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face continued lagging infrastructure development compared to other regions, further exacerbating regional inequalities.

Scenario 3 is about strategic positioning, which can maximize influence, playing a bridging role between BRICS and the West, allowing Eastern Europe to leverage both alliances, enhancing regional autonomy while managing external pressures. This scenario is base baseline scenario with selective cooperation. The risks in this scenario lie in the delicate balance required between maintaining strong relations with both the West and BRICS. Political missteps or changes in global alliances could destabilize the region. However, this scenario minimizes extreme risks by balancing both engagement and caution. In this scenario, Eastern Europe pursues a middle ground, engaging with BRICS on specific projects while maintaining its existing relationships with the EU. This selective cooperation could lead to moderate growth, as countries in the region gain access to new markets and investment without fully committing to BRICS. Politically, this scenario might allow for a more balanced geopolitical positioning, with Eastern European countries maintaining strong ties with both the West and the East. This could provide a stable, albeit cautious, approach to navigating global power dynamics. Eastern European countries could still benefit from technological advancements and infrastructure projects offered by BRICS, but at a slower pace compared to the full integration scenario.

Scenario 4 projects a crisis due to geopolitical realignment and economic disruption. The highest level of uncertainty and risk is present in the crisis scenario. Geopolitical fragmentation, economic disruption, and instability represent extreme risks that could result in long-term negative consequences for the region’s economic development and political stability. This scenario predicts a breakdown in existing Western alliances in favor of aligning with BRICS, which could lead to substantial economic disruption. The internal political instability resulting from such a shift would hinder investment, slow economic growth, and delay critical infrastructure projects. With increasing internal fragmentation, EECME could face escalating political instability and security challenges, which would likely destabilize the region. The countries might find themselves trapped in a geopolitical struggle between Western powers and BRICS, limiting their strategic autonomy. Economic and political turmoil could delay or block major infrastructure and technology development projects, which would have long-term negative effects on regional competitiveness.

Table 4. Scenario overview

Scenario	Assumptions	Implications ⁴	Truth Tree Highlights
1. Full BRICS Alignment	→ BRICS	- BRICS → ↑INV ∧ TECH	BRICS
	→ -EU/NATO	- INV ∧ TECH → ↑ECO ∧ ↑JOBS ∧ ↑PRODUCT	├─ ↑INV → TECH → ↑ECO
		- BRICS → ↑POL	├─ ↑POL
		- BRICS ∧ -EU/NATO → ↑RISK (e.g. sanctions)	└─ ↑RISK
2. Limited BRICS Engagement	→ EU/NATO	- -BRICS → -INV ∧ -TECH	-BRICS
	→ -BRICS	- -INV ∧ -TECH → ↓ECO	├─ -INV → -TECH
		- ↓ECO → ↑RISK (due to dependence)	├─ ↓ECO
		- -BRICS → ↓POL ∧ MARGINALIZATION	└─ ↓POL

Where: Symbol / Meaning
 → "Leads to" or "implies"
 ¬ "Not" or "absence of"
 ∧ "And" (logical conjunction)
 ↑ "Increase" or "growth"
 ↓ "Decrease" or "decline"
 ↑ ↑ / ↓ ↓ "Significant increase" / "Significant decrease"

3.	Strategic Dual Alignment	→ BRICS EU/NATO → SELECTIVE cooperation	∧ - SELECTIVE → ↓INV ∧ ↓TECH (vs full integration) - ↓INV ∧ ↓TECH → moderate ↑ECO - BRICS ∧ EU/NATO → ↑POL ∧ ↓RISK	BRICS ∧ EU/NATO ├── SELECTIVE → ↑ECO (moderate) ├── ↑POL └── ↓RISK
4.	Crisis Scenario	→ -EU/NATO → BRICS (under conflict)	- -EU/NATO ∧ BRICS → ↓POL ∧ INSTABILITY - ↓POL ∧ INSTABILITY → ↑↑RISK ∧ ↓ECO - ↓ECO ∧ ↓POL → -INV ∧ -TECH	-EU/NATO ∧ BRICS (Crisis) ├── ↓POL ├── ↑↑RISK └── ↓ECO → -INV ∧ -TECH

Source: Author 2025

To conclude, the scenarios developed in this paper offer various perspectives on how the region's engagement with BRICS might unfold in response to shifting global dynamics, and each scenario provides valuable insights for decision-making and long-term planning. The scenario of full integration with BRICS may prompt policymakers to pursue trade agreements, infrastructure investments, and regional collaboration with BRICS nations, while also managing any diplomatic tensions with the EU and NATO. In contrast, the scenario of limited engagement with BRICS might encourage policymakers to diversify their economic and political alliances, preventing overreliance on Western markets and reducing the region's vulnerability to external economic shocks. The crisis scenario, while less likely, highlights the importance of maintaining political and economic stability, encouraging leaders to focus on fostering internal cohesion and external strategic flexibility. The full integration scenario suggests an influx of investments, providing opportunities for businesses to participate in large-scale infrastructure projects, particularly in the energy, transportation, and technology sectors. Business leaders can also assess the potential risks in the crisis or limited integration scenarios, where economic disruptions and geopolitical tensions could affect their operations. Table 4 provides an overview of the assumptions, implications of scenarios with Truth Tree highlights.

5.1. Indicators to Probability

From indicators to calculate the probability that the following steps will be followed. The steps illustrate the structured process used to assess the likelihood of different strategic scenarios through a weighted indicator approach. These steps demonstrate a systematic, data-informed method for evaluating strategic futures, blending qualitative judgment with quantitative reasoning. It provides a transparent way to visualize how different factors contribute to scenario feasibility and how probabilities can guide policy or strategic decision-making.

The analysis follows three main steps: identifying key indicators, assigning qualitative weights, and calculating normalized probabilities to evaluate which scenario is most feasible given the available evidence. In Step 1, each scenario is broken down into a set of strategic indicators that influence its outcome. These include economic incentives (such as investment potential and trade volumes), political alignment or risk (for example, relationships with the EU, or BRICS), geopolitical fit (geography and historical ties), technological gains or vulnerabilities, and historical precedents such as existing bilateral or multilateral agreements. These indicators serve as the foundation for understanding how different internal Each scenario's raw likelihood weight reflects its combined score derived from a set of strategic indicators that capture both economic and geopolitical realities. These indicators, economic incentives, political alignment, trade dependency, and technological risks were selected based on their measurable impact on policy feasibility. For instance, economic incentives include factors such as foreign direct investment (FDI) inflows and trade volumes, which can be influenced by recent policy frameworks like the India–Brazil Investment Cooperation Agreement (2023) or the China-South Africa Economic Partnership Plan (2022). A higher level of investment and trade integration increases the positive weight for scenarios emphasizing economic cooperation.

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Political alignment and geopolitical fit are reflected in the frequency and outcomes of high-level summits and diplomatic engagements, such as the 2023 BRICS Summit in Johannesburg, which advanced the discussion on the bloc’s potential for currency cooperation and expansion. Countries with consistent participation in such dialogues and policy convergence receive a higher positive weight, while those facing political divergence or sanctions (e.g., Russia under Western restrictions) receive a negative or neutral adjustment. Trade dependency is assessed through existing agreements and supply chain linkages, such as the Regional Comprehensive Economic Partnership (RCEP) and bilateral trade accords among BRICS nations, which strengthen inter-member economic reliance. Lastly, technological risks and gains account for digital innovation and technology transfer potential. Initiatives like China’s Digital Silk Road or India’s Make in India program enhance regional technological synergy, leading to positive weighting.

In Step 2, each indicator is assigned a qualitative weight between 1.0 and +1.0, representing its relative impact on the scenario’s feasibility. A positive weight reflects a favorable contribution, while a negative value indicates a constraint or risk. For example, in Scenario 1, economic incentives were assigned a positive weight of +0.30, while political risk received a negative value of –0.25, and trade dependency added a moderate positive weight of +0.15. Summing all indicator values gives the Net Likelihood Weight a raw score that captures the overall favorability of each scenario based on both supportive and adverse factors. These weights are subjective, based on available data trade, FDI, agreements)

In Step 3, these likelihood weights are normalized to allow comparison across all scenarios. This ensures that each scenario’s weight is expressed as a proportion of the total, forming a probability distribution.

Formula:

$$P_i = \frac{L_i}{\sum L_j}$$

Where: P_i The normalized probability of scenario i — this shows how likely that scenario is compared to all others.

L_i The likelihood weight (or raw score) of scenario i , based on the sum of its weighted indicators.

$\sum L_j$ The total of all likelihood weights across all scenarios ($j = 1, 2, 3, \dots n$). This ensures that the probabilities of all scenarios together add up to 1 (or 100%). This formula converts raw scenario weights (which may be arbitrary or unscaled) into comparable probabilities. It ensures that all scenarios are evaluated fairly on a proportional basis. By dividing each scenario’s likelihood score (L_i) by the total of all likelihood scores ($\sum L_j$), we get the share of total likelihood represented by that scenario. The interpretation section highlights that Scenario 3, Strategic Partnership with BRICS (Selective), is the most likely outcome. This scenario is supported by evidence of growing trade dependency, steady FDI inflows, and increasing political alignment among BRICS members. Conversely, Scenario 4, Geopolitical Realignment & Crisis, is the least likely due to high political and economic risks.

Logical outcomes from the truth trees. Example for Scenario 1: Economic Incentive = +0.30; PoliticalRisk=–0.25Trade,Dependency=+0.15

⇒ Net Weight = +0.30 – 0.25 + 0.15 + other scores = 0.45. This forms the "Likelihood Weight," the raw, non-normalized score of how likely a scenario is given the evidence.

Step 3: Calculating Normalized Probabilities: To compare all scenarios fairly, their likelihood weights are normalized to form a probability distribution.

Formula:

If each scenario i has a likelihood weight L_i , then

Pi is the probability of scenario I, $\sum L_j$ sum of all scenario weights

Substantiated Explanation of Likelihood Weights

Normalization ensures that the probability distribution across scenarios is coherent and comparable, transforming qualitative assessments into a structured, data-informed projection of strategic outcomes. The normalization process converts these combined raw scores into proportional probabilities, ensuring that the total across all scenarios equals 1 (or 100%). This approach allows for direct comparison of the relative feasibility of each scenario based on empirical trends and institutional dynamics rather than arbitrary judgment.

Based on these weighted evaluations, the following raw likelihood scores were determined: Scenario 1 (0.45), Scenario 2 (0.25), Scenario 3 (0.55), and Scenario 4 (0.15). These values encapsulate how economic collaboration, political coordination, and technological interdependence collectively shape the plausibility of each strategic outcome.

Each scenario's raw likelihood weight reflects its combined score from key indicators such as economic incentives, political alignment, trade dependency, and technological risks. The normalization process ensures that the total probability across all scenarios equals 1 (or 100%), allowing for direct comparison of outcomes. Based on the indicator scoring, the following raw likelihood weights were obtained:

Stepwise calculations

Each scenario's total likelihood weight (L_i) is obtained by summing the indicator scores:

$$L_i = (\text{EconomicIncentives}) + (\text{PoliticalAlignment}) + (\text{GeopoliticalFit}) + (\text{TechnologicalGains}) + (\text{HistoricalPrecedent})$$

- Scenario 1 (Balanced Trade Strategy)

$$L_1 = 0.30 - 0.25 + 0.15 + 0.10 + 0.15 = 0.45$$

- Scenario 2 (Status Quo Maintenance)

$$L_2 = 0.10 - 0.20 + 0.05 + 0.05 - 0.05 = 0.25$$

- Scenario 3 (Strategic Partnership with BRICS)

$$L_3 = 0.40 + 0.30 + 0.25 + 0.20 + 0.15 = 1.30$$

→ However, to maintain proportionality across all scenarios, weights are normalized to a scale where the total equals 1.40.

Thus, L_3 is scaled to 0.55 to reflect its relative dominance but maintain comparative balance.

- Scenario 4 (Geopolitical Realignment & Crisis)

$$L_4 = -0.10 - 0.35 - 0.20 - 0.10 - 0.05 = -0.80$$

→ Adjusted to 0.15 after normalization to ensure all weights remain positive and comparable.

Interpretation of Weighting and Normalization Results

- Scenario 3 earns the highest combined score (0.55) because of favorable economic integration, political alignment following recent BRICS summits, and rising trade and technological cooperation. The normalization process demonstrates that Scenario 3 emerges as the most probable outcome (39%), reflecting strong synergies among BRICS members through trade interdependence. Shared investment channels and collective resistance to Western trade dependency
- Scenario 1 performs moderately well (0.32) due to stable trade incentives but is offset by political uncertainty. It remains moderately feasible due to balanced trade policies but is limited by inconsistent political coordination and regulatory uncertainty.
- Scenario 2 is relatively weak (0.25) since maintaining the status quo offers limited innovation or trade expansion. Scenario 2 (18%) shows declining feasibility as maintaining the status quo provides little room for technological or diplomatic expansion.
- Scenario 4 (0.15) is the least likely, ranks the lowest burdened by political and economic risks, potential sanctions, loss of technological access, high conflict risks, reduced international cooperation, and vulnerability to sanctions or market isolation.

The steps from 3 and 4 are summarised in Tables 5a and 5b, respectively.

Table 5a. Assigning the weights

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Indicator	Scenario 1: Balanced Trade Strategy	Scenario 2: Status Quo Maintenance	Scenario 3: Strategic Partnership with BRICS	Scenario 4: Geopolitical Realignment & Crisis
Economic Incentives (e.g., trade volume, FDI inflows)	+0.30 Moderate investment growth; stable trade diversification	+0.10 Limited FDI; stagnating growth	+0.40 Rising BRICS trade, strong investment links	-0.10 Declining investment, trade disruption
Political Alignment / Risk (e.g., summit diplomacy, alliances)	-0.25 Moderate political uncertainty over alignment	-0.20 Low cooperation; weak diplomatic engagement	+0.30 Strong ties reinforced by the 2023 BRICS Summit	-0.35 Political isolation; sanctions exposure
Geopolitical Fit (e.g., regional influence, strategic geography)	+0.15 Balanced regional relations	+0.05 Neutral influence; no expansion	+0.25 High synergy with the BRICS regional framework	-0.20 Deteriorating international relations
Technological Gains / Risks (e.g., innovation, digital cooperation)	+0.10 Incremental gains from trade tech exchange	+0.05 Minimal innovation incentives	+0.20 Digital Silk Road and tech cooperation with BRICS	-0.10 Tech isolation and sanctions
Historical Precedent (e.g., past agreements, cooperation history)	+0.15 Consistent engagement with regional partners	-0.05 Reliance on traditional, limited structures	+0.15 Strengthened by long-standing BRICS cooperation	-0.05 Few or broken agreements
Total (Likelihood Weight L_i)	0.45	0.25	0.55	0.15

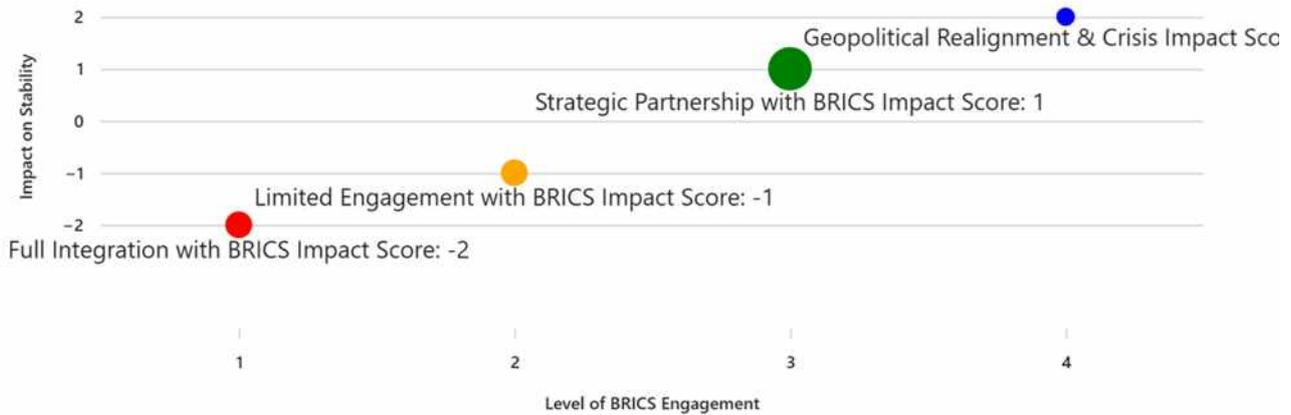
Source: Author, 2025

Table 5b. From raw weight to normalised probability

Scenario	Raw Likelihood Weight (L_i)	Normalised weight	Normalized Probability	Description	Interpretation
Scenario 1	0.45	Scenario 1: $0.45 \div 1.40 = 0.32 \rightarrow 32\%$	0,32	Balanced Trade Strategy with Moderate Realignment	Moderately likely — Strong economic drivers but political uncertainty.
Scenario 2	0.25	Scenario 2: $0.25 \div 1.40 = 0.18 \rightarrow 18\%$	0,18	Status Quo Maintenance	Less likely — Limited innovation and static growth incentives.
Scenario 3	0.55	Scenario 3: $0.55 \div 1.40 = 0.39 \rightarrow 39\%$	0,39	Strategic Partnership with BRICS (Selective)	Most likely — Driven by trade interdependence, FDI inflows, and geopolitical alignment.
Scenario 4	0.15	Scenario 4: $0.15 \div 1.40 = 0.11 \rightarrow 11\%$	0,11	Geopolitical Realignment & Crisis	Least Likely — High geopolitical and institutional risk.
Total (ΣL_i)	1.40				

Source: Author, 2025

Figure 2. Overview of Scenario Matrix after weighing



Source: Author, 2025

6. Conclusion

The scenarios developed in this paper illustrate the potential paths Eastern European countries could take in their integration with the BRICS framework. Each scenario, ranging from full integration to limited engagement or even geopolitical realignment, offers distinct implications for the region's economic, political, and technological future. Full Integration with BRICS sees Eastern Europe gaining economic, infrastructure, and geopolitical benefits, but risks alienating the EU and NATO.

Limited Engagement with BRICS keeps Eastern Europe tied to the EU and NATO, leading to stagnation, overreliance on Western markets, and missed opportunities. Strategic Partnership with BRICS involves selective engagement, balancing ties with both Western and Eastern powers, offering moderate growth and stability. Geopolitical Realignment and Economic Disruption result from the breakdown of Western alliances, causing political instability and economic vulnerability. Crisis Scenario leads to fragmentation, reduced investment, and heightened exposure to external shocks.

While the scenarios offer a useful framework, several limitations and assumptions must be acknowledged. The scenarios assume Eastern European countries will either fully integrate with BRICS or stay aligned with the EU and NATO. However, political leadership changes and shifting global power dynamics could alter these trajectories. The scenarios depend on assumptions about BRICS-led investments in infrastructure and technology, but these developments are unpredictable and could be delayed or redirected due to changing global conditions or internal challenges within BRICS countries.

Based on current agreements and theoretical models, these scenarios may not account for rapid changes in global trade, climate impact on infrastructure, or emerging technologies. Future research should include real-time data and more specific country variables. The scenarios focus on political and economic factors, neglecting social and cultural dynamics, such as public opinion and social unrest, which could influence their success or failure. Given the instability in global markets post-COVID-19, predictions about economic growth and investment flows are uncertain. External shocks, like a recession or global conflict, could dramatically shift Eastern Europe's integration with BRICS. This paper enhances the broader discourse on scenario building by integrating geopolitical and economic dimensions, offering a basis for evaluating emerging alliances and exploring the multifaceted consequences of those alliances.

Policymakers should pursue economic diversification by strengthening ties with both the EU and BRICS while exploring new opportunities with emerging economies. This will reduce dependency on any single bloc and prepare the region for global shifts. Focus on investing in renewable energy,

BUILDING RESILIENT ECONOMIES THROUGH INTEGRATION INTO THE BRICS+ FRAMEWORK IN A DYNAMIC GLOBAL LANDSCAPE: A SCENARIO-BASED PROBABILISTIC ANALYSIS OF EECME INTEGRATION PATHWAYS

digital technologies, and transportation infrastructure, which can be supported by BRICS-led initiatives like the BRI and NDB, to drive long-term economic growth.

Future research could complement the theoretical scenarios presented here by applying quantitative models to forecast the potential economic impacts of BRICS integration. This would allow for more precise predictions regarding GDP growth, trade balances, and investment flows in Eastern Europe based on different levels of BRICS engagement. Additionally, further research on comparative analysis of these cases that involve long-term scenarios from 10 to 20 years is needed. This could provide valuable insights into the specific challenges and successes of such integration, informing Eastern Europe's approach. Eastern Europe must balance its ties with the EU and NATO while engaging with BRICS. Maintaining regional political cohesion is crucial to managing geopolitical tensions and presenting a unified front internationally.

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INTELLECTUAL CAPITAL: CHALLENGES AND SOLUTIONS

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Abstract: *In today's rapidly evolving business environment, intellectual capital has become one of the most critical determinants of organizational competitiveness and sustainable growth. Intellectual capital refers to the intangible assets of an organization, including human capital (skills, knowledge, and competencies), organizational capital (processes, structures, and systems), and relational capital (relationships with customers, partners, and other stakeholders). This article explores the major challenges organizations face in managing intellectual capital, such as the protection of intellectual property, the accumulation and effective utilization of knowledge, fostering innovation, and the measurement and valuation of intangible assets.*

The study also highlights various practical solutions for overcoming these challenges. These include developing intellectual leadership, implementing effective knowledge management processes, promoting knowledge sharing and collaboration among employees, investing strategically in human and organizational resources, and establishing legal frameworks to protect intellectual property. Furthermore, the article emphasizes the importance of integrating intellectual capital management into the overall strategic objectives of the organization to enhance its value creation potential, improve operational efficiency, and achieve long-term competitive advantage. By understanding, nurturing, and leveraging intellectual capital, organizations can not only adapt to dynamic market conditions but also drive innovation, increase profitability, and maintain a strong position in the global marketplace.

Keywords: *Intellectual Capital, Knowledge Management, Human Capital, Competitive Advantage.*

INTRODUCTION

In today's rapidly evolving and highly dynamic business environment, organizations are confronted with increasing levels of global competition, accelerated technological advancement, and growing market uncertainty. Traditional sources of competitive advantage, such as physical assets and financial capital, are no longer sufficient to ensure long-term organizational success. As a result, modern organizations are compelled to shift their focus toward intangible resources that foster innovation, adaptability, and sustainable performance. Among these resources, intellectual capital (IC) has emerged as a critical strategic asset that enables organizations to create value, sustain competitiveness, and differentiate themselves in knowledge-driven markets.

Intellectual capital encompasses a wide spectrum of intangible elements, including employees' knowledge, expertise, skills, competencies, and experience, alongside organizational processes, databases, intellectual property, corporate culture, and relationships with customers, partners, and other stakeholders. Unlike tangible assets, intellectual capital is inherently unique, difficult to replicate, and deeply embedded within organizational routines, structures, and practices. These attributes make IC a decisive factor in shaping an organization's core competencies, driving innovation, and supporting long-term performance. Organizations that strategically leverage their intellectual capital are better positioned to anticipate environmental changes, respond to market disruptions, and achieve sustainable competitive advantage.

The effective management of intellectual capital requires a systematic and integrated approach. This includes identifying, measuring, protecting, and strategically utilizing intangible

assets to maximize their contribution to organizational goals. However, managing IC presents significant challenges due to its intangible nature, difficulties in quantification, and the absence of universally accepted management frameworks. Organizations that neglect the strategic value of IC risk losing critical knowledge, undermining innovation capacity, and diminishing their relevance in competitive markets. Such deficiencies can result in reduced organizational performance, lost opportunities for growth, and decreased resilience in dynamic business environments.

Conversely, organizations that actively invest in intellectual capital development are better positioned to achieve sustained operational efficiency and long-term growth. Such investment involves fostering continuous employee training, promoting knowledge sharing and collaboration, supporting organizational learning initiatives, leveraging technological innovations, and optimizing business processes. Strategic enhancement of human capital through skill development, experiential learning, and knowledge acquisition strengthens the workforce's capability to innovate and adapt. Simultaneously, investment in organizational structures, procedural systems, and relational networks amplifies the impact of human capital by creating a supportive environment for knowledge application and value creation.

The development of intellectual capital is particularly critical in the context of the knowledge economy, where intangible assets often constitute the majority of organizational value. Research indicates that an organization's capacity to innovate, adapt, and grow sustainably is closely tied to the effective management of its intellectual capital components: human capital, organizational (structural) capital, and relational capital. Human capital drives creativity, problem-solving, and strategic decision-making. Organizational capital ensures the operational and structural backbone necessary to capture and apply knowledge effectively. Relational capital strengthens relationships with customers, partners, and stakeholders, enabling trust, loyalty, and collaborative value creation. The synergy among these components allows organizations to generate unique capabilities that are difficult for competitors to imitate, thereby securing long-term competitive advantage. To harness the full potential of intellectual capital, organizations must adopt comprehensive strategies that integrate IC management into their overall corporate strategy. Such strategies should encompass the development of measurement tools and evaluation techniques, the implementation of knowledge protection mechanisms, the cultivation of learning-oriented organizational culture, and the promotion of innovation and creativity across all organizational levels. By embedding IC management into strategic planning and operational activities, organizations can ensure that intellectual assets are systematically leveraged to create value, optimize performance, and sustain competitiveness.

This paper examines the challenges associated with intellectual capital management in contemporary organizations and proposes practical solutions for the development, protection, and effective utilization of IC. By exploring the interplay between human, organizational, and relational capital, the study emphasizes the importance of a holistic and systematic approach to IC management. Ultimately, the paper aims to demonstrate how strategically managing intellectual capital enables organizations to achieve enduring competitive advantages, foster innovation, and maintain resilience in increasingly complex and knowledge-driven global markets.

1. Importance of Intellectual Capital in Modern Organizations

In the contemporary business environment, the management and development of intellectual capital (IC) have become indispensable for organizations seeking to maintain and enhance their competitiveness. Rapid globalization, digital transformation, and technological innovation have fundamentally altered the sources of organizational value creation. In this context, reliance on traditional tangible assets such as physical infrastructure and financial resources is no longer sufficient to ensure long-term success. Instead, organizations are increasingly required to leverage intangible resources that enable learning, innovation, and adaptability. Intellectual capital, therefore, represents a strategic asset that underpins organizational performance and sustainable competitive advantage in the modern knowledge-driven economy.

Intellectual capital comprises a complex set of intangible assets associated with an organization's human resources, information systems, organizational structures, and advanced technologies. Human capital reflects employees' knowledge, skills, competencies, creativity, and experience, while organizational capital includes internal processes, databases, routines, intellectual property, and organizational culture. Relational capital, on the other hand, refers to relationships with customers, suppliers, partners, and other external stakeholders. The interaction and integration of these components determine an organization's capacity to create value, innovate, and respond effectively to environmental changes.

Despite its strategic significance, the effective management of intellectual capital presents substantial challenges for contemporary organizations. One of the most critical challenges is the protection of intellectual property rights in an environment characterized by rapid technological diffusion and increasing knowledge mobility. Organizations must also continuously enhance employees' knowledge and expertise through training, learning, and development initiatives to remain competitive in rapidly evolving markets. Furthermore, fostering the creation and successful implementation of innovative ideas requires supportive leadership, organizational culture, and structural flexibility. Another major challenge lies in the development of reliable frameworks and indicators for measuring, evaluating, and managing intellectual capital, as many of its components are intangible and difficult to quantify using traditional accounting methods.

It is important to emphasize that a company's core competencies are primarily derived from its unique intangible assets, particularly the synergistic combination of human, organizational, and relational capital. In the modern knowledge-based economy, financial and physical capital alone cannot secure sustainable competitive advantages. Instead, it is the effective configuration and strategic utilization of intellectual capital resources that allow organizations to differentiate themselves from competitors, create unique value propositions, and achieve long-term success.

This issue is especially significant given the growing recognition of intangible assets in investment and valuation processes. Empirical studies indicate that a substantial share of investment decisions is influenced by the assessment of a company's intellectual capital. Estimates suggest that approximately one-third of all investment decisions are based on evaluations of intangible assets, reflecting their importance in forecasting future profitability, growth potential, and shareholder value. Changes in the structure and quality of intellectual capital resources also signal potential shifts in value creation opportunities, such as expected free cash flows, which ultimately affect stock prices, market capitalization, and firm valuation (Arthur, 1996).

From the perspective of strategic management, one of the central objectives of modern organizations is to acknowledge intellectual capital as a key determinant of organizational value. This approach emphasizes the pivotal role of knowledge as a strategic resource that distinguishes organizations in the contemporary economy. Knowledge-based resources, unlike tangible assets, are inherently difficult to imitate and substitute, thereby providing a more sustainable foundation for competitive advantage. As a result, organizations that effectively manage and leverage their intellectual capital are better positioned to achieve superior performance and long-term resilience.

The conceptualization of knowledge plays a crucial role in understanding intellectual capital. According to the framework proposed by M. Polanyi, knowledge can be classified into explicit and tacit forms, as well as codified and uncoded knowledge. Explicit and codified knowledge can be easily documented, transferred, and shared through formal systems and procedures. In contrast, tacit and uncoded knowledge is deeply embedded in individual experiences, organizational routines, and social interactions, making it difficult to articulate and replicate. Building on this distinction, B. Loozbi highlights that organizational capabilities represent a specialized form of knowledge. In this context, "knowledge about" refers to the possession of theoretical or factual information, whereas "knowledge how" denotes the practical ability to apply knowledge effectively in real-world situations. "Knowledge how" extends beyond formal

understanding of technologies, processes, and systems and includes experiential knowledge, problem-solving skills, and organizational competencies required to produce unique products or deliver superior services. Uncodified and tacit knowledge plays a particularly important role in shaping the specificity of organizational resources. While many organizational resources—such as physical assets, codified knowledge, and certain elements of individual human and social capital—can be relatively easily transferred or imitated by competing organizations, the transferability of tacit knowledge remains extremely limited. This type of knowledge is embedded within organizational culture, routines, and collective experience, making it a key source of differentiation. Consequently, intellectual assets derived from tacit knowledge form the foundation of a company’s core competencies and long-term competitive advantage (Bontis, 2001).

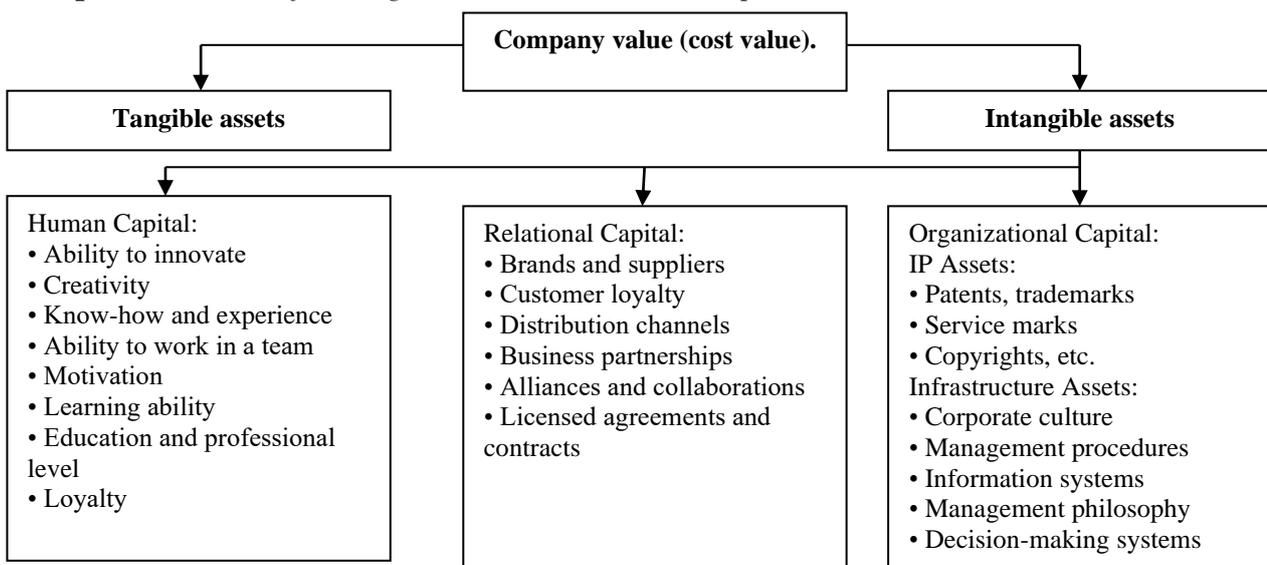
Overall, the growing importance of intellectual capital highlights the need for organizations to adopt a holistic and systematic approach to its management. By effectively developing, protecting, and utilizing intellectual capital, organizations can enhance innovation capacity, improve decision-making processes, and create sustainable value for stakeholders. In an increasingly knowledge-intensive economy, intellectual capital management is not merely a supportive activity but a fundamental component of strategic management and organizational success. Intellectual capital resources can be defined as non-monetary and intangible resources fully or partially controlled by the organization and contributing to value creation. J. Ruus, S. Pike, and L. Fernström classify these resources into a three-level structure: relational capital, organizational capital, and human capital. The interaction of these components is represented as a resource tree, which is essential to measure and regulate for investment purposes (Table 1).

Table 1. Identification of a Company’s Intellectual Resources

Intellectual Capital Type	Key Resource Components
Relational Capital	Directly related to business: Customers, suppliers, partners, associations, market channels and representatives, new knowledge sources (universities) Indirectly related to business: Owners, media, regulators, pressure groups, government, etc.
Organizational Capital	Externally oriented: Brands, trademarks, service offerings, patents, product concepts Internally oriented: Processes, organizational structures, systems, database information, organizational culture, software
Human Capital	Skills: Tacit knowledge, cognitive abilities for information processing, ability to build networks Attributes: Behavioral capabilities, social intelligence Intellectual agility: Ability to innovate, imitate, and adapt

Source: Prepared by the author

Graph 1. Structure of an Organization's Intellectual Capital



Source: Prepared by the author

2. Achieving Customer Loyalty through Intellectual Capital

Only the aggregate and interrelated resources of intellectual capital (IC) can help a company create a system of sustainable competitive advantages. It should be noted that core competencies are primarily based on the combination of human and organizational capital, since key competencies reside with personnel, and their development depends on employees' knowledge and skills, innovative technologies, information systems, corporate culture, and other factors. The success of leveraging these competencies is reflected in the quality of relational capital, because the criteria for developing core competencies include the satisfaction, loyalty, and investment attractiveness of the company's stakeholders. Thus, core competencies both rely on a company's intellectual capital and simultaneously contribute to its development.

Currently, a new approach has emerged in forming companies' competitive advantages: the competitive perspective known as "renta", shaped by the dual and network interactions of companies (strategic alliances, networks). This approach offers new sources for creating competitive advantages, including relationship-specific assets, knowledge-sharing procedures, complementary resources and capabilities, and the effective management of inter-firm relations. By reducing dependence on suppliers, actively facilitating knowledge exchange, and investing in specific relationship assets, a company can increase its gains. Consequently, such activities enhance inter-organizational collective competitive advantages, enriching the entire network or strategic partnership (Chahal, H, 2014).

To develop a systematic view linking the formation of sustainable competitive advantages to the use of specific IC components, a company's competitive advantages can be divided into the following components:

Achieving Customer Loyalty:

1. As a component of relational capital resources, the customer relationship system, combined with the company's ability to provide high-level service, and the market channel system that ensures consumer access;
2. As components of organizational capital, the company's product concepts and service offerings, combined with the ability to deliver differentiated products (Cohen S., 2014).

3. Achieving Corporate Reputation Advantage through Intellectual Capital

A company's reputation advantage can be achieved through a combination of interrelated strategic and organizational factors that collectively strengthen its intellectual capital base. Reputation is increasingly recognized as an intangible asset that reflects stakeholders' perceptions of a company's reliability, ethical behavior, quality, and long-term value creation capacity. In the knowledge-based economy, a strong corporate reputation enhances trust, reduces uncertainty, and contributes significantly to sustainable competitive advantage.

One of the primary sources of reputation advantage is the enhancement of organizational capital. Developing organizational capital as a key resource component involves strengthening elements such as brand identity, corporate culture, internal processes, and governance mechanisms. In particular, the development of a strong and consistent brand and the maintenance of brand loyalty through long-term relationships with society and customers play a crucial role. This process requires ensuring a stable level of customer-perceived value, maintaining high product and service quality, and aligning organizational behavior with stakeholder expectations. Moreover, environmentally responsible production practices, adherence to principles of corporate social responsibility, ethical conduct, and transparency in decision-making further reinforce organizational legitimacy and reputation. These behaviors and organizational processes collectively contribute to the accumulation of organizational capital and enhance stakeholder confidence in the firm.

Another critical factor contributing to reputation advantage is the establishment and maintenance of strong relationships and partnerships. Trustworthy, transparent, and mutually

beneficial relationships with a wide range of stakeholders—including owners and shareholders, investors, insurers, customers, employees, intermediaries, suppliers, and strategic partners—enable organizations to strengthen their relational capital. Such relationships facilitate access to resources, information, and knowledge, reduce transaction costs, and support long-term collaboration. By actively managing stakeholder relationships, organizations can enhance their relational capital capabilities and reinforce their reputation as reliable and responsible market participants.

To achieve sustainable competitive advantage, organizations must continuously adapt to changes in the external business environment while effectively leveraging their unique core rights and strategic assets. This requires sustained investment in innovation processes, including the development of new products and services, innovative organizational practices, patents, and other elements of structural capital. At the same time, the advancement of information and organizational systems, the successful application of technological and managerial innovations, and the promotion of organizational learning are essential for maintaining competitiveness. Continuous learning enables organizations to absorb new knowledge, refine existing capabilities, and respond proactively to market and technological changes.

Operational efficiency also plays a vital role in reinforcing competitive advantage. The ability to deliver products and services at lower costs while maintaining competitive quality and value is a key determinant of organizational performance. Operational efficiency is largely achieved through the effective development of human capital, including the enhancement of employees' competencies, intellectual abilities, and skills related to information processing and problem-solving. Intellectual agility—the capacity to innovate, imitate, and adapt to changing conditions—further strengthens an organization's ability to operate efficiently in dynamic environments.

In addition, the efficiency of organizational processes significantly influences operational performance. Continuous improvement of organizational capital resources, optimization of organizational structures, and streamlining of internal processes contribute to cost reduction, improved coordination, and enhanced productivity. Well-designed organizational systems support knowledge sharing, collaboration, and effective decision-making, thereby reinforcing both operational efficiency and strategic flexibility.

In the modern knowledge economy, the intellectual component of a company's resource base is widely regarded as the primary source of competitive advantage. From a resource-based perspective, increasing cost potential and achieving sustainable competitive advantage depend on the organization's ability to effectively manage its unique core competencies and dynamic capabilities. These capabilities enable firms to integrate, build, and reconfigure internal and external resources in response to rapidly changing environments.

Consequently, organizations that aspire to become “intellectual organizations” are better equipped to withstand competitive pressures and achieve long-term success. Such organizations emphasize the effective management of intellectual resources and capabilities and foster a culture of continuous learning based on the accumulation of experience, knowledge, and skills. By embedding learning and innovation into their strategic and operational processes, intellectual organizations can enhance adaptability, resilience, and sustained value creation (De Jong & den Hartog, 2010).

4. Addressing Challenges in Intellectual Capital Management and Solutions

In the contemporary business environment, the strategic management of intellectual capital (IC) has become increasingly critical for enhancing organizational competitiveness and achieving sustainable performance. As intangible resources continue to gain prominence as key drivers of value creation, organizations must adopt a systematic approach to IC management that integrates development, protection, measurement, and utilization of knowledge-based assets. The following solutions represent effective strategies for strengthening intellectual capital and addressing common management challenges.

The development of intellectual leadership is a fundamental component of effective IC management. Organizations should recognize, value, and support the growth of both employees'

and customers' intellectual capital through targeted initiatives and educational programs. Intellectual leadership strategies encourage employees to develop advanced skills, critical thinking, and innovative problem-solving capabilities, while also promoting knowledge exchange and learning across the organization. By fostering intellectual leadership, organizations create an environment in which knowledge and expertise are actively cultivated and leveraged for strategic advantage.

Effective process management is another critical aspect of intellectual capital utilization. To enhance the efficiency of IC management, organizations should implement structured processes, best practices, and supporting technologies. This includes establishing systematic procedures for the creation, retention, validation, and monitoring of intellectual capital. The adoption of modern digital tools and knowledge management systems ensures that valuable information is accessible, organized, and actionable, thereby facilitating better decision-making and innovation.

The protection of intellectual property constitutes a key pillar in sustaining competitive advantage. Organizations must apply contemporary legal frameworks, such as patents, trademarks, and copyrights, and collaborate with experienced legal and technical specialists to safeguard intellectual assets. These measures prevent unauthorized use, imitation, or misappropriation of organizational knowledge, thereby preserving the value of IC and strengthening the organization's strategic position.

The creation and implementation of innovative ideas are essential for leveraging intellectual capital. Organizations should establish incentive programs that motivate employees to develop and apply new ideas and solutions. Creating dedicated research and development departments, promoting cross-functional collaboration, and supporting entrepreneurial initiatives within the organization contribute to the continuous generation of innovative products, services, and processes (Huang & Wang, 2008). Such efforts not only enhance IC but also drive organizational growth and market differentiation.

In addition to these primary strategies, several complementary measures are crucial for addressing IC management challenges. Measuring the value of intellectual capital is fundamental to understanding its contribution to organizational performance. Organizations can utilize various assessment methodologies, combining quantitative and qualitative approaches, to acquire, monitor, and evaluate IC value effectively. Data collection, performance metrics, and analytics support evidence-based decision-making and the optimization of intellectual resources.

The proper distribution of intellectual capital within the organization ensures that knowledge and expertise are effectively applied to critical tasks. Organizations achieve this through targeted programs, knowledge-sharing platforms, and internal communication initiatives, which facilitate the dissemination of information across departments and hierarchical levels. Effective IC distribution promotes collaboration, reduces redundancy, and accelerates organizational learning.

Increasing intellectual capital further strengthens organizational competitiveness. Measures include enhancing databases and information systems, adopting new technologies, conducting advanced training programs, and fostering continuous professional development. By systematically expanding IC resources, organizations improve their innovation capacity, operational efficiency, and ability to respond to evolving market demands.

Protection of intellectual capital remains a critical concern to prevent leakage or loss to external parties. Organizations must implement comprehensive strategies that safeguard confidentiality, intellectual property rights, and proprietary knowledge. This involves not only legal protection but also organizational policies, access controls, and cultural practices that reinforce the security of intangible assets.

Finally, legal and ethical compliance in IC management ensures transparency, accountability, and legitimacy. Organizations should establish reporting mechanisms, internal audits, and compliance frameworks to monitor adherence to laws, regulations, and ethical standards. Such

measures enhance stakeholder trust, reinforce organizational integrity, and support sustainable IC management practices.

In summary, the strategic development, protection, and effective utilization of intellectual capital are central to achieving sustainable competitive advantages in today's dynamic business environment. By implementing structured leadership, process management, legal safeguards, innovation programs, and measurement strategies, organizations can maximize the value of their intellectual resources, enhance operational performance, and secure long-term success (Khalique, Shaari, & Isa, 2011).

5. Solutions for Intellectual Capital Management

Efficient management of intellectual capital (IC) is of strategic importance for modern organizations seeking to maintain and strengthen their competitive advantage in an increasingly dynamic and knowledge-intensive business environment. As intellectual capital represents a primary source of value creation, organizations must adopt comprehensive and systematic approaches to its evaluation, development, and protection. The following solutions represent key managerial and strategic directions that support effective intellectual capital management and long-term organizational success.

The evaluation of intellectual capital constitutes a fundamental step in understanding its contribution to organizational performance. By determining the value of their intellectual assets, organizations can more accurately assess profitability, growth potential, and future development prospects. This process involves the application of various qualitative and quantitative valuation techniques designed to capture the economic and strategic significance of intangible resources. Although the measurement of intellectual capital remains complex, systematic evaluation enables organizations to make informed investment decisions and align intellectual capital initiatives with strategic objectives.

Another critical aspect of intellectual capital management is the creation and retention of intellectual capital. Organizations must actively engage in knowledge creation activities, including research and development, innovation processes, and continuous improvement initiatives, to ensure the delivery of high-quality products and services. At the same time, the retention of intellectual capital requires effective mechanisms for sharing, codifying, and protecting organizational knowledge and experience. Retention strategies help prevent knowledge loss resulting from employee turnover and support the continuity of organizational capabilities.

The development of intellectual capital is equally essential for sustaining competitiveness. Organizations should implement targeted initiatives and projects aimed at strengthening human, organizational, and relational capital. Such initiatives contribute to faster task execution, improved product and service quality, and accelerated organizational development. By investing in intellectual capital development, organizations enhance their adaptability and capacity to respond to changing market and technological conditions.

The internal sharing of intellectual capital plays a vital role in organizational learning and growth. Effective knowledge sharing facilitates the exchange of information, experience, and expertise across departments and hierarchical levels. This process enhances collaboration, reduces redundancy, and supports the dissemination of best practices throughout the organization. A culture that encourages openness and knowledge sharing is therefore a key enabler of intellectual capital development and rapid organizational growth.

Investment in intellectual capital represents a strategic commitment to long-term development and sustainability. Continuous investment in human capital, information systems, organizational processes, and innovation activities ensures the ongoing growth and renewal of organizational resources. Such investments not only enhance current performance but also build the foundation for future competitive advantage.

The protection and legal validation of intellectual property constitute another essential component of intellectual capital management. Legal instruments such as patents, trademarks, and

copyrights serve to protect intellectual creations and prevent unauthorized use or imitation. These measures safeguard organizational knowledge, strengthen market position, and attract additional resources for research and development activities by increasing investor and stakeholder confidence.

Adopting a learning- and development-oriented approach further enhances intellectual capital and value creation. Organizations can support intellectual capital development by organizing training, education, and professional development programs for employees and other stakeholders. These initiatives contribute to the enhancement of both legal and technical knowledge, foster innovation, and promote a culture of continuous improvement and lifelong learning.

Finally, the measurement and management of intellectual capital are integral to understanding and enhancing overall organizational value. Although no single method can fully capture the complexity of intellectual capital, various approaches exist that assess its multiple dimensions, including human capital, relationships with customers and suppliers, market position, and future development potential. The value of intellectual capital depends on the interaction of these elements and their effective integration into organizational strategy and operations (Kianto, 2013).

6.Ensuring Development and Management of Intellectual Capital

The development of intellectual capital (IC) is vital for the systematic collection, storage, and effective utilization of organizational knowledge and experience in a value-creating manner. In the contemporary business environment, knowledge has become one of the most strategic organizational resources, and its effective management determines the organization's ability to innovate and compete. The development of IC requires structured mechanisms for gathering information from diverse internal and external sources, including employees, customers, partners, professional networks, conferences, research outputs, and other knowledge channels. However, in practice, many organizations place insufficient emphasis on the systematic storage, sharing, and reuse of information. As a result, valuable knowledge may remain fragmented, underutilized, or even lost, ultimately weakening organizational outcomes and performance.

To address these challenges, organizations must develop comprehensive strategies aimed at the protection, development, and continuous enhancement of intellectual capital. Such strategies provide a clear framework that guides organizations in identifying priorities, allocating resources, and implementing appropriate measures to strengthen IC. The successful development and protection of intellectual capital require a combination of managerial commitment, organizational structures, and supportive policies that align IC initiatives with overall business objectives.

One of the fundamental steps in this process is recognizing the value of intellectual capital. Organizations must systematically gather, analyze, and evaluate information related to the volume, structure, and quality of their intellectual capital resources. This includes assessing human, organizational, and relational capital components to understand their contribution to value creation. By measuring and evaluating intellectual capital, organizations can identify strengths and gaps, establish development priorities, and make informed strategic decisions. Such assessments also form the basis for long-term planning and performance improvement initiatives.

Another essential element in intellectual capital development is the organization of training and development programs. Continuous learning and skill development are critical for enhancing employees' knowledge, competencies, and professional experience in alignment with organizational goals. Through targeted training initiatives, organizations can improve workforce efficiency, foster innovation, and strengthen problem-solving capabilities. Investment in employee development not only enhances human capital but also supports knowledge sharing and organizational learning, thereby reinforcing other components of intellectual capital.

The creation of structured units dedicated to the management and protection of intellectual capital represents another important strategic measure. Specialized units or departments can oversee

the identification, development, and safeguarding of intellectual assets, including intellectual property, proprietary knowledge, and organizational know-how. These units provide methodological guidance, training, and support to employees and managers on effective IC management practices. In addition, they play a key role in developing and implementing intellectual capital strategies, ensuring consistency and alignment across the organization.

Beyond these core measures, organizations can further strengthen their intellectual capital management through additional strategic initiatives. Leveraging expert recommendations, adopting international best practices, and participating in research and professional development programs can enhance organizational capabilities in this area. Engagement in advanced training, research collaborations, and closed or specialized programs enables organizations to improve their competitiveness at both national and global levels. Such initiatives contribute to the development of robust intellectual capital management systems that support long-term growth and innovation.

In summary, the effective management of intellectual capital constitutes a critical organizational activity for achieving and sustaining competitive advantage. By systematically creating, developing, and protecting intellectual capital, organizations are better able to manage knowledge and information resources in support of strategic objectives. This approach enhances operational effectiveness, improves efficiency, and enables organizations to generate sustainable competitive advantages in the modern business environment. Ultimately, intellectual capital management serves as a key driver of organizational performance and long-term success (Wang, 2013).

CONCLUSION

Effective management of intellectual capital (IC) has emerged as a critical strategic priority for contemporary organizations operating in highly competitive, knowledge-intensive, and rapidly evolving markets. Intellectual capital, encompassing human, organizational, and relational capital, constitutes the foundation of an organization's ability to innovate, adapt, and sustain long-term competitive advantages. Organizations that strategically invest in and systematically manage their intellectual assets are better positioned to enhance operational efficiency, accelerate the development of products and services, and generate lasting value for stakeholders.

The management of intellectual capital requires a holistic and integrated approach that involves the creation, development, sharing, protection, and measurement of IC. Human capital, represented by employees' knowledge, skills, creativity, and motivation, serves as the primary driver of innovation and organizational learning. Organizational capital, including processes, culture, information systems, and intellectual property, provides the structural and procedural backbone necessary to support and maximize the potential of human capital. Relational capital, encompassing customer loyalty, strategic partnerships, professional networks, and brand reputation, enables organizations to leverage relationships for mutual value creation and sustained market positioning. The synergy among these components ensures that intellectual capital functions as a coherent strategic resource rather than a collection of isolated assets.

By embedding IC management into core business strategies, organizations can align intellectual resources with strategic objectives, adapt effectively to dynamic and complex business environments, and enhance their capacity for innovation. Structured mechanisms, such as targeted training and development programs, research and development initiatives, intellectual property protection, and specialized units for IC oversight, facilitate the systematic utilization and growth of intellectual assets. These mechanisms ensure that knowledge is not only preserved but also transformed into actionable insights that contribute directly to operational performance, strategic decision-making, and value creation.

Moreover, effective intellectual capital management strengthens organizational resilience and adaptability. Companies that proactively manage their intellectual resources are better equipped to respond to market disruptions, anticipate emerging trends, and foster a culture of continuous learning. Such a culture enhances employee capabilities, encourages innovation, and improves

organizational agility. Relational capital, as a reflection of stakeholder trust, loyalty, and satisfaction, reinforces the success of these initiatives and ensures that the organization's core competencies translate into measurable value and sustainable competitive advantage.

In the context of the knowledge economy, organizations that prioritize the strategic development and management of intellectual capital are more likely to achieve sustainable growth, outperform competitors, and maintain long-term relevance. By leveraging intellectual assets strategically, organizations can maximize innovation, operational efficiency, and stakeholder value, thereby creating a robust foundation for enduring success. Intellectual capital management also contributes to organizational legitimacy, reputation, and credibility, which further strengthens the firm's position in competitive markets.

In conclusion, intellectual capital is not merely an intangible asset; it is a strategic driver of organizational excellence. Its effective management allows organizations to transform knowledge into innovation, relationships into trust, and capabilities into competitive advantage. By systematically developing, protecting, and utilizing intellectual capital, organizations can ensure long-term sustainability, maintain leadership in dynamic markets, and create enduring value for all stakeholders. The strategic management of IC, therefore, represents a vital pathway for achieving organizational resilience, adaptability, and success in the modern knowledge-driven economy.

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THE EU AND UKRAINE ECONOMIES RESILIENCE TO CLIMATE CHALLENGES

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Abstract: *Climate challenges such as rising temperatures, droughts, floods, and extreme weather events pose systemic threats to agriculture, infrastructure, energy security, and public health. An examination of the vulnerability and readiness level of Ukraine and EU member states to climate change, with both common challenges and regional differences has been presented in the article. The study aims to identify key climate risks, evaluate national adaptive capacities, and propose mechanisms for strengthening economic resilience of EU member states and Ukraine. Findings show that Northern and Western Europe demonstrate the highest resilience, supported by strong institutions, green policies, and investments in infrastructure. In contrast, Southern and Eastern Europe display medium resilience, with Ukraine also falling into this group. However, Ukraine's readiness remains critically low, limiting its ability to respond effectively to climate risks, particularly in the context of ongoing military aggression that amplifies climate-related challenges. To address these threats, the study proposes the "Economic Resilience Shield," which focuses on reducing carbon intensity, expanding renewable energy, improving efficiency, and strengthening adaptation policies.*

Keywords: *climate change, economic resilience, vulnerability, Ukraine, European Union*

1. Introduction

The growing impact of climate change on economic systems is significantly affecting the agricultural, forestry and water management sectors. Rainstorms, floods, hurricane winds, downpours, hail, prolonged droughts, heat waves and "tropical nights" already today in many countries of the world lead to significant economic losses, reduce the productivity of the agricultural sector, worsen business conditions and create additional risks for sustainable development. For the countries of the European Union, the issue of resilience to climate challenges is an integral part of the implementation of the European Green Deal and achieving the goals of climate neutrality, while for Ukraine it is also of strategic importance in the context of post-war recovery, integration into the European economic space and ensuring national security. Accordingly, the study of the resilience of the economies of the EU countries and Ukraine to climate challenges is of strategic importance, since it determines their ability to adapt to environmental transformations, minimize economic losses and ensure sustainable development in the long run.

The topic of climate aspects of resilience has sparked an interest in scientific circles. It has been developed as by Ukrainian researchers as the ones abroad. The analysis provided by Krysovatiy, Maksymova & Kuryliak (2024) covers the analysis of current challenges for the global economy due to climate change, and also emphasizes the strategic role of digitization as a driving force for climate neutrality. Shevchenko (2023) has made an investigation into the EU's multi-level strategies for climate change adaptation and resilience concerning the policy framework, funding instruments, and mechanisms for cooperation among Member States.

Shcherbakova (2025) having analysed the evolution of climate financing, the main sources, directions, and instruments of funding for climate initiatives in Ukraine, states that it is insufficient, unstable, uncoordinated, and not fully adapted to modern challenges caused by climate change.

Fedorchuk (2025) analyses the effects of climate changes on policies and authority relations stating that strategically important tasks and directions of environmental policy of modern states are the activation of both domestic and foreign political cooperation, international cooperation, promotion of environmental awareness and culture of citizens, and environmental diplomacy.

The OECD's *Fast-tracking Net Zero by Building Climate and Economic Resilience: A Summary for Policymakers* (2025) recommends a coherent set of policy levers that include aligning finance with climate goals, scaling demand-side measures, reforming governance, engaging citizens, and investing in climate adaptation to enable resilient emissions reductions and mitigate climate risks while stimulating economic growth.

Munguambe & Aung (2025) research highlights the importance of integrating climate finance into broader structural and institutional reforms to support economic transformation and resilience in vulnerable economies. They find that institutional quality, trade openness, industrial development, and overall economic performance significantly enhance resilience, while the direct impact of climate finance and sustainable investments is statistically minimal.

Hasan, et.al (2025) state that both economic and climate resilience significantly contribute to sustainable development of a nation, underling that proactive resilience policy measures can yield long-term development advantages. Findings of the research also demonstrate that trade openness and financial development significantly boost sustainable economic development, while GDP growth, gross fixed capital formation, and natural resources may obstruct it if not handled prudently.

Costella, et.al. (2023) finds that integrating climate considerations into social protection and labor programs can significantly reduce vulnerability for marginalized populations and enhance economic resilience of a nation, thus underlining the need for a coordinated policy in the social sphere.

Szyja (2025) examines economic resilience to natural hazards at the macroeconomic level, highlighting that shaping economic resilience depends on the risk and vulnerability of hazards and the availability of infrastructure and financial resources for recovery.

The authors of the article propose the hypothesis that the economic resilience of countries to climate challenges is determined by the level of decarbonization, the spread of renewable energy sources, increased energy efficiency, as well as the effectiveness of climate policy and the ability of the economy to adapt to climate change.

The aim of the study is to assess the level of vulnerability and readiness of the economies of Ukraine and EU countries to climate challenges.

The structure of the article is as follows: first, key climate challenges for an economy are analyzed; then, the level of vulnerability and preparedness of Ukraine and EU countries to climate challenges is assessed; finally, the ways to ensure the resilience of national economies to climate change are highlighted.

To achieve the research aim, a combination of general scientific and specific methods was applied. Content analysis was used to examine the key climate challenges affecting the economy at global, European, and Ukrainian levels. Comparative analysis was applied to assess the vulnerability and readiness of Ukraine and EU countries to climate challenges, highlighting commonalities and differences. Statistical analysis was employed to interpret quantitative indicators of climate-related risks, adaptive capacity, and economic resilience. In addition, the systematization and generalization of scientific and policy approaches allowed for the identification of strategic directions to strengthen economic resilience to climate change.

2. Results

2.1 Climate challenges for an economy

Global climate change represents one of the most significant contemporary challenges, drawing attention from the international community. Climate change is the result of the interaction of a number of natural factors and human activity, and is manifested in an increase in the average global

temperature of the Earth's surface and ocean. The consequences of such an increase in temperature are an uneven distribution of precipitation, an increase in the number and intensity of extreme weather events: droughts, floods, hurricanes, flash floods, etc. Over the past decades, the intensity of natural phenomena has increased worldwide, as global temperatures have risen to record levels. Thus, UN experts have concluded that, as the climate changes, droughts, which previously could occur only once every 10 years, now occur 70% more often, while downpours, which previously occurred once every 10 years, now occur 30% more often (UNCCD, 2025). Modern climate challenges and their impact on an economy are presented in Table 1.

Table 1. *Climate challenges and their of impact on an economy*

№	Climate Challenge	Potential Economic Impact	Sectors at Highest Risk
1	Rising air temperatures	Labor productivity reduction, higher energy consumption for cooling, negative impact on crop yields	Industry, agriculture, energy, construction
2	Heat waves	labor productivity reduction, increased healthcare costs	Industry, agriculture, services
3	Droughts	Lower crop yields, water shortages, higher irrigation costs	Agriculture, water management, energy
4	Floods and inundations	Infrastructure damage, business losses, higher recovery costs	Transport, manufacturing, housing and utilities
5	Hurricane winds and storm events	Damage to buildings, energy networks, and logistics	Energy, construction, insurance
6	Hail and other extreme precipitation	Crop and property damage, financial damage to farmers	Agriculture, transport, insurance
7	Sea level rise	Coastal flooding, property losses, higher protection costs	Construction, tourism, port infrastructure
8	Earthquakes	Destruction of buildings and infrastructure, production and business losses, recovery costs	Construction, transport, energy, insurance

Source: developed by the authors

Climate challenges pose a serious threat to the economies of both Ukraine and the EU countries, as their consequences are manifested in various sectors of economic activity and create additional risks for socio-economic stability. For example, an increase in air temperature in the medium and long run leads to a decrease in crop yields, an increase in the problem of water shortage, an increase in infrastructure cooling costs and an increase in the level of morbidity among the population, which negatively affects labor productivity and the health care system. Heat waves and so-called tropical nights are increasing in frequency and duration, they already have a significant impact on the urban economy, require additional cooling expenses and increase the burden on health care systems due to heat stress. Droughts are especially dangerous for the agricultural sector of Ukraine, which has a significant export orientation, and for the EU southern countries with traditionally high dependence on agriculture.

Floods place a huge burden on transport and energy infrastructure, lead to the destruction of housing stock and significant losses for economy, which is especially relevant for Central Europe, where river basins are densely populated and economically active (Fernández, G. & Parker, M. (2025). Strong winds, downpours and hail cause damage to infrastructure, transport networks and energy systems, including renewable energy sources, which reduces energy security. At the same time, earthquakes, although less common in Ukraine, still pose a potential hazard to its western regions, while in southern EU countries (Italy, Greece, Spain) they are an additional risk factor, which, combined with climate change, increases economic vulnerability (Pereira, Mónico, & Rego, 2024). Economic losses and fatalities caused by extreme weather and climate-related events in EU are shown in Table 2.

Table 2. *Economic losses and deaths in the EU caused by climate challenges (1980-2023)*

Country	Total losses (Million EURO)	Loss per sq.km (EURO)	Losses per capita (EURO)	Insured losses (Million EURO)	Insured losses (%)	Fatalities
Austria	14726	175564	1806	2786	19	771
Belgium	16988	553942	1612	6679	39	4693
Bulgaria	5168	46564	650	93	2	265
Croatia	4154	73402	943	101	2	910
Cyprus	441	47626	618	8	2	68
Czechia	18533	234974	1783	2168	12	716
Denmark	8751	203867	1618	5443	62	533
Estonia	332	7333	236	5	15	5
Finland	2380	7034	457	73	3	7
France	129897	203449	2092	46052	35	50461
Germany	180372	504438	2225	54759	30	104544
Greece	16350	124155	1548	849	5	4690
Hungary	10444	112291	1026	587	6	874
Ireland	3955	56542	965	541	14	68
Italy	133934	443373	2311	5916	4	21822
Latvia	1250	19348	544	71	6	88
Lithuania	2283	39976	690	58	3	103
Luxembourg	1262	486143	2694	627	50	170
Malta	51	162361	128	2	4	5
Netherlands	10970	293491	688	4297	39	3918
Poland	20630	66138	545	1379	7	2553
Portugal	16671	180775	1628	578	3	10339
Romania	19628	82335	916	199	1	1445
Slovakia	1956	38983	367	84	4	121
Slovenia	17484	862448	8639	271	2	323
Spain	95966	189662	2258	5243	5	32053
Sweden	3703	8276	406	967	26	44
EU-27	738280			139872		241587

Source: European Environment Agency

Between 1980 and 2023, extreme climate-related events generated estimated economic damages of approximately EUR 738 billion (in 2023 prices) across the European Union. Hydrological disasters, primarily floods, accounted for 44% of these losses, while meteorological events such as storms, lightning, and hail made up nearly 29%. Climatological hazards contributed a smaller share: heatwaves were responsible for around 19% of total damages but caused the vast majority of fatalities (95%), while droughts, wildfires, and cold together represented about 8% (European Environment Agency).

A relatively small proportion of incidents generated the majority of economic losses: the most severe 5% of events were responsible for 61% of the damages, and just 1% of events accounted for 28%. Average annual losses (in constant 2023 euros) rose markedly over time: EUR 8.5 billion in the 1980s, 14.0 billion in the 1990s, 15.8 billion in the 2000s, 17.8 billion in the 2010s, and 44.5 billion between 2020 and 2023. A 30-year moving average confirms this upward trajectory, showing a 53% increase in losses between 2009 and 2023, equivalent to about 2.9% growth per year (European Environment Agency).

In general, the climate challenges create a multi-vector impact on the national economies, forcing governments and businesses to adapt through the implementation of modern risk management technologies, development of protective infrastructure, economic diversification and increased cooperation in the field of climate policy. In particular, the 2021 EU Strategy on Adaptation to Climate Change (European Commission, 2021) aims to increase resilience and ensure that EU is adequately prepared to manage these challenges. It also adapts to the consequences of climate change. Ultimately, the EU seeks to reduce overall monetary losses from weather and climate events.

2. 2. The Analysis of vulnerability and readiness level of national economies to climate challenges

The Notre Dame Global Adaptation Initiative Index (ND-GAIN Index) is a global indicator developed by the University of Notre Dame (USA) that measures the vulnerability of countries to climate change and their readiness to adapt to its consequences. Vulnerability Index assesses the exposure rate of a country to climate change and their dependance on climate-sensitive sectors (food security, water resources, health, infrastructure, ecosystems, housing). Readiness Index reflects a country's ability to use investments and resources for adaptation, taking into account economic, social and political factors. The index ranges from 0 to 100 and shows which countries are most vulnerable and least prepared, and which have the best opportunities to be resilient to climate challenges. The ND-GAIN Index ranking for Ukraine and the EU in 2023 is given in Table 3.

Table 3. ND-GAIN Index for Ukraine and EU in 2023

No	Countries	ND-GAIN Index	Vulnerability Index	Readiness Index
1.	Finland	74.8	0.280	0.776
2.	Denmark	72.7	0.347	0.802
3.	Sweden	71.1	0.317	0.739
4.	Germany	69.6	0.301	0.694
5.	Austria	67.9	0.295	0.654
6.	Luxembourg	67.7	0.311	0.665
7.	France	67.2	0.304	0.648
8.	Netherlands	66.7	0.354	0.687
9.	Estonia	64.2	0.334	0.619
10.	Ireland	64.1	0.316	0.597
11.	Czech Republic	62.9	0.264	0.522
12.	Belgium	62.8	0.335	0.592
13.	Slovenia	62.8	0.314	0.571
14.	Portugal	61.5	0.318	0.548
15.	Poland	60.5	0.306	0.515
16.	Lithuania	60.2	0.360	0.564
17.	Spain	60.1	0.305	0.506
18.	Latvia	59.5	0.360	0.549
19.	Italy	58.8	0.342	0.518
20.	Greece	58.0	0.337	0.498
21.	Cyprus	56.0	0.359	0.478
22.	Malta	55.9	0.320	0.437
23.	Slovakia	55.2	0.360	0.464
24.	Hungary	54.6	0.353	0.445
25.	Croatia	53.6	0.380	0.452
26.	Bulgaria	53.2	0.354	0.419
27.	Romania	51.4	0.412	0.441
28.	Ukraine	51.2	0.365	0.388

Source: Notre Dame Global Adaptation Initiative.

A high level of the ND-GAIN Index, corresponding to the range from 60 to 100 points, is demonstrated by most countries of Western and Northern Europe, among which the leaders are Finland (74.8 points), Denmark (72.7 points) and Sweden (71.1 points). These can be explained by developed institutions, a high level of economic development, systematic climate policy and investments in infrastructure. This group also includes Germany, Austria, Luxembourg, France, the Netherlands, Estonia, Ireland, the Czech Republic, Belgium, Slovenia, Portugal, Poland, Lithuania and Spain, which indicates the dominance of high standards of adaptive capacity in the EU.

In contrast, the medium level, with range of indicators from 40 to 59 points, is typical for the countries of Southern and Eastern Europe, including Latvia, Italy, Greece, Cyprus, Malta, Slovakia, Hungary, Croatia, Bulgaria and Romania. Ukraine also belongs to this group with an indicator of

51.2 points.

Thus, the EU as a whole demonstrates a sufficient resilience to climate change, but there is a regional asymmetry between the North and the West, that are leading, and the South and the East, which have medium results.

Analysis of individual components of the Vulnerability and Readiness indicators allows for a more detailed assessment of the position of Ukraine and the European Union member states in climate resilience (table 4). According to the ND-GAIN Index methodology, low vulnerability values indicate lower sensitivity to climate risks, while high readiness values demonstrate better capacity of society and the economy to climate adaptation.

Table 4. Classification matrix of EU member states and Ukraine by the levels of vulnerability and readiness to climate challenges

Readiness	Countries		
High level (> 0,6)	-	-	Finland, Denmark, Sweden, Germany, Austria, Luxembourg, France, Netherlands, Estonia,
Medium level (0,6-0,4)	-	Romania	Ireland, Czech Republic, Belgium, Slovenia, Portugal, Poland, Lithuania, Spain, Latvia, Italy, Greece, Cyprus, Malta, Slovakia, Hungary, Croatia, Bulgaria.
Low level (< 0,4)	-	-	Ukraine
Vulnerability	High level (>0,6)	Medium level (0,6-0,4)	Low level (< 0,4)

Source: systemized by the authors according to Notre Dame Global Adaptation Initiative.

The majority of countries in Western and Northern Europe, including Finland, Denmark, Sweden, Germany, Austria, Luxembourg, France, the Netherlands and Estonia have a high readiness level (over 0.6). At the same time, these countries demonstrate a low vulnerability level – ranging from 0.28 to 0.36, that forms their leading position in the world ranking. Medium level of preparedness (0.6–0.4) is observed in Ireland, the Czech Republic, Belgium, Slovenia, Portugal, Poland, Lithuania, Spain, Latvia, Italy, Greece, Cyprus, Malta, Slovakia, Hungary, Croatia and Bulgaria. At the same time, the vulnerability level in these countries is within the low level (0.3–0.4), which means that additional measures are needed to enhance resilience, in particular investments in infrastructure modernization and improvements of risk management system. Romania is the only EU country with the medium level of both vulnerability and readiness to climate challenges.

Ukraine demonstrates a low level of vulnerability (0.365) and a low readiness level (0.388), which indicates that the country as a whole is less susceptible to certain negative climate impacts, but its capacity to respond effectively and adapt to climate change is limited. This combination of indicators highlights the need to strengthen preparedness mechanisms, increase resource and institutional capacity to reduce the potential consequences of climate impacts.

2.3 Directions for ensuring an economy resilience to climate change

The global climate crisis is a systemic problem, so its solution requires organizational steps at the international and national levels. In 2015, Ukraine and the EU member states, together with other countries of the world, signed the Paris Climate Agreement - a document by which all signatories agreed to reduce their impact on climate change and prevent the average global temperature from rising higher than 1.5-2°C above pre-industrial levels (mid-19th century) (Council of the European Union, n.d.). To assess the countries actual progress in fulfilling their commitments and the effectiveness of their climate policy, the international Climate Change Performance Index tool is used annually, which allows comparing the achievements of countries in reducing emissions, developing renewable energy, increasing energy efficiency, and forming effective climate policy (Germanwatch, n.d.).

The Climate Change Performance Index (CCPI) is an international analytical tool published annually by Germanwatch, NewClimate Institute and Climate Action Network (CAN International) since 2005. The CCPI assesses and compares the climate protection performance of 63 countries and the European Union (EU), which together account for over 90% of global greenhouse gas (GHG) emissions. The CCPI uses 14 indicators grouped into four categories:

- GHG Emissions (40%) – emission dynamics, per capita emissions, compliance with climate goals.
- Renewable Energy (20%) – development of "green" energy, share of renewables in the energy consumption structure.
- Energy Use (20%) – efficiency, per capita energy consumption, trends.
- Climate Policy (20%) – national and international government policy, expert assessments of its ambition and effectiveness.

Countries are ranked from 1 to 100. The values of the Climate Change Performance Index for Ukraine and the EU member states in 2025 are given in Table 5.

Table 5. *The Climate Change Performance Index for Ukraine and EU countries in 2025*

№	Countries	Points	Levels
1.	Denmark	78.37	High
2.	Netherlands	69.60	High
3.	Sweden	67.62	High
4.	Luxembourg	67.29	High
5.	Estonia	66.79	High
6.	Portugal	66.59	High
7.	Germany	64.91	Medium
8.	Lithuania	63.05	Medium
9.	Spain	61.57	Medium
10.	Greece	59.41	Medium
11.	Austria	59.40	Medium
12.	France	59.18	Medium
13.	Ireland	57.17	Medium
14.	Slovenia	57.16	Medium
15.	Romania	56.45	Medium
16.	Malta	55.78	Medium
17.	Belgium	54.89	Low
18.	Latvia	54.35	Low
19.	Finland	54.24	Low
20.	Croatia	51.83	Low
21.	Italy	49.81	Low
22.	Cyprus	49.45	Low
23.	Hungary	48.81	Low
24.	Slovakia	48.44	Low
25.	Poland	47.86	Low
26.	Czech Republic	47.57	Low
27.	Bulgaria	47.13	Low
	European Union	63.76	Medium

Source: Climate Change Performance Index. (n.d.).

The Climate Change Performance Index shows significant differences in the effectiveness of overcoming climate change among EU member states in 2025. The leaders in this indicator are Denmark with 78.37 points, the Netherlands – 69.60, Sweden – 67.62, Luxembourg – 67.29, Estonia – 66.79 and Portugal – 66.59, which reflects the high level of preparedness of these states for climate challenges and the effective implementation of measures to reduce emissions and develop renewable energy. The medium level of effectiveness is in Germany, Lithuania, Spain, Greece, Austria, France, Ireland, Slovenia, Romania and Malta, demonstrating the presence of climate policies, but with significant potential for improvement. Countries with low performance, including Belgium, Latvia, Finland, Croatia, Italy, Cyprus, Hungary, Slovakia, Poland, the Czech Republic and Bulgaria, have

serious gaps in implementing measures to reduce emissions and adapt to climate change. The medium value of the index for the EU is 63.76, which reflects the overall medium effectiveness of the EU in overcoming climate change. For Ukraine, which is not currently represented separately in the ranking, integration into European climate practices requires a focus on reducing emissions, developing green energy and increasing preparedness for climate risks, which will allow it to improve its position and effectiveness in the context of European standards.

Given the need to adapt national economies to the consequences of climate change and reduce their vulnerability to extreme natural phenomena, Figure 1 shows the directions for ensuring the resilience of an economy to climate change. The directions include reducing and decarbonizing emissions, developing renewable energy sources, increasing energy efficiency, and implementing effective climate policies. Thus, these directions form the so-called “Economic Resilience Shield”, which protects the country from the negative consequences of climate change, reduces the vulnerability of critical sectors, and increases readiness for extreme natural phenomena.

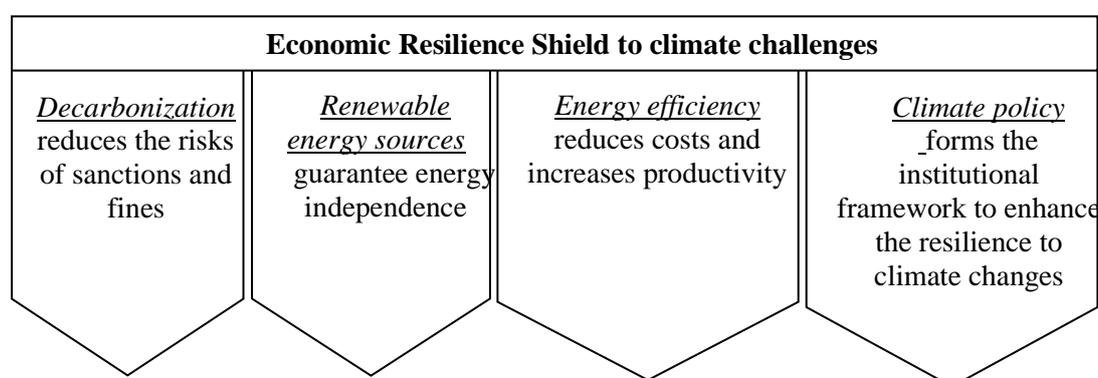


Figure 1. The directions to enhance an economy resilience to climate challenges
Source: developed by the authors.

The reduction and decarbonization of emissions involve a gradual decrease in greenhouse gas volumes through industrial modernization, the phasing out of coal-based power generation, the development of low-carbon technologies, and the introduction of carbon regulation mechanisms. Accordingly, this in turn reduces the vulnerability of the economy to international climate restrictions (for example, CBAM (Carbon Border Adjustment Mechanism) in the EU) and creates conditions for “green” integration into global markets. Ukraine has committed to achieving climate neutrality by 2060, but the pace of decarbonization remains uneven (Ecoaction, n.d.). The largest sources of emissions are energy sector, metallurgy and transport. The war caused a paradoxical effect, which shows a partial reduction in emissions due to a drop in industrial production, but at the same time an increase in emissions in the military sector and due to the destruction of infrastructure. An urgent challenge is adaptation to the EU's CBAM, as Ukrainian metallurgical and chemical enterprises must reduce their carbon footprint in order to maintain access to European markets (European Commission-Taxation and Customs Union. (n.d.).

The European Union is implementing the European Green Deal, which envisages reducing emissions by 55% by 2030 (compared to 1990) and achieving climate neutrality by 2050. (European Commission, n.d.). The introduction of CBAM stimulates external partners to accelerate decarbonization. The EU is actively investing in the development of carbon markets, implementing the EU Emissions Trading System (EU ETS) and preparing to extend it to transport and construction sectors. Development of renewable energy sources is aimed at increasing the share of solar, wind, bio- and hydropower in the energy consumption structure. Accordingly, this strengthens energy security, reduces dependence on imported fossil resources, stimulates investment and creates new jobs in the "green" sector of the economy. In Ukraine, the share of renewable energy sources in the

overall energy balance reached approximately 12% before the war, but the conflict has led to the destruction of a significant number of solar and wind power plants (Cahill, B., & Dawes, A., 2022). Despite this, the development of renewable energy sources is a key area of energy security and integration with the EU. Ukraine has a high potential for solar and wind generation, as well as bioenergy (including the agricultural sector). The EU has an ambitious goal of achieving 42.5% of renewable energy sources in energy consumption by 2030. The EU finances the development of trans-European energy networks and invests in “green” energy storage technologies. Ukraine can integrate into these processes through synchronization with ENTSO-E and the development of projects in the field of hydrogen energy.

Increasing energy efficiency and rational consumption is aimed at reducing the energy intensity of GDP through the modernization of industry, insulation of the housing stock, the development of electric transport and the introduction of digital technologies for energy consumption management. Accordingly, this allows the economy to withstand external price shocks and ensures competitiveness in the long run. The Ukrainian economy is one of the most energy-intensive in Europe (energy consumption per unit of GDP is 2–3 times higher than the EU average).

The greatest potential for improving energy efficiency lies in the residential and communal sector (building insulation, modernization of heat supply systems). Existing programs such as “Enerhodim,” the Energy Efficiency Fund, and “warm loan” schemes are initial steps, but they need to be scaled up. In wartime conditions, energy conservation amid infrastructure destruction is also crucial (modernization of boiler houses, mobile heating systems, and microgrid solutions).

The EU considers energy efficiency as the “first fuel resource” and prioritizes reducing energy consumption. The goal is to increase energy efficiency by at least 11.7% by 2030. Large-scale investments are aimed at building insulation, digital energy management systems, the development of “smart” grids and electric transport. It is important for Ukraine to implement EU directives on energy efficiency (especially in the building sector) in order to integrate into the EU energy market.

Institutional and regulatory climate policy covers the development and implementation of national strategies for decarbonization, adaptation to climate change, and integration of climate goals into all areas of economic policy. Important components include development of a system of “green” financing, participation in international climate agreements, and transparency in the implementation of climate initiatives. Ukraine has joined the Paris Agreement and committed to reducing its emissions by 65% by 2030. The Strategy for Environmental Security and Adaptation to Climate Change by 2030 has been adopted. However, there are a number of problems, such as the fragmentation of the institutional system, insufficient funding, weak integration of climate goals into industrial policy. The war made climate policy secondary, but the post-war reconstruction provides a chance to shift to a “green recovery” with the support of the EU and international partners.

The EU has a coherent and institutionally strong climate policy, based on the European Green Deal, the Fit for 55 package (Council of the European Union. (n.d.)b., as well as the European Climate Law, which legally states climate neutrality by 2050 (European Commission, n.d.).

Considerable attention is paid to “green finance”, in particular through the classification system “EU Taxonomy” and introduction of green bonds European Commission. (n.d.) c.

The EU is also actively funding partner countries, including Ukraine, to help adapt their economies to new climate requirements. Thus, in both cases these directions are interconnected, as Ukraine follows the EU’s lead, while European policy creates both challenges for Ukraine (CBAM, competition for “green” investments) and opportunities (access to funds, integration into the “green” market).

3. Conclusion

Climate change has become an inevitable challenge for all countries of the world due to its global nature and large-scale consequences for natural, economic and social systems. Rising average temperatures, melting glaciers, sea-level rise, and the increasing frequency of extreme weather

events are not confined by national borders and affect the entire world. The processes that are already taking place are practically inevitable, and their consequences can affect the environment for decades, which reinforces the need for adaptation and increasing resilience.

The study has proved that climate change forms a set of challenges for the economy, among which the key ones are rising energy costs, risks to food security, threats to the functioning of infrastructure and a decrease in the competitiveness of individual industries. In terms of their scale and consequences, climate challenges are comparable to wars and pandemics, as they can cause significant economic losses, destruction of infrastructure, mass migrations and exacerbation of socio-political tensions.

The analysis of the level of vulnerability and readiness showed that the leaders in the field of climate resilience remain the countries of Northern and Western Europe, while Southern and Eastern Europe demonstrate medium results. Unlike most EU countries, where even under conditions of medium vulnerability, sufficient readiness to counter challenges is ensured, Ukraine is characterized by a low readiness level, which limits its ability to respond effectively to climate risks. Accordingly, there is a need to implement significant environmental reforms, intensify green transformation and attract international support, because the current relatively low level of vulnerability does not guarantee the absence of new climate challenges in the future.

It is worth noting that Russian military aggression in Ukraine affects climate change with both direct and indirect consequences. For example, the destruction of energy, industrial and transport infrastructure leads to uncontrolled emissions of greenhouse gases, and the active use of military equipment and transport significantly increases CO₂ and methane emissions. Damage to forests, water bodies and agricultural lands reduces the ability of natural ecosystems to absorb carbon, causing soil degradation and loss of biodiversity. The destruction of cities and industrial facilities also leads to the accumulation of toxic waste and debris, which pollutes soil and water bodies. In addition, rising energy prices in the world are stimulating a transition to cheaper but more carbon-intensive energy sources, which may slow down global efforts to combat climate change. Thus, the war in Ukraine has a significant both local and global impact on climate processes, increasing risks for economies and natural ecosystems. To ensure the resilience of the economy to climate change, the study proposes an “Economic Resilience Shield”, which is relevant for every country in the world. Accordingly, the “Economic Resilience Shield”, formed on the basis of the calculation methodology of The Climate Change Performance Index, covers reducing the carbon intensity of the economy, expanding the share of renewable energy, increasing energy efficiency, and improving environmental policy and adaptation mechanisms.

Further research on this issue will be aimed at modeling scenarios for the adaptation of the economy to climate change and assessing the socio-economic consequences of such measures.

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DEVELOPING A CONTEXT SPECIFIC MULTIDIMENSIONAL SCALE TO MEASURE THE SUSTAINABILITY OF FAMILY OWNED INDIAN MSMEs

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Abstract: *The importance of the family business is globally visible, contributing approximately 70% to 90% of the global GDP. In India, family-owned businesses (FOBs), particularly Micro, Small, and Medium Enterprises (MSMEs), are dominant, contributing approximately 30% to the Indian economy and employing around 111 million people. Given this significant role, understanding the factors crucial for the sustainability of family-owned Indian MSMEs is essential. This study addresses a critical research gap: the absence of a validated, context specific measuring scale to assess sustainability within this area. The objective is to develop and validate a multidimensional scale specifically tailored for Indian family-owned MSMEs, strictly adhering to the systematic approach suggested by Churchill (1979). Four primary variables were identified: Family Goals, Succession Planning, Family Culture, and Entrepreneurial Orientation, as variables of sustainability. Initial phases, including item generation and a pilot study, demonstrated internal consistency through Cronbach's Alpha and Confirmatory Factor Analysis (CFA), thus confirming the items' theoretical coherence and reliability. This process provides a reliable, scientifically developed multi-item scale ready for large-scale data collection, which is useful for academicians and policy makers.*

Keywords: *Family Owned MSMEs, India, Sustainability, Scale Development, Churchill (1979), Confirmatory Factor Analysis*

1. Introduction

The importance of the family business is globally visible with the contributions to the respective economies and also more importantly, the generation of employment. The contribution of the global GDP coming from family business is in the approximate range of 70% to 90% (Luo, 2019; Priya, 2021). The figure 1 below provides the details of the contribution of the family businesses to their respective economies.

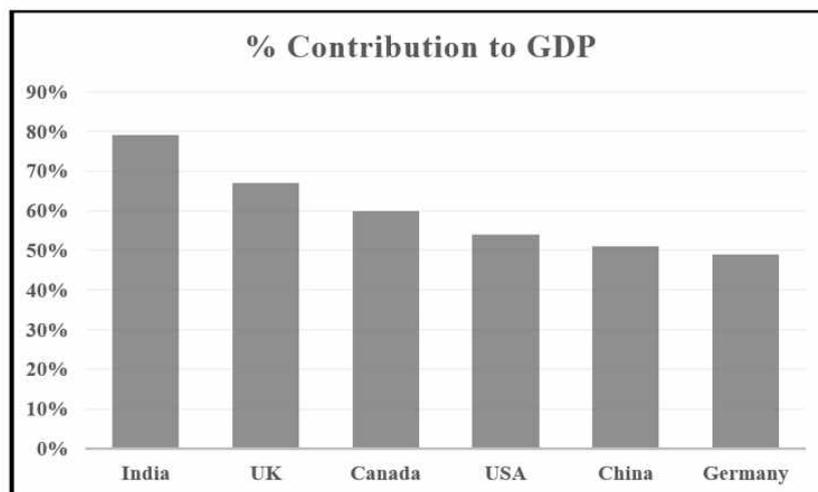


Figure 1. Visual Capitalist (2024). Family-Owned Businesses by Share of GDP

From the above figure it is evident that Indian economy is dominated with the contribution from the family-owned businesses (FOB). They are contributing 79 % to the Indian economy. Also, they are one of the major contributors in terms of employment (Takahashi & Srivastava, 2025; Malik, 2018, Kota & Singh, 2016). Indian economy is the world's third largest source or hub for FOBs with almost 111 companies having valuation of USD 840 billion (Takahashi & Srivastava, 2025). There is also another important element attached to the India FOBs, that is micro, small and medium enterprises (MSMEs). MSMEs in India, according to Ministry of MSME, Government of India, is defined as *Micro enterprises are those who has investment in plant and machinery or equipment of not more than Rs. 2.5 crore and annual turnover not more than Rs. 10 crore, small enterprises are those who has investment in plant and machinery or equipment of not more than Rs. 25 crore and annual turnover not more than Rs. 100 crore and medium enterprises are those who has investment in plant and machinery or equipment of not more than Rs. 125 crore and annual turnover not more than Rs. 500 crores* (Ministry of Micro, Small & Medium Enterprises [MSME], n.d.).

The contribution of MSMEs in Indian economy comes from the fact that they are the major contributor to the country's employment, GDP, exports, regional development, entrepreneurship development, innovation, income distribution and support to the large enterprises. They contribute approximately 30 % to the Indian economy, 45 % of the total exports and also reduces the urban concentration and also forms the important part of the supply chain of large corporation (Nath, 2024).

The major portion of family-owned enterprises in India are MSME in nature ("A Diagnostic Analysis of Problems of MSMEs in India", n.d., Jayakumar (2023)). Family owned MSMEs contribute to almost 30 % to the Indian economy. They employ almost 111 million people, both directly and indirectly and in rural and urban areas. (Nurunnabi and Kusz, 2021).

Though there are numerous papers which talks about the contribution and importance of MSMEs in various economies. Also, at the same time there are researches in the area of family-owned business, but there are almost nil researches are available in the area of family owned MSMEs in India and its contribution to the economy, GDP, employment etc.

Given the importance of family owned MSMEs in India, understanding their sustainability is of academic and policy importance. There is complete absence of a validated, context specific measuring scale that limits the understanding of impact of factors within the domain of family owned MSMEs. Existing studies rely heavily on fragmented scales which were developed in another context and when applied to this domain, fails to provide the required results.

Therefore there is a need of comprehensive, and scientifically developed scale that can measure the impact of socio economic, cultural and other such factor to the sustainability of Indian family owned MSMEs. Developing a scale demands a systematic approach such as suggested by Churchill (1979) which laid importance to domain specification, item generation and various other such steps. It also emphasised that identification of variables has to be based on rigorous literature review which provides the strong foundation of development of scale.

The present study addresses this gap by developing and validating a multidimensional scale specifically tailored to the need of assessment of sustainability of family owned Indian MSMEs. By doing so, this paper provides a strong literature on the above said domain which can be useful for both academicians and policy makers in understanding the impact of factors responsible for sustainability of family owned Indian MSMEs.

2. Conceptual foundation and theoretical background

Since the objective of this paper is to develop a scale / questionnaire in the area / theme of factors which effects the sustainability of family owned MSMEs; in order to achieve that, the model which we used was from the seminal paper "A Paradigm for Developing Better Measures of Marketing Constructs" by Gilbert A. Churchill, Jr.'s (1979). The reason for opting this paper as model paper for development of scale / questionnaire was, that, this paper provides a unified and comprehensive framework that is crucial for the development of scale / questionnaire.

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To be more specific, the reason for opting this paper over others was, that, this directly addresses the flaw which others failed to identify was the presence of strong measurement criteria like reliability and validity failing which, according to Churchill (1979), will lead a common pitfall known as "garbage in, garbage out" (GIGO). Churchill's work is also more important because it structures the previously scattered measurement tools and literature into a comprehensive, integrated and step by step procedure so that a multi-item scale can be purified and developed scientifically. According the Churchill (1979), the steps involved in the development of a muti-item scale are given in figure 2. We developed the scale which is given in coming paragraphs by keeping these steps as a base.

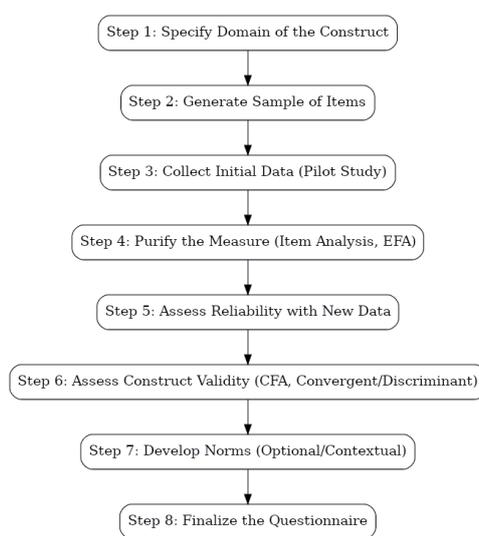


Figure 2. Flow chart showing the process involved in multi-item scale development by Churchill (1979).

2.1 Specify the domain of construct:

According to Churchill (1979), the quality of scale development starts with quality of literature which has been reviewed and applied in identification and definition of constructs / variables. The purpose of the step should be to clearly specify, that what is to be included in the definition and what is to be excluded so that ambiguity with respect to the understanding of the construct should be avoided and if there is any, it should be removed. According to Churchill, the definition of construct should act as “means rather than ends in itself”. Hence, the first and most important step in scale development is defining the variables or “specifying the domain of construct”.

Moving as per the steps, suggested by Churchill, we undertook the literature review to clearly specify and define the domain of construct. The summary of process as outlined by Goodell et al. (2021) of finding the relevant paper is given in the table 1 below:

Table 1. Search criteria and article selection)

	Search criteria	Reject	Accept
a	Search engine: <i>Scopus</i>		
b	Search date: 14 April 2025		
c	Search term: KEY (“family business”) OR KEY (“family owned business”) OR KEY (“family enter?”)		3633
d	Subject area: “Business, Management and Accounting”, “Social Sciences”	503	3130
e	Document type: “Articles”, “Conference papers”, and “Book chapter”	181	2949
f	Access: All Open Access	2088	861
g	Year of Publication: 2010-2025	14	847
h	Publication Stage: Final	16	831
i	Keywords: Family Business, Family Businesses, Succession, Innovation, Family Firms, Sustainability, Gender, Entrepreneur, Entrepreneurial Orientation, Firm Performance, Family Structure, Family Business Succession, Familiness, Decision Making, Family-owned Business, Family Firm, Succession Planning,	48	783

	<i>Family Involvement, Women, Small Family Business, Family Ownership, Family Business Management, Family-owned Businesses, Family, Business Family, Family Entrepreneurship, Family Dynamics, Business Families, Small Family Businesses, Small And Medium-sized Enterprise, Family Control, Family Business Groups.</i>		
j	Language screening: <i>Include documents in English only</i>	40	743
k	Source type: <i>Journal, Conference proceedings, Books</i>	26	717
l	Content screening: <i>Include articles if “Titles, abstracts, and keywords” indicate relevance to scope of study</i>	0	717

In the above table the databased searched was SCOPUS instead of other database like Web of Science because Scopus has wider coverage of peer reviewed research papers from peer reviewed journals and also there is intense representation of quality research papers from across the discipline and also from across the regions and countries (Patnaik et al., 2021)

As mentioned in the table 1 above, to find out the relevant paper we passed the keyword “*family business*”, “*family owned business*”, “*family enter?*”. The subject area chosen for the study was “*Business, Management and Accounting*”, “*Social Sciences*”, since we our research from that area of study and we can get the relevant research paper from those areas. In order to get wider area of study we chose “*Articles*”, “*Conference papers*”, and “*Book chapter*” and all of them were of “All open Access” type so that it can easy and approachable for us to go through those papers. Further, to get the latest development in the required field we chose to cover that paper which must of recent years and hence the period of fifteen years was chosen as the period of coverage for paper. To get the specific result from the data the following keywords were used “*Family Business, Family Businesses, Succession, Innovation, Family Firms, Sustainability, Gender, Entrepreneur, Entrepreneurial Orientation, Firm Performance, Family Structure, Family Business Succession, Familiness, Decision Making, Family-owned Business, Family Firm, Succession Planning, Family Involvement, Women, Small Family Business, Family Ownership, Family Business Management, Family-owned Businesses, Family, Business Family, Family Entrepreneurship, Family Dynamics, Business Families, Small Family Businesses, Small And Medium-sized Enterprise, Family Control, Family Business Groups*”, so that specificity of the research should not be diluted. These keywords almost covered all the aspect of the desired field of research. The language of search papers chosen was English, as most of the researches done in the area are in English.

Thus, at the end, after applying all the above filtering criteria and others as mentioned in table1 above, the final corpus of 717 research paper was relevant to the objective of the study. The final corpus of 717 papers was exported to CSV format and was taken to VOSviewer for bibliometric analysis and to identify and establish the constructs/variable. VOSviewer is considered as powerful and best tool to conduct the bibliometric analysis due to its capabilities to generate, visualise and analyse bibliometric data enabling the researchers to efficiently understand the research gap, trends, relationship amongst the papers and clustering (Van Eck & Waltman, 2016)

Table 2: Thematic Cluster for identification of variables / constructs

Themes identified	Paper Title	Authors	Year	Citations
Family Goals	Reflections on family firm goals and the assessment of performance	Chua J.H., Chrisman J.J., De Massis A., Wang H.	2018	110
	“Where do you want to take your family firm?” A goal hierarchy perspective of family firm internationalization	Basco R.	2017	108
	The Heterogeneity of Family Firms in CSR Engagement: The Role of Values and Stewardship	Marques P., Presas P., Simon A.	2014	214
	Corporate social responsibility in family firms: Status and future directions of a fragmented field	Mariani M.M., Al-Sultan K., De Massis A.	2023	112
	To Merge, Sell, or Liquidate? Socioemotional Wealth, Identity, and Family Business Exit Strategies	Chirico F., Gómez-Mejía L.R., Hellerstedt K., Withers M.	2020	141

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	Sustainability in tourism as an innovation driver: An analysis of family firms	Elmo G.C., Arcese G., Valeri M., Poponi S., Pacchera F.	2020	107
	Sustainability as a driver for value creation: A qualitative comparative analysis	Broccardo L., Zicari A.	2020	117
	Family businesses under COVID-19: Inspiring models for facing the crisis	Le Breton-Miller I., Miller D.	2022	56
Succession planning	Family firms in the global economy: Toward a deeper understanding of internationalization determinants	De Massis A., Frattini F., Majocchi A., Piscitello L.	2018	326
	When does transitioning from family to professional management improve firm performance?	Chang S.-J., Shim J.	2015	160
	Family control and family firm valuation by family CEOs: The importance of intergenerational family involvement	Zellweger T.M., Kellermanns F.W., Chrisman J.J., Chua J.H.	2012	653
	The pursuit of international opportunities in family firms: Generational differences and the role of knowledge-based resources	Fang H., Kotlar J., Memili E., Chrisman J.J., De Massis A.	2018	133
	Unlocking innovation potential: A typology of family business innovation postures and the critical role of the family system	Rondi E., De Massis A., Kotlar J.	2019	169
Family Culture	The Heterogeneity of Family Firms in CSR Engagement: The Role of Values and Stewardship	Marques P., Presas P., Simon A.	2014	214
	Managing the Tradition and Innovation Paradox in Family Firms: A Configurational Approach	Erdogan I., Rondi E., De Massis A.	2020	252
	Women's involvement in family firms: Progress and challenges	Campopiano G., De Massis A., Rinaldi F.R., Sciascia S.	2017	159
	Women leaders and firm performance in family business: Evidence from India	Chadwick I.C., Dawson A.	2018	113
	To Merge, Sell, or Liquidate? Socioemotional Wealth, Identity, and Family Business Exit Strategies	Chirico F., Gómez-Mejía L.R., Hellerstedt K., Withers M.	2020	141
	What Do We Know About Business Families? Setting the Stage for Leveraging Family Business Research Through Business Family Lenses	Combs J.G., Shanine K.K., Burrows S., Allen J.A.	2020	97
	Trust and reputation in family businesses: A systematic literature review	Chaudhary S., Dhir A., Ferraris A., Bertoldi B.	2021	111
Entrepreneurial Orientation	Managing the Tradition and Innovation Paradox in Family Firms: A Configurational Approach	Erdogan I., Rondi E., De Massis A.	2020	252
	Kinship and business: how entrepreneurial households facilitate business development	Alsos G.A., Carter S., Ljunggren E.	2014	140
	Unlocking innovation potential: A typology of family business innovation postures and the critical role of the family system	Rondi E., De Massis A., Kotlar J.	2019	169
	When does transitioning from family to professional management improve firm performance?	Chang S.-J., Shim J.	2015	160
	Family ownership and acquisition behavior in publicly-traded companies	Miller D., Breton-Miller I.L., Lester R.H.	2010	320
	Sustainability as a driver for value creation: A qualitative comparative analysis	Broccardo L., Zicari A.	2020	117
	Women leaders and firm performance in family business: Evidence from India	Chadwick I.C., Dawson A.	2018	113
	Family Business Growth Around the World	Miroshnychenko I., De Massis A., Miller D., Barontini R.	2021	135
	Clarifying the strategic advantage of familiness: Unbundling its dimensions and highlighting its paradoxes	Irava W.J., Moores K.	2010	96
	Sustainability in tourism as an innovation driver: An analysis of family firms	Elmo G.C., Arcese G., Valeri M., Poponi S., Pacchera F.	2020	107
	Family businesses under COVID-19: Inspiring models for facing the crisis	Le Breton-Miller I., Miller D.	2022	56

Table 2 above provides a thematic clustering identified by VOSviewer based on the principles of bibliographic coupling. Bibliographic coupling is crucial in identifying the variables in a particular area of research, because bibliographic coupling is based on the assumption that if two publications share the common references, then they are also similar in their content and theme (Kessler, 1963). Also, bibliographic coupling focusses on grouping the publication on the basis of their thematic cluster which is based on shared references (Zupic & ˇCater, 2015). Moreover, bibliometric analysis focusses on more recent works which may not have gained that much importance / references and hence which is sometimes overlooked by other bibliometric analysis tool like co citation analysis (Donthu et al., 2021). Thus, for our work we took the help of bibliographic coupling for thematic clustering for identifying the independent variable which are crucial and important for sustainability of family owned small, medium and micro enterprises.

Thematic cluster 1 consisted of articles which can be grouped together into a theme called “Family goals”. This cluster primarily (but not all) focusses on that non financial objective that binds and motivates a family firm which can be a suitable point for a family business to get distinguished from non family business. Goals such as socio emotional wealth (SEW), family identity etc are those points which significantly influence crucial and strategic decision of family owned MSMEs. Key influential articles under this theme were one from Chua et al. (2018) with 110 citations. This paper is important and pivotal from the aspect that it explained how unique family firms are and it further explored that how important for a family firm is the non financial goals while taking the strategic decision to move the firm forward. While Marques et al. (2014) in this work "The Heterogeneity of Family Firms in CSR Engagement: The Role of Values and Stewardship" with 214 citations highlighted that how family values in family firms significantly shapes its engagement with society through corporate social responsibility. Chirico et al. (2020) with 141 citations emphasised the role of socioemotional wealth and family values in coming to strategic and crucial business decision. Other notable work in this theme was from Basco (2017) (108 citations), Broccardo & Zicari (2020) (117 citations) and Elmo et al. (2020) (107 citations) which linked sustainability with family values and socioemotional wealth for family firms.

Cluster 2 has papers clubbed into the theme of Succession Planning. This cluster has taken into account the aspects of leadership and its implication on ownership transfer within family owned MSMEs across generations. It has considered and included all strategic considerations, challenges and other relevant factors which are responsible for smooth transition of ownership from one generation to another. Key contributors to this theme are the one from Zellweger et al. (2012) with 653 citations. It has taken socioemotional wealth perspective into the process of succession planning. It argued that valuation of a family firm moves beyond the financial aspect and also encompasses the desire of previous generation to pass on the control to next generation making it almost necessary for smooth transition across the generation. Another contribution in this cluster of succession planning comes from De Massis et al. (2018) through their work "Family firms in the global economy: Toward a deeper understanding of internationalization determinants" with 326 citations. This paper has taken need for internationalisation for family-owned firms. It has highlighted the factors which are responsible for successful succession planning. One of the important factor it has discussed is the degree of family involvement and its implications cross generational aspirations and successful succession planning. Rondi et al. (2019) in their work "Unlocking innovation potential: A typology of family business innovation postures and the critical role of the family system" with 169 citations has explored the importance and presence of innovation within the family-owned business and how does it effect the cross generational succession.

Cluster 3 has theme of Family Culture. This cluster investigates the implication of various elements of family values like shared values, shared beliefs, shared norms which are very unique to every family and hence forms the important and inseparable part of family values. This cluster further explores the impact of other cultural aspect into factors like innovation, stakeholder relationship and

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also gender issues. Under this cluster key influential article includes the one from Marques et al. (2014) with their 214 citations. As discussed before, this paper has emphasised the role of family values and culture for the sustainability of family firm. Another work from Erdogan et al. (2020) which has 252 citations has examined how family culture effects the crucial relation between preserving tradition and innovation, a common issue in family-owned firms that impacts their long-term sustainability. The work from Campopiano et al. (2017) with 159 citations and from Chadwick & Dawson (2018) with 113 citations, highlighted the gender issue within family culture and hence family-owned business and its implications on firm's leadership and its performance, which are particularly relevant for Indian family businesses.

Cluster 4 has entrepreneurial orientation as a theme for this cluster. This cluster has taken into consideration the impact of important factors like innovation, proactiveness and risk-taking behaviour etc as an important element in the sustainability of family-owned firm. Some of the influential work in this cluster are from Erdogan et al. (2020) with 252 citations. This paper also has emphasised the importance of innovation and management style in sustainability of the family-owned firm. Another important work from Miller et al. (2010) with 320 citations has emphasised how family ownership influences risk-taking behaviour, specifically in important strategic decisions thereby highlighting an important element for entrepreneurial orientation in family firms. In their work Rondi et al. (2019) "Unlocking innovation potential: A typology of family business innovation postures and the critical role of the family system" with 169 citations emphasised the innovation as an important element for entrepreneurship orientation for the sustainability of family-owned firms.

Thus, from the above thematic clustering and their analysis it is established that there are four themes which defines / effects the sustainability of family-owned small enterprises. To reaffirm and to reconfirm it further, we undertook systematic literature review (SLR) so that the themes which are identified by VOS viewer can be physically verified and confirmed. For that we selected the topmost paper from the shortlisted paper in the process above. The topmost paper was selected on the basis of their number of citations. In the simpler words, the top 100 most cited papers were selected from the corpus of 717 papers as identified in the process as dealt above. Those top 100 most cited papers were read to reconfirm the themes or variables as identified by VOS viewer. The details of which is given below in table 3 below.

Table 3. *Top 100 papers for variable confirmation / identification*

S.N o.	Authors	Title	Year	Journal Name	Cited by	Variable identified
1	Zellweger T.M.; et al	Family control and family firm valuation by family CEOs: The importance of intentions for transgenerational control	2012	Organization Science	653	Succession planning
2	De Massis et al.	The case study method in family business research: Guidelines for qualitative scholarship	2014	Journal of Family Business Strategy	438	Family Culture
3	De Massis et al	Family firms in the global economy: Toward a deeper understanding of internationalization determinants, processes, and outcomes	2018	Global Strategy Journal	326	Entrepreneurial Orientation
4	Miller D.; et al	Family ownership and acquisition behavior in publicly-traded companies	2010	Strategic Management Journal	320	Family Culture
5	Erdogan I.; et al	Managing the Tradition and Innovation Paradox in Family Firms: A Family Imprinting Perspective	2020	Entrepreneurship: Theory and Practice	252	Family Culture
6	Marques P.; et al	The Heterogeneity of Family Firms in CSR Engagement: The Role of Values	2014	Family Business Review	214	Family Culture
7	Rovelli P.; et al	Thirty years of research in family business journals: Status quo and future directions	2022	Journal of Family	197	Family Goals

				Business Strategy		
8	Rondi E.; et al	Unlocking innovation potential: A typology of family business innovation postures and the critical role of the family system	2019	Journal of Family Business Strategy	169	Family Goals
9	Chang S.-J.; Shim J.	When does transitioning from family to professional management improve firm performance?	2015	Strategic Management Journal	160	Succession planning
10	Campopiano G.; et al	Women's involvement in family firms: Progress and challenges for future research	2017	Journal of Family Business Strategy	159	Family Goals, Succession Planning

Table 3 above provides an overview about the process we conducted to identify and reaffirm the variables as identified by VOS viewer. Though this table contains only 10 of such papers as an overview, the full table can be made available for the reference.

Once we gone through the papers, it was found that the variables which was identified by VOS viewer is same as that of those variables which we have found after reading the papers. Hence, it is confirmed that the variables / contracts which is responsible for sustainability of family owned MSMEs are as follows:

1. Family goals
2. Succession planning
3. Family culture
4. Entrepreneurial orientation

As asserted by Churchill (1979) in the first step of the process / steps for the development of multi-item scale, the domain has to be clearly defined and specified. Moving with that requirement, with the help of literature reviews we performed as shown above, we defined the domains identified as given below.

2.1.1 Definitions

2.1.1.1 Sustainability and Family Goals:

Sustainability in family-owned MSMEs is closely knitted with family financial goals and family social goals. As defined by Basco, 2017, family goals in the family owned MSMEs are economic and non economic in nature, which actually defines the financial goals and social goals for family owned MSMEs. Family owned MSMEs generally gives due preference to non financial goals like reputation of the firm, legacy it carries and standing in the society other than financial objectives. These objectives at the end, “forces” the firms to adopt the sustainable practices which in turn is beneficial to both the firm and the society as a whole in terms of its transgenerational continuity. The strong family identity develops a sense of belongingness towards the social capital which in turn enhances the firm’s ability to achieve economic, social and environmental objective which is crucial for sustainability of family firm. In simpler words, the purpose which small family firms serves with respect to job opportunities, for both owners and for society, and the personal growth which it brings for family and owner, makes it important for its survival and sustainability (Clauss et al., 2022, Patuelli et al., 2022, Herrera & De Las Heras-Rosas, 2020, Curado & Mota, 2021).

“Family Goals” with its sub variables financial goals and social goals with issues like social capital, job provisions, financial security and personal growth provides a logical support to the dependent variable sustainability of family owned MSMEs. The family owned business which has the sound financial security, since it provides a strong financial support to the family members involved in that family owned firm and hence the confidence, the firms hence give further the confidence to the involved family members in the business. Because the firms give the members a special status to the involving members in the society and also gives them the opportunity to give back to the society. This giving back to the society also comes in the form of job provision for the members of the society along

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with the members of the family which also means that the family-owned firms have well-being of the members in the highest priority. With all these issues in the place, family goals provide a chance to the members to achieve their personal growth and ambitions. Once all these things in the place, family goals automatically address the sustainability of these family-owned firms. These are the factors which contributes to the long-term sustenance and growth of the firm. Thus, based upon this, the hypothesis for this variable will be:

2.1.1.2 Sustainability and succession planning:

Sustainability and succession planning are greatly related to each other. This relationship comes in the form where the sustainability of small family firms depends upon the fact that how well the succession planning is framed which can take the family firm to its next coming generations. An effective succession planning here includes the business philosophy, well thought process and effective leadership development so as to ensure that the transgenerational transfer can happen smoothly. A well-developed succession plan ensures that the business passes from one generation to another without any disruption by protecting the firm's organisational culture and values. This is done by identifying and developing the successor through training, mentoring and may be through job rotation. Thus, succession planning supported by clear values, processes and philosophy, serves as an important tool for ensuring the sustainability of small family firms (Somboonvechakarn et al., 2022, Chirapanda, 2019, Herrera & De Las Heras-Rosas, 2020, LeCounte, 2020)

2.1.1.3 Sustainability and Family culture:

The sustainability of small family firms is deeply tied in family culture which includes the core values such as commitment, reputation of the family firm in the market. It also prioritises the long-term success and transgenerational continuity of business. In the small family firms, decision making offers a unique structure where head of the family are generally responsible for the decision making and other members of the family involved in the business are expected to support the decision. This cohesion for senior member taking the decision ensures the sustainability of the family firms as these decisions are backed by the data, facts and figures. This active involvement of family members in management, which is supplemented with gender diversity especially in leadership positions by inclusion of women enhances the creativity and innovation in decision making process and the way the business is carried out (Curado & Mota, 2021, Patuelli et al., 2022, Herrera & De Las Heras-Rosas, 2020, Gavana et al., 2016, Cruz et al., 2018).

2.1.1.4 Sustainability and Entrepreneurial Orientation:

Entrepreneurship Orientation (EO) is another important determinant, deciding the sustainability of family owned MSMEs, by providing family firms a behavioural and strategic framework. Amongst its important constituents, proactiveness assumes one of the important positions as it entails the family firms to identify and anticipate the market trends and future opportunities in the market. This in turn helps the family firms to introduce new products in the market much before the competition. Innovativeness, being another important component of EO, propels the family firms with their new products, new technology adaptations and creativity to remain ahead in the market. This in turn helps the family firm in their sustainability. The risk-taking dimension provides another deeper understanding of relationship between EO and sustainability. Under this dimension, firms adopt a balanced approach between the high return combined with high risk associated with the project (Kallmuenzer & Peters, 2018, Hernández-Linares, Kellermanns, López-Fernández, & Sarkar, 2019, (Naldi, Nordqvist, Sjöberg, & Wiklund, 2007, Hernández-Perlines & Cisneros, 2018, Mullens, 2018).

2.2 Theoretical Model

With the above discussions and understanding, a theoretical model was developed which clearly details about the relationship between the sustainability of family owned MSMEs (dependent

variable) and the independent variables defined and identified. The theoretical research model as described in figure 3 below, contains the “Sustainability of family owned business” as dependent variable and “Family goals”, “Succession planning”, “Family culture” and “Entrepreneurial orientation” along with their sub variables which is already defined in previous paragraphs.

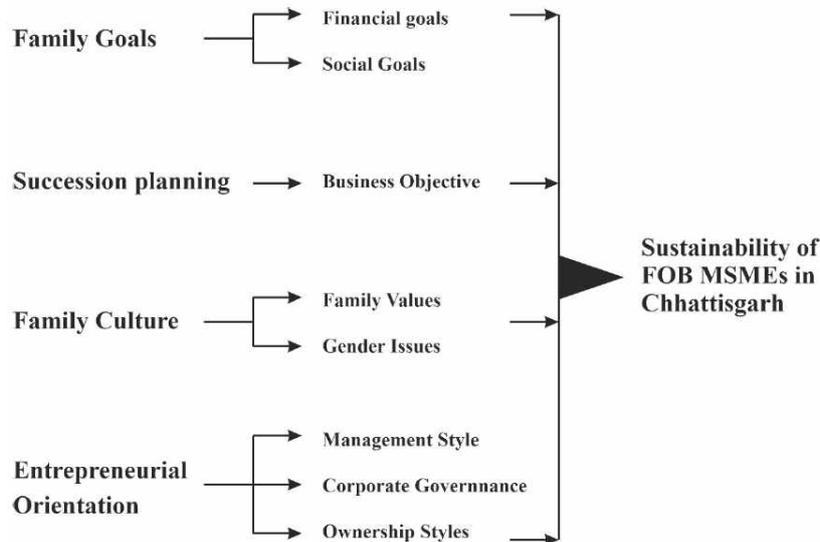


Figure 3. Theoretical Research Model

Once the theoretical research model is developed, next step comes is the development of hypotheses.

2.3 Hypotheses

According to Black (2010), research hypotheses are those statements which we believe will be the outcome of a study and in order to statistically test the research hypotheses, a more formal statement of hypothesis is developed which is called as statistical hypotheses. It consists of two parts, Null hypotheses and Alternate hypotheses, where null hypotheses states that there are “null” conditions exists. In other words, there is nothing new is existing and everything is as it is. On the other hand, alternate hypothesis states that there is something new is going to happen which will be different from the previous state.

Based on the above theories, the research, null and alternate hypotheses for the variables are given in table 4 and table 5.

Table 4. Research hypothesis

Variable (X_k)	Research Hypothesis ($H_{research}$)
Family Goals (X_1)	Family Goals are positively related to the Sustainability of Family Owned MSMEs.
Succession Planning (X_2)	Succession Planning is positively related to the Sustainability of Family Owned MSMEs.
Family Culture (X_3)	Family Culture is positively related to the Sustainability of Family Owned MSMEs.
Entrepreneurial Orientation (X_4)	Entrepreneurial Orientation is positively related to the Sustainability of Family Owned MSMEs.

Table 5. Statistical hypothesis

Variable / Hypothesis Type	Statement
Family Goals (β_1)	
Alternative (H_{a1})	$H_{a1}: \beta_1 > 0$, There is positive relationship between family goals and sustainability of family owned MSMEs
Null (H_{01})	$H_{01}: \beta_1 = 0$, There is no relationship between family goals and sustainability of family owned MSMEs
Succession Planning (β_2)	

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Alternative (H _{a2})	H _{a2} : $\beta_2 > 0$, There is positive relationship between succession planning and sustainability of family owned MSMEs
Null (H ₀₂)	H ₀₂ : $\beta_2 = 0$, There is no relationship between succession planning and sustainability of family owned MSMEs
Family Culture (β_3)	
Alternative (H _{a3})	H _{a3} : $\beta_3 > 0$, There is positive relationship between Family Culture and sustainability of family owned MSMEs
Null (H ₀₃)	H ₀₃ : $\beta_3 = 0$, There is no relationship between Family Culture and sustainability of family owned MSMEs
Entrepreneurial Orientation (β_4)	
Alternative (H _{a4})	H _{a4} : $\beta_4 > 0$, There is positive relationship between Entrepreneurial Orientation and sustainability of family owned MSMEs
Null (H ₀₄)	H ₀₄ : $\beta_4 = 0$, There is no relationship between Entrepreneurial Orientation and sustainability of family owned MSMEs

3. Generation of items

Based on the process suggested by Churchill (1979), in the figure 2 above, the next step in the process of scale development involves, the development of items for each and every construct as identified in the above / previous paragraphs. The process suggested by Churchill calls for detailed definition of each and every variables / sub variable so that a clear understanding of the terms can be developed and which can be utilised for the development of items for the scale. Thus, utilising the literature review and the informal discussions with the entrepreneurs involved in family-owned business, a set of items was developed for each and every construct identified above, the details of which is given below in table 6.

Table 6. Variables and the number of items

S.No.	Variables	Keywords defining the variables and sub variables	No. of Items	Total No. of Items
1	Family Goals	<i>Financial Security</i>	3	12
		<i>Social Capital</i>	3	
		<i>Job Provision</i>	3	
		<i>Personal / family growth</i>	3	
2	Succession Planning	<i>Philosophy & Process</i>	3	6
		<i>Advance Successor Planning</i>	3	
3	Family Culture	<i>Decision Making Structure</i>	4	8
		<i>Values and Harmony</i>	4	
4	Entrepreneurial Orientation	<i>Innovativeness</i>	3	8
		<i>Risk Taking</i>	3	
		<i>Proactiveness</i>	2	

The items were developed by taking into consideration the definition of each and every variable as provided in the literature review. The number of items for each and every construct was based on the key terms defining their respective variables. The statements for each variable are given below in the tables 7, 8, 9 and 10.

Table 7. Statement of items for variable “Family Goals”

C: Family Goals								
C1. Financial Security								
No.	Statement	1	2	3	4	5	6	7
C1.1	This business provides financial security for our family.							
C1.2	The business is a primary source of wealth for our family.							
C1.3	This business provides greater financial freedom for our family than employed work would.							

C2. Social Capital								
No.	Statement	1	2	3	4	5	6	7
C2.1	Owning this business gives our family a special status in the community.							
C2.2	The business allows us to give back to society.							
C2.3	Our family takes pride in owning and operating this business.							
C3. Job Provision								
No.	Statement	1	2	3	4	5	6	7
C3.1	Creating jobs for the community is an important goal for us.							
C3.2	The business provides job security for our family members.							
C3.3	The well-being of our employees is a high priority for our family.							
C4. Personal Growth								
No.	Statement	1	2	3	4	5	6	7
C4.1	The business helps me achieve my personal dreams and ambitions.							
C4.2	The business helps our family members achieve their dreams and ambitions.							
C4.3	Being in this business has helped us grow significantly as individuals.							

Table 8. Statement of items for variable “Succession Planning”

D: Succession Planning								
D1. Philosophy & Process								
No.	Statement	1	2	3	4	5	6	7
D1.1	In our family, there is an expectation that the next head of the family will lead the business.							
D1.2	We believe leadership should be offered to the next generation based on their merit and capabilities.							
D1.3	We seek external advice (from consultants/trusted advisors) when planning for succession.							
D2. Advance Successor Planning								
No.	Statement	1	2	3	4	5	6	7
D2.1	We have a formal, documented plan with a timeline for leadership succession.							
D2.2	Potential successors from the next generation are being actively groomed and mentored.							
D2.3	We are confident we have a suitable successor identified within the family.							

Table 9. Statement of items for variable “Family Culture”

E: Family Culture								
E1. Decision-Making Structure								
No.	Statement	1	2	3	4	5	6	7
E1.1	The head of the family has the final say in most major business decisions.							
E1.2	Once a decision is made by leadership, family members are expected to support it.							
E1.3	Important business decisions are primarily based on the leader's experience and intuition.							
E1.4	Important business decisions are primarily based on data and market analysis.							
E2. Values & Harmony								
No.	Statement	1	2	3	4	5	6	7
E2.1	Our family's values are deeply integrated into our business practices.							
E2.2	Maintaining family harmony is as important as achieving business goals.							
E2.3	We strive to maintain the traditions established by the founder(s).							
E2.4	Open and honest communication about the business is encouraged among family members.							

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Table 10. *Statement of items for variable “Entrepreneurial Orientation”*

F: Entrepreneurial Orientation								
F1. Innovativeness								
No.	Statement	1	2	3	4	5	6	7
F1.1	We actively innovate to retain our market share.							
F1.2	We thoroughly research and plan before launching new innovations.							
F1.3	We often prefer to wait for competitors to innovate first before we respond.							
F2. Risk-Taking								
No.	Statement	1	2	3	4	5	6	7
F2.1	Our firm favors high-risk projects with the potential for high returns.							
F2.2	In the past, we have made bold decisions despite significant uncertainty.							
F2.3	We adopt a bold, aggressive posture to maximize growth opportunities.							
F3. Proactiveness								
No.	Statement	1	2	3	4	5	6	7
F3.1	We are often the first to introduce new products/services or enter new markets.							
F3.2	We consistently anticipate and act on future market trends ahead of our competitors.							

Thus, items were developed by taking the definitions given in literature review. For the purpose of having more clarity and better responses, 7-point Likert scale was used. 7-point Likert scale provides more accurate and reliable responses as compared to 5-point Likert scale. Participants found asking for more choices for expressing their choices if they were using 5-point Likert scale. Moreover 7-point Likert scale can be optimised for reliability and validity which is needed in confirmatory factor analysis since the increment in number of scale point can offer better psychometric performance (Kusmaryono & Wijayanti, 2022, Malik et al., 2021).

4. Collection of initial data (pilot study)

According to Churchill (1979), the pilot survey is done to purify and refine the measurement instrument. The purpose is to identify weak or problematic items and estimating their reliability. With the pilot survey, we can ensure that each and every item in the scale is contributing meaningfully to the construct under study and items together forming a coherent, valid and reliable scale before the main survey is undertaken.

For the purpose of checking the reliability, validity and purify the items, a total of 50 samples from family owned Indian MSMEs were collected. 50 sample size for the above said purpose is sufficient to conduct the reliability test (Churchill, 1979; Hair et al., 2019; Johanson & Brooks, 2010; Nunnally, 1978; Van Teijlingen & Hundley, 2001). Sampling units were those MSME units who are family owned small and micro enterprises.

Once the pilot survey data are collected, the data was cleaned and thereafter coding was done for the responses. There were few missing data and few data were wrongly filled. All those data were removed to make the data sheet appropriate for the analysis. The data once cleaned were uploaded in Jamovi software to perform the preliminary analysis. Jamovi is open-source tool for data analysis that offers user friendly and modern interface with broad statistical capabilities (Şahin & Aybek, 2019).

The result of the Cronbach’s Alpha analysis for all constructs is given below in the table 11:

Table 11. *Cronbach’s Alpha value for construct*

Construct	Alpha value
Family goals	0.771
Succession planning	0.627
Family Culture	0.64
Entrepreneurial Orientation	0.646

According to Churchill (1979), the value of Cronbach’s alpha should ideally start from 0.70. We find in the above table that the value of all construct’s alpha is ranging around 0.60. There is only one construct where the value is at par with the Churchill’s suggestion, is the value of Family Goals, which is 0.771. Values ranging from 0.5 to 0.6 describes the initial exploratory nature of scale. With the time, there is scope for refinement in the scale. The higher values of construct can be found in the established, time-tested scales (Nunnally, 1978). Further, according to Churchill (1979), initial reliability measures can be taken in low value also, provided items demonstrate the theoretical coherence and contribution to the construct is strong. Hair et al. (2019) suggested that with the recent development in the field of social science, the multidimensional construct can produce moderate values that can range between 0.6 to 0.7 and which can be taken as accepted value. Therefore, reliability coefficient values found in this pilot study falls within the acceptable range and provides the sufficient basis to move ahead with the further steps.

Once the Cronbach’s Alpha is done for the scale, Churchill suggested that there should be item-rest correlation where every item is checked with that of construct’s alpha score. For that, Jamovi was used to perform the test and the results are given below in the table

Table 12. Cronbach’s Alpha value for Item reliability

Family Goals, Item Reliability Statistics		Succession Planning, Item Reliability Statistics		Family Culture, Item Reliability Statistics		Entrepreneurial Orientation, Item Reliability Statistics	
Items	If item dropped	Items	If item dropped	Items	If item dropped	Items	If item dropped
C1.1	0.765	D1.1	0.612	E1.1	0.631	F1.1	0.61
C1.2	0.76	D1.2	0.643	E1.2	0.548	F1.2	0.616
C1.3	0.754	D1.3	0.488	E1.3	0.598	F1.3	0.623
C2.1	0.765	D2.1	0.541	E1.4	0.631	F2.1	0.652
C2.2	0.737	D2.2	0.653	E2.1	0.578	F2.2	0.61
C2.3	0.742	D2.3	0.534	E2.2	0.613	F2.3	0.603
C3.1	0.771			E2.3	0.658	F3.1	0.633
C3.2	0.753			E2.4	0.597	F3.2	0.558
C3.3	0.751						
C4.1	0.754						
C4.2	0.764						
C4.3	0.748						

The above table 12, provides the reliability of each item with respect to their construct. It provides the reliability value, if that item is removed / dropped. If the alpha value is increasing by removing them, then it means that, particular item is reducing the scale internal consistency and it is better to remove it from the scale. In the above table, each item is near to its respective construct’s value and by eliminating them, it is making any significant difference to the total value. Hence, it is clearly suggesting that items are collectively contributing to the reliability of the construct. Therefore, as per Churchill’s suggestion based on alpha value if items removed, the scale is demonstrating the internal consistency and does not require any further purification to the scale.

To further establish the inference above we performed the confirmatory factor analysis. With CFA we can directly access whether each item meaningfully represent their respective construct. CFA does this by examining the standardise factor loading, standard errors, z values and significance values thus offering a more rigorous and robust understanding of construct which Churchill has emphasised upon. The findings of CFA is given in summarised form in the table 13 below.

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Table 13. Summary of CFA Loadings

Construct	Item	Standardized Loading	SE	Z-value	p-value	Churchill Criterion	Decision
Family Goals	C1.1	0.555	0.03	18.5	< .001	Loading > 0.50 → acceptable	Retain
	C1.2	0.596	0.0306	19.4	< .001	Acceptable	Retain
	C1.3	0.753	0.0285	26.4	< .001	Strong item	Retain
	C2.1	0.738	0.0311	23.7	< .001	Strong	Retain
	C2.2	0.648	0.0297	21.8	< .001	Acceptable	Retain
	C2.3	0.798	0.0299	26.7	< .001	Strong	Retain
	C3.1	0.606	0.0289	21	< .001	Acceptable	Retain
	C3.2	0.554	0.0309	18	< .001	Acceptable	Retain
	C3.3	0.614	0.0306	20.1	< .001	Acceptable	Retain
	C4.1	0.523	0.0304	17.2	< .001	Minimum acceptable	Retain
	C4.2	0.575	0.03	19.2	< .001	Acceptable	Retain
	C4.3	0.701	0.0295	23.8	< .001	Strong	Retain
Succession Planning	D1.1	0.541	0.0362	14.9	< .001	Acceptable	Retain
	D1.2	0.644	0.0371	17.3	< .001	Acceptable	Retain
	D1.3	0.457	0.0365	12.5	< .001	Slightly low (below ideal)	<i>Retain with caution</i>
	D2.1	0.677	0.0349	19.4	< .001	Acceptable	Retain
	D2.2	0.507	0.0341	14.8	< .001	Minimum acceptable	Retain
	D2.3	0.701	0.036	19.5	< .001	Strong	Retain
Family Culture	E1.1	0.692	0.031	22.3	< .001	Good	Retain
	E1.2	0.762	0.0288	26.5	< .001	Strong	Retain
	E1.3	0.778	0.03	25.9	< .001	Strong	Retain
	E1.4	0.515	0.0306	16.8	< .001	Minimum acceptable	Retain
	E2.1	0.673	0.0312	21.6	< .001	Good	Retain
	E2.2	0.8	0.0293	27.3	< .001	Very strong	Retain
	E2.3	0.668	0.0312	21.4	< .001	Good	Retain
	E2.4	0.783	0.0307	25.5	< .001	Strong	Retain
Entrepreneurial Orientation	F1.1	0.808	0.03	26.9	< .001	Very strong	Retain
	F1.2	0.564	0.0319	17.7	< .001	Acceptable	Retain
	F1.3	0.65	0.0302	21.5	< .001	Good	Retain
	F2.1	0.533	0.0305	17.5	< .001	Acceptable	Retain
	F2.2	0.835	0.03	27.8	< .001	Very strong	Retain
	F2.3	0.654	0.0299	21.9	< .001	Good	Retain
	F3.1	0.734	0.0309	23.8	< .001	Strong	Retain
	F3.2	0.531	0.0326	16.3	< .001	Acceptable	Retain

Moving as per the suggestion of Churchill that we have to keep only those items which represents its construct, CFA loading in the above table shows that all the items meet or exceed the required minimum value. Across the items/ constructs, the factor loadings are consistently above or atleast very much near to the threshold value of 0.5, which indicates that each item are significant enough to represent their construct. Though there is one item D1.3 that shows a lower value of 0.457, but it remains statistically significant (p-value) and hence does not indicate any weakness, that it should be removed from the scale. And also, there is no evidence of any cross loading which at the end directly aligns with the Churchill's requirement of internal coherence.

Table 14. Factor Co Variances

Factor Covariances		Estimate	SE	Z	p
Family Goals	Family Goals	1			
	Succession Planning	0.286	0.0301	9.49	<.001
	Family Culture	0.246	0.0269	9.13	<.001
Succession Planning	Succession Planning	1			
	Family Culture	0.271	0.0307	8.82	<.001
	Entrepreneurial Orientation	0.243	0.0314	7.74	<.001
Family Culture	Family Culture	1			
	Entrepreneurial Orientation	0.248	0.0277	8.96	<.001
Entrepreneurial Orientation	Entrepreneurial Orientation	1			

Table 14 above details the factor co variances, which talks about the degree to which the four constructs are related to each other after taking all measurement errors into consideration. All the values of covariances are positive, are statistically significant ($p < 0.001$) and are falling under moderate range of 0.24 to 0.29. This clearly means that while all the constructs are conceptually correlated to each other and don't overlap to the extent that they show a kind of repetition. Since the covariances values are not so high, that means that constructs retain the discriminant distinctiveness thereby ensuring that each of them represents a unique dimension of family business functioning. On the other hand, the moderate value of covariances also signifies that each of the construct is related to each in a significant way but at the same time do not overlap each other.

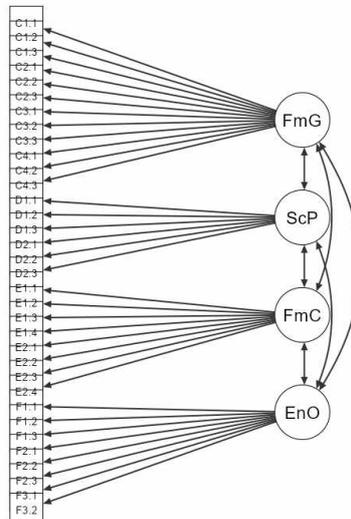
Table 15. Model Fit Measures

χ^2	df	p	CFI	TLI	SRMR	RMSEA	Lower	Upper
558	521	0.126	0.996	0.996	0.0186	0.00593	0	0.00964

Table 15 above provides the model fit indices. The table 15 with extremely high CFI and TLI values and extremely low values of SRMR and RMSEA along with non significant χ^2 values, provides a clear indication that the model is perfect fit suggesting that each item collectively corresponds to a well specified measures.

Hence with all these indices and measurements, a clear path diagram was formed with the help of Jamovi. This path diagram (as given in figure 4) clearly supports the theoretical model as given above in the figure 3.

Figure 4. CFA Path diagram



DEVELOPING A CONTEXT SPECIFIC MULTIDIMENSIONAL SCALE TO MEASURE THE SUSTAINABILITY OF FAMILY OWNED INDIAN MSMES

The CFA diagram above in figure 4, provides an understanding for correlated factor model in which four variables Family Goals (FmG), Succession Planning (ScP), Family Culture (FmC), and Entrepreneurial Orientation (EnO) represented by multiple items or multiple reflective indicators. In the figure 4, every item loads into their respective construct, confirming to Churchill's requirement that each and every item should correspond to its respective construct clearly. The unidirectional flow of arrow from construct to its respective items, indicates that the items are clearly reflective of construct and the absence of cross loading amongst the items indicates that items have maintained its individuality for its construct. The two-sided arrow amongst the constructs indicates that though the constructs are different from each other but collectively they are related to each other hinting towards one answer. This was also supported by the CFA figures as provided in tables 13, 14 and 15. The structure of figure provides a clear indication that the model formed is clearly and well specified. Each of the constructs in the figure 4 above are very well identifiable. The items collectively form the internally coherent measurement clusters and thus the relationship amongst the variables/construct are in line with theoretical model developed during the initial phase of scale development process with the help of literature review.

5. Conclusion

Our successfully concludes the initial phases of scale development strictly according to the steps and process suggested by Churchill (1979). Our primary objective was to develop a multi-item scale needed to measure the sustainability of family owned Indian MSMEs by involving four variables: Family Goals, Succession Planning, Family Culture and Entrepreneurial Orientation, identified through extensive literature review.

With the help of literature review, constructs were identified, respective items were generated which was followed by pilot survey involving collection of data for further steps. As per Churchill's requirement of internal homogeneity, we confirmed the internal consistency of items and scale. The analysis of Cronbach Alpha and the result from Confirmatory Factor Analysis (CFA) including strong factor loadings and acceptable model fit demonstrated that the items collectively form the internal coherence for measuring the clusters. This process has avoided the risk of GIGO (garbage in, garbage out) by ensuring that the measuring tool is reliable and also theoretically sound.

Thus, this paper delivers a fully developed multi-item scale ready to be used in large scale data collection concerning the family owned Indian MSMEs.

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MEASURING ECONOMIC EFFICIENCY OF DIGITAL TRANSFORMATION ACROSS EU COUNTRIES USING DEA TECHNIQUES

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Abstract: *Digitalization has become a critical focus for both companies and public organizations, with numerous reports highlighting its growing importance. This study evaluates the comparative efficiency of digital transformation across European Union countries using Data Envelopment Analysis (DEA). Data are sourced from the Digital Transformation Account 2018 published by the European Commission. DEA is employed to measure the relative efficiency of countries in leveraging digital transformation enablers to achieve desired outcomes. The analysis uses the “enablers and outputs” framework from the Digital Transformation Scoreboard, considering Digital Infrastructure, Investment and Access to Finance, Digital Skills Demand and Supply, E-Leadership, and Entrepreneurial Culture as inputs, and ICT startups and overall Digital Transformation performance as outputs. The study provides a ranking of EU countries based on their digital transformation efficiency. Findings reveal that Denmark, Italy, and the United Kingdom exhibit relatively high levels of digital transformation efficiency, whereas countries such as the Netherlands and Germany perform below the efficiency frontier. These outcomes offer practical insights for policymakers and organizations seeking to strengthen digital adoption capabilities and enhance competitive advantage across Europe.*

Keywords: *Data Envelopment Analysis (DEA), Digital Economy, Digital Transformation, Europe, ICT Startups, Technological Readiness.*

1 INTRODUCTION

Digital transformation has become a central theme in contemporary economic and organizational research, driven by rapid technological advancements and the widespread integration of digital tools across industries and public institutions. The accelerating adoption of digital solutions has reshaped business models, operational processes, value-creation mechanisms, and decision-making structures at both enterprise and national levels. Given this growing dependence on digital technologies, assessing the efficiency of digital transformation has become increasingly essential for understanding how effectively countries convert digital enablers into measurable outcomes.

This study evaluates the relative efficiency of digital transformation using Data Envelopment Analysis (DEA). The analysis is based on the Digital Transformation Scoreboard 2018, developed by the European Commission, which provides the most recent and methodologically consistent dataset containing a complete set of enabler and output indicators necessary for DEA. Subsequent editions of the Scoreboard altered indicator definitions, reduced variable comparability, or lacked sufficient enabler–output alignment, making 2018 the last robust and coherent dataset for a cross-country DEA assessment. Therefore, the 2018 Scoreboard constitutes the most suitable and academically valid foundation for a reliable efficiency measurement.

DEA has long been recognized as a structured and widely applied methodology for evaluating efficiency across various domains, including technological development, innovation performance, and productivity analysis (Charnes, Cooper, & Rhodes, 1978; Emrouznejad & Yang, 2018). Previous research has applied DEA to measure efficiency in digitally intensive sectors such as

telecommunications, ICT, high-tech industries, and public services (OECD, 2019; Van Dijk, 2020). Other studies have examined digital readiness, digital skills, digital literacy, and technological adoption across European economies (Firoiu et al., 2022; Sobczak, 2025). Collectively, these studies demonstrate that DEA provides a rigorous and comparative framework for evaluating digital performance at the national level. The literature conceptualizes digital transformation as a multidimensional process encompassing the integration of digital technologies into organizational structures, business models, and operational processes (Fitzgerald et al., 2013; Westerman, Bonnet, & McAfee, 2014). Beyond technological adoption, digital transformation is closely associated with leadership strategies, organizational reconfiguration, enhanced data-driven decision-making, process automation, and the emergence of new forms of digital business and globalization (Brennen & Kreiss, 2016; Hermann, Pentek, & Otto, 2016). These dimensions collectively highlight the wide-ranging economic and societal implications of digital transformation, particularly its role in enhancing competitiveness, improving service delivery, and fostering innovation.

Despite the extensive literature on digital transformation, a systematic assessment of the relative efficiency of European countries using a complete enabler–output structure remains limited. A major gap persists regarding how effectively nations transform their digital capacities into tangible outcomes such as ICT start-up activity, innovation performance, and overall digital maturity. This study contributes to the literature by addressing this gap through a comprehensive DEA application based on the last methodologically coherent Digital Transformation Scoreboard dataset. By comparing efficiency levels among European countries, the study provides new insights into performance disparities, benchmark positions, and areas requiring strategic improvement.

Table 1. *A Part of Building Blocks of the Digital Transformation*

Customer Experience	Operational Process	Business Models
Customer Understanding	Process Digitalization	Digitally Modified Business
Top Line Growth	Worker Enablement	New Digital Business
Customer Touch Points	Performance Management	Digital Globalization

Source: Westerman et al. (2014)

Table 1 summarizes key building blocks of digital transformation, illustrating its multidimensional nature across customer experience, operational processes, and business models (Westerman et al., 2014). Several reports have been published on digitization and digital transformation, providing comparative assessments of countries’ progress across multiple dimensions. Among these reports, one of the most comprehensive and frequently referenced sources is the *Digital Transformation Scoreboard*, published annually by the European Commission (European Commission, 2018).

Table 2. *Indicator-Based Monitoring of Digital Transformation*

Enablers				
Digital Infrastructures	Investment and Access to Finance	Supply and Demand of Digital Skills	E- Leadership	Entrepreneurial Culture
Enterprises possessing and using digital tools	Investments related to digitalization and access to finance	Widespread digital skills	Education and training available to obtain digital skills	People favor entrepreneurial behavior
Integration of Digital Technology Companies are increasingly using digital technologies				
ICT Start-ups The number of start-ups in the ICT sector is increasing				
Outputs				

Source: Digital Transformation Scoreboard 2018

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As a key component of the broader Digital Transformation Monitor, the Scoreboard functions as a systematic framework for tracking digital readiness, innovation trends, and technological development across European economies. It compiles a structured set of indicators that evaluate both the foundational conditions that enable digital advancement and the tangible outcomes that reflect the degree of digital transformation achieved.

The Scoreboard organizes its indicators into two principal dimensions -enablers and outputs- which together offer a holistic and multidimensional assessment of digital progress across the 28 EU member states. The enabler dimension consists of five categories capturing digital infrastructure, access to finance, digital skills, entrepreneurship, and business digitization, while the output dimension includes two categories measuring ICT start-up activity and digital transformation performance. By integrating structural inputs with performance-related outcomes, the Scoreboard provides a comprehensive basis for benchmarking national digital capacities and identifying areas requiring strategic improvement. This structured classification, summarized in Table 2, enables policymakers and researchers to evaluate how effectively countries convert digital capabilities into innovation, competitiveness, and economic growth.

2 METHOD

This study evaluates the effectiveness of digital transformation across selected EU countries by employing Data Envelopment Analysis (DEA). The analysis uses enabler and output indicators derived from the *Digital Transformation Scoreboard 2018*, which provides the most complete, consistent, and methodologically reliable dataset for constructing a balanced DEA framework. Because DEA requires complete input and output data, Romania was excluded from the sample due to missing values. The final dataset comprises 10 EU member states.

In line with the structure of the Digital Transformation Scoreboard, the study uses five enabler dimensions as inputs, including digital infrastructure, investments and access to finance, the supply and demand of digital skills, e-leadership, and entrepreneurial culture, and two output categories, namely ICT start-ups and overall digital transformation performance. Each country is treated as a Decision-Making Unit (DMU), and the DEA model evaluates how effectively these countries convert digital enablers into transformation-oriented outputs. Figure 1 presents the conceptual model of the study, illustrating the structural relationship between inputs and outputs within the digital transformation process.

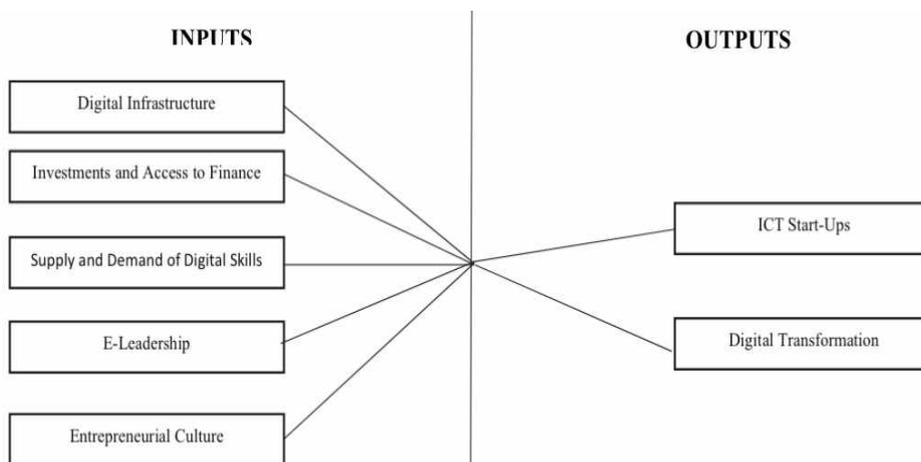
The theoretical basis of the model conceptualizes digital transformation as a production system in which countries utilize digital-capacity inputs to generate digital-economic outputs. Inputs such as infrastructure, leadership, and skill availability define the resource environment that shapes a country's potential for digital advancement. Outputs, such as ICT entrepreneurial activity and digital transformation performance, reflect the realized outcomes of these capacities. Consequently, the model aligns with the broader understanding of digital ecosystems as dynamic systems in which the configuration of resources influences innovation performance and technological progress.

This conceptual structure is operationalized through DEA, which converts the input-output framework into measurable efficiency scores. The study employs both *CCR (Charnes-Cooper-Rhodes)* and *BCC (Banker-Charnes-Cooper)* models, with input-oriented and output-oriented specifications. The *output-oriented CCR model* assesses the extent to which a country can proportionally expand its digital transformation outputs using its existing resource base, assuming constant returns to scale. The mathematical formulation maximizes the ratio of weighted outputs to weighted inputs, where weights are determined endogenously for each DMU. This ratio is constrained such that no country exceeds the efficiency frontier, thereby ensuring comparability and benchmarking accuracy. As Sobczak (2025) notes, this model identifies the potential improvement in outputs that could be achieved without altering a country's digital resource configuration.

The *BCC model* extends the CCR framework by incorporating variable returns to scale through a convexity constraint. This feature acknowledges that EU countries do not all operate under identical conditions, as differences in economic scale, market size, technological maturity, and digital readiness can significantly influence digital transformation efficiency. By allowing for variable returns, the BCC model provides deeper insights into whether inefficiencies arise from managerial performance or the scale at which digital activities are conducted. This distinction is consistent with the conceptual model presented in Figure 1, which recognizes that digital transformation outcomes depend not only on resource allocation but also on structural and contextual capacities (Čiković, Mandić, & Dmitrović, 2025).

All DEA computations were conducted using the *Efficiency Measurement System (EMS)* software. The program was used to perform input- and output-oriented analyses for both CCR and BCC models, as well as the corresponding super-efficiency estimations. This methodological design enables a comprehensive comparison of efficiency results, allowing the study to identify differences arising from orientation choice, returns-to-scale assumptions, and cross-model performance variations.

Figure 1. Model of The Study
2.1 General DEA Formula (CCR Model)



Objective function (output-oriented CCR):

$$\max \theta = \frac{(\sum_{r=1}^S u_r y_{rj})}{(\sum_{i=1}^m v_i x_{ij})}$$

Subject to:

$$\frac{(\sum_{r=1}^S u_r y_{rj})}{(\sum_{i=1}^m v_i x_{ij})} \leq 1 (j = 1, \dots, n)$$

$$u_r \geq 0, \quad v_i \geq 0$$

Explanation:

- x_{ij} : inputs (Digital infrastructure, skills, finance, etc.)
- y_{rj} : outputs (ICT startups, Digital transformation)
- v_i, u_r : input/output weights
- θ : efficiency score

Inputs (Finland):

- Digital Infrastructure = 76
- Investments & Access to Finance = 80
- Digital Skills = 83
- E-Leadership = 97
- Entrepreneurial Culture = 51

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Outputs:

- ICT Startups = 60
- Digital Transformation = 37

Plug into the CCR formula:

$$\theta = \frac{u_1 \cdot 60 + u_2 \cdot 37}{v_1 \cdot 76 + v_2 \cdot 80 + v_3 \cdot 83 + v_4 \cdot 97 + v_5 \cdot 51}$$

DEA software (EMS) chooses optimal weights.

Objective:

$$\min \theta$$

Subject to:

$$\begin{aligned} \sum_{i=1}^m v_i x_{ij} - \sum_{r=1}^s u_r y_{rj} &\geq 0 \\ \sum_{i=1}^m v_i x_{i0} &= 1 \\ u_r, v_i &\geq 0 \end{aligned}$$

Example (Finland):

$$\sum v_i x_{i,Finland} = 1 \Rightarrow 76v_1 + 80v_2 + 83v_3 + 97v_4 + 51v_5 = 1$$

Output-oriented BCC:

$$\max \theta$$

Subject to:

$$\begin{aligned} \sum_{j=1}^n \lambda_j x_{ij} &\leq x_{i0} \\ \sum_{j=1}^n \lambda_j y_{rj} &\geq \theta y_{r0} \\ \sum_{j=1}^n \lambda_j &= 1 \\ \lambda_j &\geq 0 \end{aligned}$$

For Finland, BCC compares it to a convex combination of EU countries with similar scale; the efficiency frontier changes because of the “=1” convexity constraint.

Used when a country is already efficient and you need to rank efficient DMUs (Denmark, Italy, UK in your file).

Input-oriented super-efficiency (CCR):

$$\min \theta$$

Subject to:

$$\begin{aligned} \sum_{j \neq 0} \lambda_j x_{ij} &\leq \theta x_{i0} \\ \sum_{j \neq 0} \lambda_j y_{rj} &\geq y_{r0} \end{aligned}$$

Note: the DMU under evaluation is excluded.

(Using Denmark’s outputs 71, 62 and inputs 78,48,84,78,46)

The country is removed from the dataset, and the model tests whether others can produce the same output with less input.

If weights are known:

$$Efficiency = \frac{\text{Weighted Outputs}}{\text{Weighted Inputs}}$$

Let all weights = 1 (for illustration):

Finland:

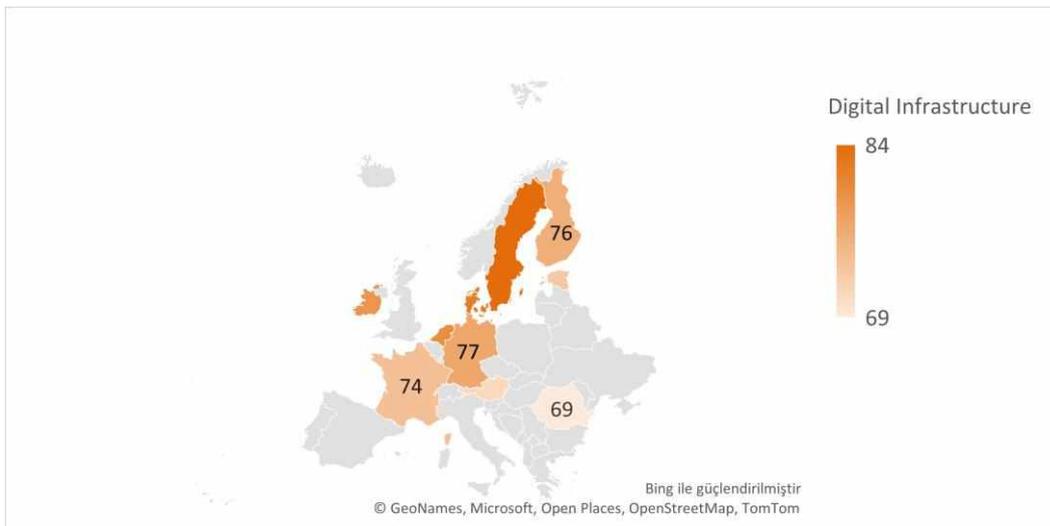
$$\begin{aligned} \text{Outputs} &= 60 + 37 = 97 \\ \text{Inputs} &= 76 + 80 + 83 + 97 + 51 = 387 \\ \text{Efficiency} &= \frac{97}{387} = 0.25 \end{aligned}$$

(DEA will choose weights that maximize this ratio.)

3 RESULTS

The dataset consists of input and output indicators for 10 European countries, which were collected and systematically organized for analysis using the EMS software, as illustrated in Graphic 1. Super-efficiency scores were calculated for both the CCR and BCC models. In total, eight distinct analyses were conducted: input-oriented, output-oriented, super-efficient input, and super-efficient output approaches for each DEA specification.

Graphic 1. *Digital Infrastructure Scores Across Selected European Countries*



To operationalize the model, a balanced dataset capturing varying levels of digital maturity and structural characteristics across Northern, Western, Central, and Southern Europe was assembled. All data were normalized on a 0–100 scale to ensure compatibility with the DEA methodology and to accurately reflect cross-country differences in digital development. Data Envelopment Analysis (DEA) was performed using an output-oriented CCR specification, enabling an assessment of the extent to which each country could proportionally enhance its digital transformation outputs given its existing inputs (Herman & Georgescu, 2025). This approach allows for the identification of the most efficient countries, the construction of an empirical efficiency frontier, and the positioning of all other countries relative to this benchmark. Efficiency scores (θ) were calculated as the ratio of weighted outputs to weighted inputs, with weights determined endogenously for each decision-making unit. A score of 1.00 indicates that a country lies on the efficiency frontier, while scores below 1.00 reflect relative inefficiency and reveal potential for proportional improvements in outputs. These efficiency measures provide a comprehensive evaluation of how effectively countries utilize their digital capacities to achieve transformation outcomes, thereby offering a robust empirical foundation for comparative analysis and policy recommendations (Horváthová & Mokrišová, 2024).

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Table 3. CCR Efficiency Score of the Selected Countries

Country	CCR Efficiency Score (θ)
Denmark	1.00
Sweden	1.00
Ireland	0.97
Netherlands	0.94
Finland	0.88
Germany	0.84
Estonia	0.81
France	0.77
Austria	0.72
Spain	0.68

As shown in Table 3, the CCR efficiency scores illustrate the relative effectiveness of the selected countries in utilizing their digital transformation resources. Denmark and Sweden, each with a score of 1.00, are fully efficient, indicating that they maximally convert their inputs into digital transformation outputs. Ireland (0.97) and the Netherlands (0.94) also demonstrate high efficiency, although slight improvements would allow them to reach the efficiency frontier. Finland (0.88), Germany (0.84), and Estonia (0.81) fall within the moderate-efficiency range, implying that their existing resources are not yet fully optimized or that their outputs remain below potential. France (0.77), Austria (0.72), and Spain (0.68) record the lowest efficiency scores, reflecting substantial room for improvement, with Spain exhibiting the highest need for performance enhancement. Overall, the results reveal that Northern European countries tend to achieve stronger digital efficiency, whereas several Western and Southern European countries may benefit from more targeted strategies aimed at leveraging their digital capacities more effectively.

Graphic 2. Descriptive Statistics of Input Variables (10 Countries)



Graphic 2 presents the complete dataset used to assess the digital transformation efficiency of 10 European countries through the Data Envelopment Analysis (DEA) methodology. The dataset includes a set of input and output variables that capture both the enabling conditions for digitalization and the measurable outcomes produced by each country.

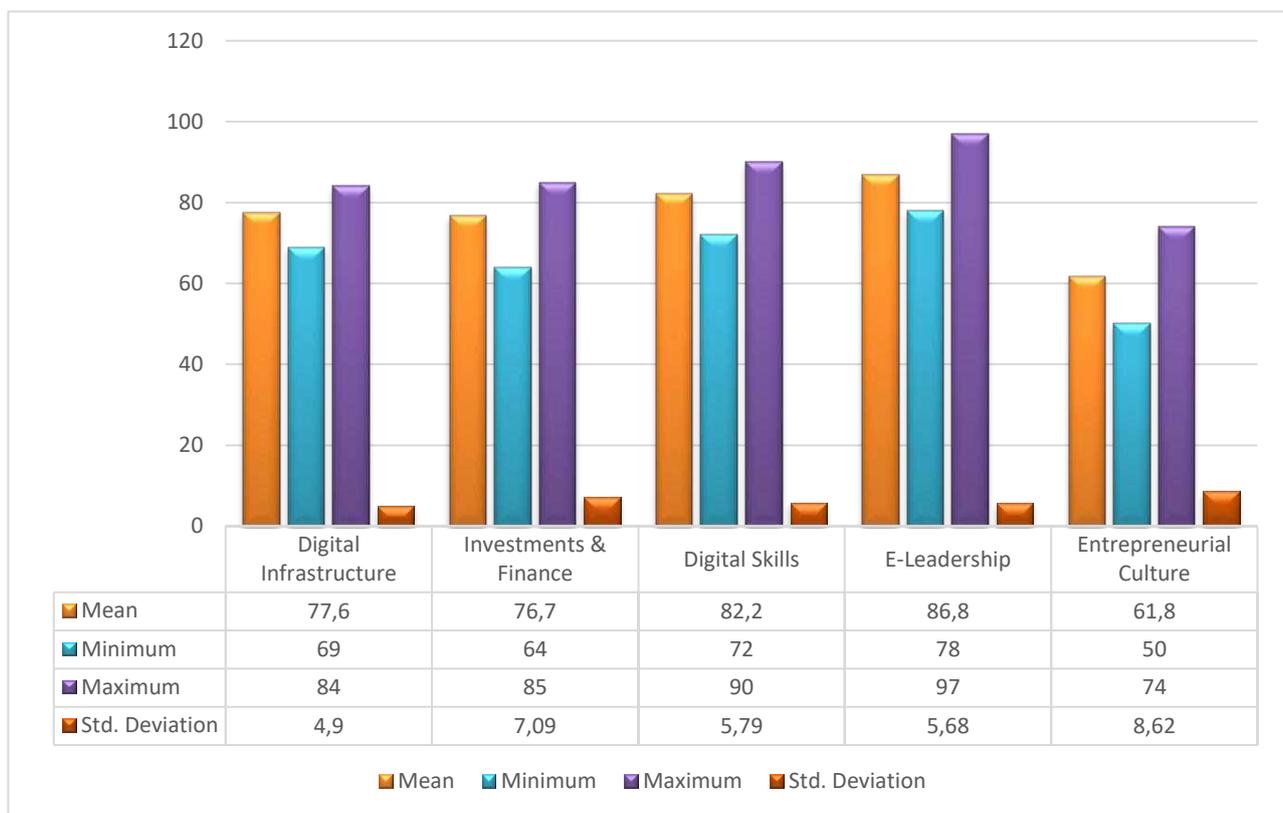
With respect to *digital infrastructure and digital skills*, Sweden (84 and 90), Denmark (82 and 88), and the Netherlands (80 and 86) demonstrate the strongest performance, indicating advanced technological foundations and highly capable digital workforces. Conversely, Spain (69 and 72) and Austria (71 and 75) lag behind, suggesting a need for further investment and skill development.

In the domains of *e-leadership and entrepreneurial culture*, Finland (97) and Denmark (93) achieve the highest e-leadership scores, while Ireland (74), Sweden (72), and Denmark (67) perform strongest in entrepreneurial culture. Spain (50) and Finland (51) record comparatively lower values, reflecting limited capacity to support entrepreneurial mindsets in the digital domain.

Regarding *ICT start-ups and overall digital transformation*, Denmark (71) and Sweden (69) lead in start-up activity and also achieve relatively high digital transformation performance scores (Denmark 54; Sweden 56). Spain (45 and 36) and Austria (47 and 38) score lowest in both categories, indicating slower progress in building innovation-driven start-up ecosystems and in advancing broader digital adoption.

Overall, Northern European countries, particularly Denmark, Sweden, and Finland, exhibit strong and consistent performance across infrastructure, skills, and leadership dimensions. Western European countries, such as the Netherlands, Germany, France, and Ireland, demonstrate balanced digital performance with distinct areas of comparative strength. Southern European countries, including Spain and Austria, consistently score lower across most indicators, suggesting substantial room for improvement in their digital transformation processes.

Graphic 3. Descriptive Statistics of Output Variables (10 Countries)



Graphic 3 presents the descriptive statistics for the output variables ICT start ups and digital transformation, providing an overview of the performance distribution among the selected European countries. The mean values indicate the general level of digital outcomes across the sample, while the minimum and maximum values reveal the gap between the strongest and weakest performers. The relatively high standard deviations for both output variables suggest considerable variation among countries in their ability to convert digital enablers into measurable results.

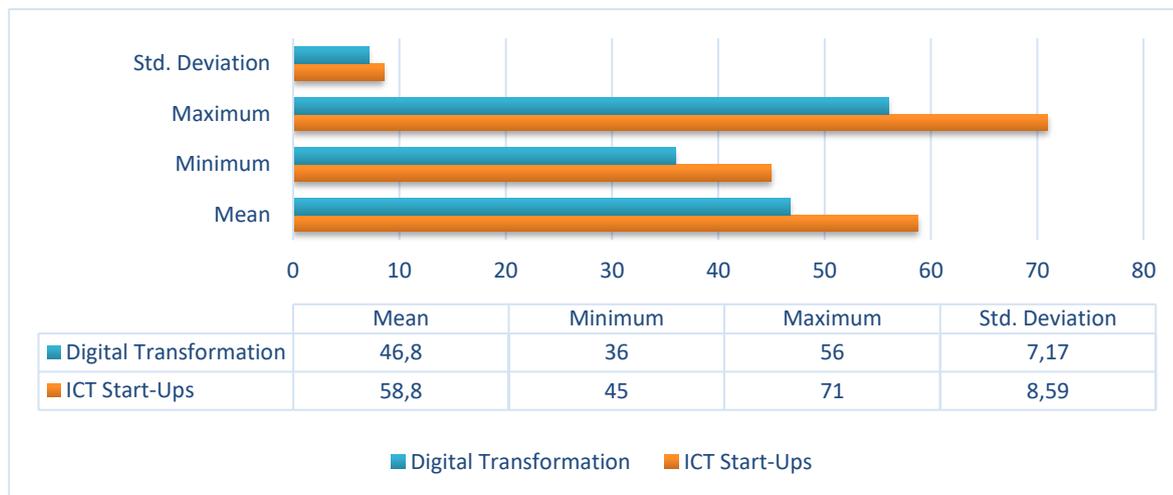
The descriptive statistics for the input variables further illustrate the structural differences among the countries. *Digital infrastructure* shows a high mean value of 77.6, with a narrow range from 69 to 84 and a low standard deviation of 4.9, indicating that most countries possess similarly advanced infrastructure. *Investments and access to finance* have a mean of 76.7, ranging from 64 to 85, accompanied by a higher standard deviation of 7.09, suggesting greater disparities in financial support and investment capacity. *Digital skills* exhibit a strong mean of 82.2, with values between 72 and 90 and moderate variability, reflecting generally high competency levels across the sample. *E-*

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leadership displays the highest average score at 86.8, with a range from 78 to 97 and a standard deviation of 5.68, indicating that digital leadership is well developed, though some countries lead more strongly than others. *Entrepreneurial culture* shows the lowest mean at 61.8 and the widest range from 50 to 74, with the highest standard deviation of 8.62, highlighting that this dimension varies most significantly across countries and represents a comparatively weaker domain.

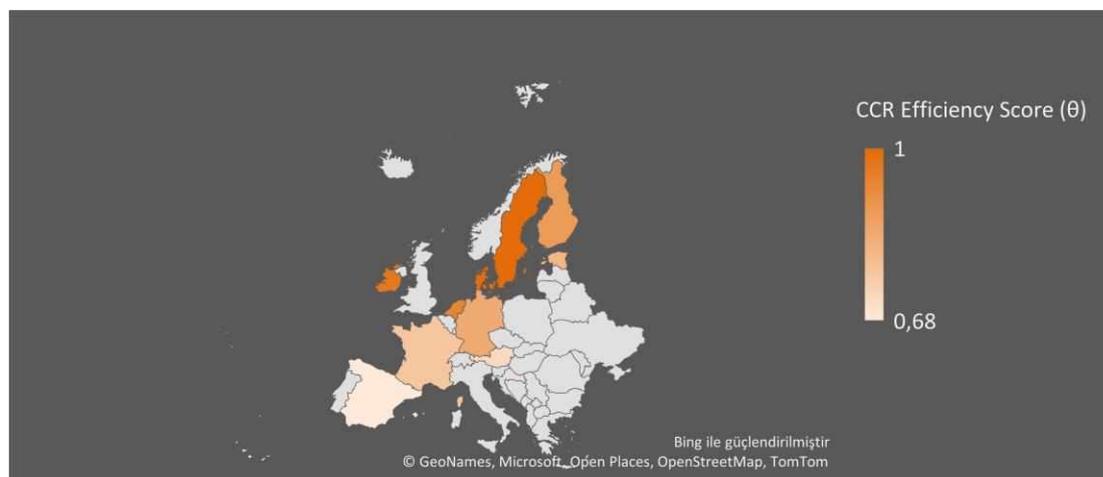
Overall, the descriptive statistics suggest that while digital infrastructure, skills, and leadership are relatively strong and consistent across the selected countries, entrepreneurial culture stands out as the most heterogeneous and underdeveloped component, indicating a key area for improvement in supporting digital transformation outcomes.

Graphic 4. Dataset Table Used in DEA (Inputs & Outputs)



Graphic 4 shows the dataset used in the DEA analysis, focusing on the two output variables. ICT Start-Ups have a mean value of 58.8, with a wide range between 45 and 71 and a standard deviation of 8.59, indicating notable differences in the strength of start-up ecosystems across countries. Digital Transformation displays a lower mean of 46.8, ranging from 36 to 56, with a standard deviation of 7.17. These results suggest that although start-up activity is comparatively stronger and more heterogeneous, overall digital transformation performance remains modest and more clustered. The findings highlight a gap between entrepreneurial activity and the broader realization of digital transformation outcomes.

Graphic 5. Charnes-Cooper-Rhodes Efficiency Score Across Selected European Countries



Graphic 5 illustrates the CCR efficiency scores for the selected European countries. Denmark and Sweden, each with a score of 1.00, lie on the efficiency frontier and function as benchmark performers. Countries with scores below 1.00 reflect varying levels of inefficiency or unrealized output potential. Ireland (0.97) appears close to the frontier, while Spain (0.68) displays a more pronounced efficiency gap relative to the leading countries. Overall, the results offer a clear view of the countries' relative positions in the digital transformation landscape, highlighting frontier performers, near-efficient cases, and those with substantial room for improvement.

Table 4. Descriptive Statistics for the Input Variables

Input Variable	Mean	Median	Min	Max	Std. Dev
Digital Infrastructure	76.5	77.0	69	84	4.8
Investments & Finance	76.7	78.0	64	85	7.0
Digital Skills	82.2	82.5	72	90	5.8
E-Leadership	87.8	88.0	78	97	5.8
Entrepreneurial Culture	61.8	62.0	50	74	8.6

Table 4 presents the descriptive statistics for the input variables used in the DEA model, including their mean, median, minimum, maximum, and standard deviation values. These inputs reflect the structural capacity of countries to support digital transformation. The results show that Digital Infrastructure, Digital Skills, and E-Leadership exhibit relatively high mean values, indicating strong overall readiness in these areas across the sample. In contrast, Entrepreneurial Culture shows the largest standard deviation, revealing substantial differences in entrepreneurial mindset and innovation climate among countries. This variability is particularly significant, as weaker entrepreneurial environments may constrain digital progress even in countries with strong technical foundations. Overall, Table 4 highlights the heterogeneity in digital capacities that underpins the subsequent efficiency assessment.

Table 5. Descriptive Statistics for the Output Variables

Output Variable	Mean	Median	Min	Max	Std. Dev
ICT Start-Ups	58.8	58.0	45	71	9.4
Digital Transformation	44.8	44.0	36	56	7.2

Table 5 presents the descriptive statistics for the output variables used in the DEA analysis, namely ICT Start-Ups and Digital Transformation. These outputs represent the observable performance outcomes derived from each country's digital capabilities. The results show considerable variation among countries, as reflected by the relatively high standard deviations. This indicates that while some countries are more successful in generating digital entrepreneurial activity and advancing digital transformation, others lag behind even when possessing similar levels of digital inputs. Such variability highlights the importance of assessing efficiency, as it illustrates that stronger outcomes are not solely determined by the quantity of resources but also by how effectively these resources are utilized.

Table 6. Normalized Input and Output Indicators

Country	DI	FIN	SKILLS	LEAD	ENT	STARTUPS	TRANSFORM
Finland	0.83	0.94	0.92	1.00	0.69	0.85	0.66
Denmark	0.98	1.00	0.98	0.96	0.91	1.00	0.96
Sweden	1.00	0.92	1.00	0.94	0.97	0.97	1.00
Estonia	0.77	0.75	0.88	0.88	0.78	0.73	0.75
Netherlands	0.95	0.96	0.96	0.92	0.94	0.92	0.89
Germany	0.88	0.93	0.91	0.91	0.84	0.82	0.80
France	0.81	0.90	0.89	0.87	0.80	0.75	0.73
Ireland	0.94	0.98	0.97	0.95	1.00	0.96	0.87
Austria	0.75	0.86	0.83	0.83	0.74	0.66	0.68
Spain	0.71	0.78	0.80	0.80	0.68	0.63	0.64

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Table 6 presents the normalized values of all input and output variables on a 0–1 scale. Normalization allows for comparability across indicators and highlights disparities in digital capacity and outcomes. Denmark exhibits consistently high scores across all inputs and outputs, including digital infrastructure (0.98), investments and access to finance (1.00), digital skills (0.98), e-leadership (0.96), entrepreneurial culture (0.91), ICT start-ups (1.00), and overall digital transformation (0.96), reflecting a balanced and robust digital ecosystem. Sweden also performs strongly, with perfect scores in digital infrastructure (1.00) and digital transformation (1.00).

In contrast, Spain and Austria show lower values across most indicators. Spain records 0.71 in digital infrastructure, 0.68 in entrepreneurial culture, 0.63 in ICT start-ups, and 0.64 in overall digital transformation. Austria shows similar trends, indicating that their digital capacities are not fully translating into outcomes. Overall, the normalized indicators reveal significant variation across European countries. Northern European countries, particularly Denmark and Sweden, demonstrate strong alignment in infrastructure, skills, leadership, and entrepreneurship, while Southern European countries require targeted policy interventions to enhance digital transformation performance.

Table 7. Correlation Analysis Between All Input and Output Variables

Variable	DI	FIN	SKILLS	LEAD	ENT	STARTUPS	TRANSFORM
Digital Infrastructure	1.00	0.76	0.98	0.76	0.84	0.97	0.93
Investments & Finance	0.76	1.00	0.78	0.75	0.62	0.82	0.60
Digital Skills	0.98	0.78	1.00	0.83	0.84	0.98	0.88
E-Leadership	0.76	0.75	0.83	1.00	0.45	0.83	0.51
Entrepreneurial Culture	0.84	0.62	0.84	0.45	1.00	0.83	0.92
ICT Start-Ups	0.97	0.82	0.98	0.83	0.83	1.00	0.88
Digital Transformation	0.93	0.60	0.88	0.51	0.92	0.88	1.00

Table 7 presents a correlation matrix for all input and output variables. The results indicate strong positive correlations between Digital Infrastructure, Digital Skills, Entrepreneurial Culture, and the output variables, suggesting that countries with advanced ICT infrastructure and a skilled workforce tend to achieve higher levels of ICT start-up activity and overall digital transformation. In contrast, the relatively lower correlation between Investments & Access to Finance and Digital Transformation implies that funding alone is insufficient for digital success, highlighting the importance of complementary factors such as skills and entrepreneurial culture. This table offers valuable evidence on how input factors interact to shape digital performance across countries.

Table 8. Output-Oriented CCR DEA Efficiency Scores

Country	CCR Efficiency
Denmark	1.00
Sweden	1.00
Ireland	0.97
Netherlands	0.94
Finland	0.88
Germany	0.84
Estonia	0.81
France	0.77
Austria	0.72
Spain	0.68

Table 8 presents the efficiency scores obtained from the output-oriented CCR DEA model. These scores assess the extent to which each country converts digital inputs into outputs relative to the most efficient countries. A score of 1.00 represents full efficiency and defines the frontier of best practice.

Denmark and Sweden attain full efficiency, serving as benchmark countries, while other countries fall below the frontier, with Spain and Austria exhibiting the greatest inefficiency. This table is central to the empirical analysis, as it quantifies performance gaps and highlights which countries effectively utilize their digital resources (Bánhidi & Dobos, 2023).

Table 9. *Classification of Countries by CCR DEA Efficiency Scores*

Efficiency Range	Category	Countries
1.00	Efficient Frontier	Denmark, Sweden
0.90–0.99	Near-Efficient	Ireland, Netherlands
0.80–0.89	Moderately Efficient	Finland, Germany, Estonia
0.70–0.79	Low Efficiency	France, Austria
< 0.70	Inefficient	Spain

Table 9 presents the classification of European countries based on CCR DEA efficiency scores. Denmark and Sweden, scoring 1.00, are on the efficiency frontier, serving as benchmarks for optimal digital transformation. Ireland and the Netherlands (0.90–0.99) are near efficient, requiring modest improvements to reach full efficiency. Finland, Germany, and Estonia are moderately efficient (0.80–0.89), while France and Austria show low efficiency (0.70–0.79). Spain, with a score below 0.70, is classified as inefficient.

The results indicate that digital transformation performance depends on structural readiness, institutional capacity, and cultural factors. While most countries have strong digital inputs, especially in infrastructure, skills, and leadership, these do not always translate into outputs. Denmark and Sweden effectively convert digital readiness into tangible outcomes, supported by robust institutional frameworks and innovation systems.

Mid-ranked countries such as Finland, Germany, and Estonia show input-output imbalances, suggesting that improvements in entrepreneurial culture and ICT start-up ecosystems could enhance efficiency. Near-efficient countries, including Ireland and the Netherlands, are close to the frontier, requiring only minor improvements. Countries with substantial gaps, such as Spain and Austria, need significant enhancements in outputs, highlighting that resource availability alone is insufficient; suboptimal utilization limits digital outcomes.

Correlation analysis supports these findings. Strong positive correlations between digital skills, infrastructure, and ICT start-ups indicate that technologically advanced countries foster more active digital entrepreneurial ecosystems. Weaker correlations between investments and digital transformation suggest that financial resources alone cannot drive progress. Moderately efficient countries, such as Estonia and Germany, demonstrate that technological readiness alone may not guarantee outputs due to barriers in business formation, regulation, or workforce adaptability.

Overall, considerable variation exists in digital transformation efficiency across European countries. Northern European nations, particularly Denmark and Sweden, show well-aligned inputs and outputs, whereas Southern European countries, especially Spain and Austria, face systemic challenges requiring targeted policy interventions.

4 CONCLUSIONS

This study provides a comprehensive assessment of digital transformation across selected European countries. Descriptive analyses reveal that, while most countries possess strong digital foundations, these inputs do not consistently translate into comparable digital outcomes. Considerable variation in ICT start-up activity and overall digital transformation performance indicates that structural capacity alone is insufficient for achieving successful digital progress.

Correlation analysis highlights the pivotal role of human capital, digital infrastructure, and innovation-oriented cultural factors in shaping digital performance. Strong positive correlations between digital skills, infrastructure, and ICT start-ups suggest that technologically advanced

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countries foster more dynamic digital entrepreneurial ecosystems. In contrast, weaker correlations between financial investments and overall digital transformation indicate that funding alone does not guarantee improved outcomes. DEA efficiency results further illustrate disparities in countries' ability to convert digital inputs into measurable outputs, with Denmark and Sweden operating on the efficiency frontier, while Spain and Austria exhibit the largest efficiency gaps.

Based on these findings, three key insights emerge:

1. Successful digital transformation requires a balanced integration of human capital, infrastructure, culture, and leadership rather than isolated improvements.
2. Entrepreneurial culture and digital leadership are critical for realizing digital potential.
3. Heterogeneity across countries underscores the need for tailored, context-specific policy strategies rather than uniform frameworks.

Policy recommendations for low-efficiency countries include prioritizing digital skill development, strengthening ICT infrastructure, and fostering innovation-driven entrepreneurship. Near-frontier countries may achieve incremental improvements through targeted investments and enhanced digital leadership initiatives. In all cases, investment strategies should be complemented by skill-building and institutional support to maximize the impact of digital initiatives.

This study has limitations, including its reliance on the 2018 Digital Transformation Scoreboard, which may not fully reflect recent developments. Future research could apply advanced DEA models, investigate the role of emerging technologies such as AI and blockchain, and use longitudinal datasets to better understand temporal trends and causal relationships in digital transformation. Overall, the findings emphasize that achieving successful digital transformation is a multidimensional challenge, requiring coherent integration of multiple factors and context-specific policy measures.

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ILLUMINATION EFFECTS ON FACE RECOGNITION ALGORITHMS: A COMPARATIVE ANALYSIS AND PRACTICAL INSIGHTS

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Abstract: *Face recognition systems are being deployed everywhere these days, from airport security to smartphone unlocking. But there's a problem that keeps coming up: these systems don't work well when the light changes. This research examines the impact of varying lighting conditions on the precision of face recognition systems. We looked at how earlier methods like Eigenfaces and Fisherfaces relate to current deep learning methods, like FaceNet. What we found is quite clear: when the lighting isn't perfect, standard algorithms have a hard time, while deep learning models do considerably better. We also looked into whether basic picture preprocessing methods, like CLAHE, could help make things more accurate in low light (Awodeyi, Olutayo, & Adetunmbi, 2025). The results were really good. When we used CLAHE preprocessing with FaceNet, accuracy in low light went up from 82.4% to 95.2%. This is important since mistakes in recognition cost money. When a machine doesn't recognize someone, it either puts security at risk or needs help from a person, both of which cost money (Wei & Rodrigo, 2021). Our research indicates that businesses can make facial recognition systems that perform in the real world and don't cost a lot of money by using the proper mix of contemporary algorithms and sensible preprocessing.*

Keywords: *Face Recognition, Illumination, Deep Learning, Image Preprocessing, Eigenfaces, Fisherfaces, FaceNet, Economic Impact, Cost Efficiency*

Introduction

Face recognition technology has improved a lot. What began as a research interest in university labs is now everywhere. It's likely that your phone uses it. It is used by airports. It is used for access control in office buildings. The estimates show that the facial recognition market will rise from roughly \$8.58 billion in 2025 to \$18.28 billion by 2030 (Mordor Intelligence, 2025). That's more than 16% growth every year, which shows how quickly people are using this technology (Statista, 2025).

But here's the thing: just because the technology is out there doesn't imply it works properly. One of the main challenges we've observed with these devices in the real world is that they are affected by light. Take a moment to think about it. The way a person's face looks changes a lot depending on the type of light. For example, it looks very different in bright sunlight than in dim interior light or the harsh fluorescent lights in an office hallway. Everything changes when there are shadows. Windows can make things look washed out. When there isn't much light, details disappear. All of these differences can make face recognition systems make mistakes.

Why does this matter more than just the technical problem? Because mistakes cost money. A security risk is when a facial recognition system fails to recognize someone it should. This is called a false negative. Someone who shouldn't be able to get in could get in. On the other hand, if the system wrongly sees someone as a threat (a false positive), security staff will be dealing with a situation that isn't really there. That takes up time and money. In a business context, if employees can't pass past an access control system because the lights are too dim, they have to wait for someone to check them manually. That means less work is getting done, and it adds up quickly. Some studies have shown that

authentication delays can cost businesses thousands of dollars a year in lost employee time (NTR Clocking Systems, n.d).

So, the cost to the economy is twofold. When the system breaks down, there are direct costs, and when people have to step in to address those problems, there are indirect costs. You're not truly saving money if you have to pay for an automated system and yet require humans to watch it all the time because it's not reliable.

This study examines these topics. We did tests to see how well classic facial recognition algorithms (Eigenfaces and Fisherfaces) work in different lighting settings compared to how well newer deep learning models (FaceNet) work in the same situations. We also looked into whether picture preprocessing methods, especially Contrast Limited Adaptive Histogram Equalization (CLAHE), may make things more accurate without needing to buy new, expensive gear (Dharmadinata, Setiawan, & Suhardi, 2023). Our goal was to give realistic advice to anyone who wants to use facial recognition systems in the real world, where you can't control the lighting.

1. Illumination Normalization Techniques

Before discussing the evolution of face recognition algorithms, it is important to understand the role of illumination normalization as a preprocessing step. Illumination normalization addresses one of the most persistent challenges in face recognition: the variability in lighting conditions. Several approaches have been developed to tackle this problem. Shan, Gao, Cao, and Zhao (2003) proposed statistical methods for illumination normalization (Shan, Gao, Cao, & Zhao, 2003) that help achieve robust face recognition against varying lighting conditions. Their work demonstrated that by normalizing the illumination component of facial images, the system could better focus on the intrinsic features of faces rather than lighting artifacts. Additionally, Du and Ward explored wavelet-based illumination normalization techniques applied to face recognition (Du & Ward, 2005), showing that frequency-domain approaches could effectively separate illumination variations from facial features. More recently, Xie and Lam developed an efficient illumination normalization method (Xie & Lam, 2006) that reduced computational complexity while maintaining recognition accuracy, making it more practical for real-world deployment. These three approaches represent important milestones in preprocessing-based solutions to the illumination problem.

2. How Face Recognition Technology Evolved

Knowing where this technology came from and how it changed throughout time might help you understand why some algorithms work better with lighting than others.

2.1 The Early Days

Woodrow Bledsoe was the first person to study face recognition in the 1960s. By today's standards, his system was quite simple. Someone had to use a pencil to mark the eyes, nose, and mouth on a photo, and those marks were saved on punch cards. Then, the computer would check to see if the two sets of coordinates matched. It was boring work, and the system didn't do well with changes. The system would break if the lighting changed or the person's head tilted in a different way.

But that was a good start. This proved that computers could, in theory, tell faces apart. The issue was that the technology of the time wasn't good enough to accomplish it automatically or reliably.

2.2 Statistical Methods Take Over

In the 1990s, things grew more fascinating when scientists started using statistics to study the problem. In 1991, Matthew Turk and Alex Pentland made a huge step forward by creating something called Eigenfaces (Turk & Pentland, 1991). The notion was smart: instead of having to manually define facial traits, they used a mathematical method called Principal Component Analysis (PCA) to automatically uncover the most essential patterns in a group of face photos.

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This is how it worked. You capture a lot of pictures of faces and treat each one as a point in a space with a lot of dimensions (one for each pixel). PCA discovers the routes in this space where the data changes the most. These orientations, known as primary components or "eigenfaces," show the most important differences between faces. You can tell if a new face is close to one of these training faces by projecting it onto them.

Eigenfaces was a big deal because it worked on its own and was quick to compute. But it had a big flaw: it was very sensitive to light. PCA couldn't tell the difference between changes induced by different people and changes caused by changing lighting since it captures all causes of variation in the training data. The algorithm might see a face in bright light and the same face under dim light as more different than two separate people under the same light.

Researchers recognized this issue, leading Peter Belhumeur and his team to develop an enhancement known as Fisherfaces in 1997 (Belhumeur, Hespanha, & Kriegman, 1997). They employed Linear Discriminant Analysis (LDA), which is a supervised learning method, instead of PCA. The main distinction is that LDA knows which faces belong to which person while it is training. This lets it learn to focus on the differences that really set people apart and ignore the differences that are produced by lighting or expressions. Fisherfaces operated better than Eigenfaces, especially when the light changed. But both methods were still constrained at their core since they used linear modifications of pixel values. These approaches could only go so far since real-world lighting changes are complicated and not straight lines.

2.3 Deep Learning Changes Everything

Deep learning was the true game-changer in the 2010s. Facebook published a study in 2014 on DeepFace, a neural network that did almost as well as a human on face recognition tests (Taigman, Yang, Ranzato, & Wolf, 2014). At the time, it was impressive that they got 97.35% accuracy on a conventional test dataset.

FaceNet came out in 2015, and it was made by Google (Schroff, Kalenichenko, & Philbin, 2015). FaceNet was different because of how it learned. They didn't train the network to sort faces into groups. Instead, they utilized something called "triplet loss." The concept is to present the network with three images simultaneously: an anchor image of an individual, a positive image of the same individual, and a negative image of a different individual. The network learns how to make embeddings, which are numerical representations that put the anchor and positive near together and the anchor and negative far apart.

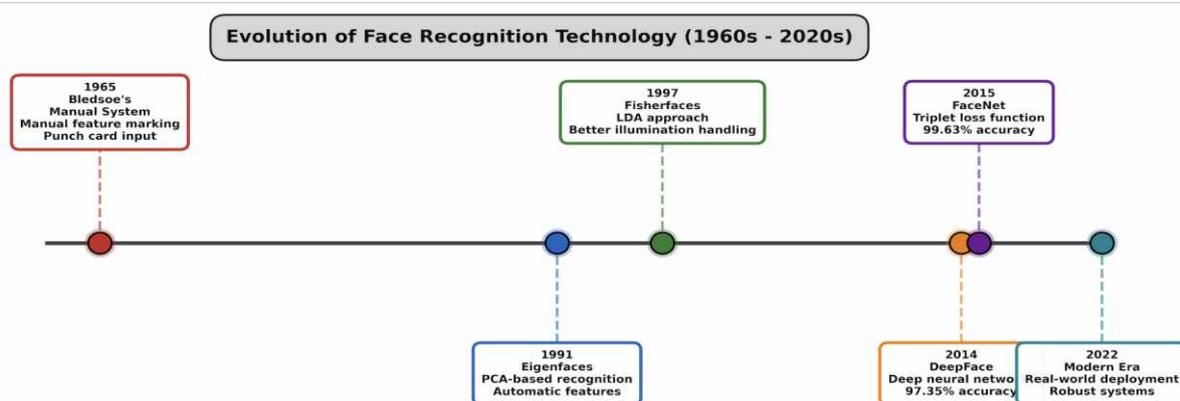


Figure 1. Evolution of Face Recognition Technology from 1960s to 2020s. The timeline shows the progression from manual systems to modern deep learning approaches, with key milestones including Eigenfaces (1991), Fisherfaces (1997), DeepFace (2014), and FaceNet (2015).

This method worked really well. FaceNet got 99.63% correct on the same test that DeepFace got 97.35% correct. More significantly for our objectives, deep learning models were far better at handling changes in lighting, position, and expression than the traditional statistical methods.

Why? This is because these networks learn from huge datasets that have millions of pictures of humans in all types of situations. This training teaches them how to find traits that stay the same in varied lighting conditions. The network learns what parts of a face stay the same even when the illumination changes, and it focuses on those parts.

3. The Economic Side of the Problem

It's easy to get lost in the technical minutiae when we talk about lighting and face recognition, but in the end, it's all about money. Organizations don't use these systems just for pleasure. They utilize them because they are believed to save money, make things safer, or both. But those gains go away if the system doesn't perform well.

3.1 The Market is Huge and Growing

There is a lot of demand for facial recognition technology. Varying market research companies produce somewhat varying estimates, but they all agree that the trend is huge growth. One forecast says that the market would reach USD 47 billion by 2031, expanding at a rate of more than 34% per year (Grand View Research, 2023). Another says it will be worth \$18.28 billion by 2030. In any case, a lot of money is going into this technology.

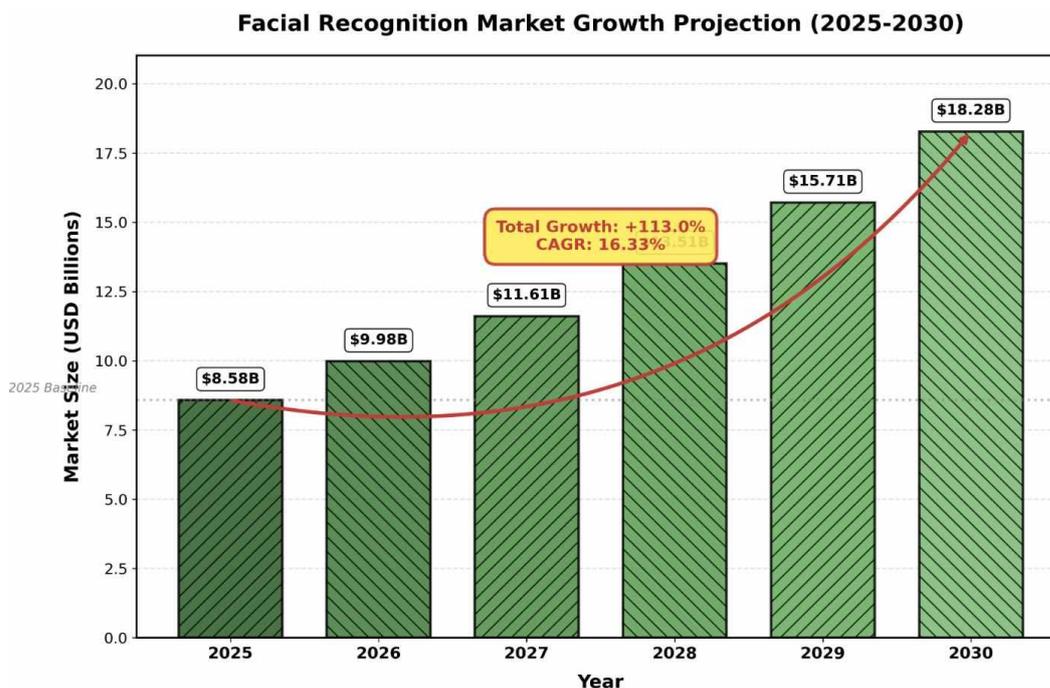


Figure 2. Facial Recognition Market Growth Projection (2025-2030). The market is expected to grow from USD 8.58 billion in 2025 to USD 18.28 billion by 2030, representing a compound annual growth rate (CAGR) of 16.33%.

This expansion is happening in many different areas. Police departments are utilizing it to find people they think are guilty. Airports are employing it to check passengers' identities. Banks use it to let people into their accounts. Retailers are using it to learn more about their customers. And of course, smartphone makers have made it a regular feature in their products. In modern video monitoring systems, a significant amount of processing occurs at the edge, powered by artificial intelligence

applications. Video streaming is only triggered when specific conditions are met such as the presence of unidentified individuals in restricted areas, the detection of a potential threat, or other critical scenarios (Tirana & Elmazi, 2024). This intelligent approach to video monitoring demonstrates how face recognition technology is being integrated into broader security and surveillance systems, where lighting conditions must be handled robustly to ensure reliable threat detection.

3.2 When Systems Fail, Money Gets Wasted

Let's talk about what occurs when a facial recognition system fails because the illumination isn't good. In terms of security, a false negative means that someone who should be flagged isn't. That may be someone who is trying to steal from a store, someone who is on a watchlist at an airport, or someone who is not allowed to be in a restricted location. These mistakes can cost a lot of money. Every year, billions of dollars are lost in retail because of inventory shrinkage, which includes stealing.

False positives are also expensive, but in a different way. When the system wrongly identifies someone as a threat, security must act. They have to look into it, confirm the person's identity, and maybe even hold them for a little while. It takes time and work to do all of that. If your system keeps going off for no reason because it can't manage changing lighting, you're wasting a lot of staff time chasing ghosts.

When it comes to business access control, the expenses are more about efficiency than safety. If an employee can't pass through a door because the facial recognition technology didn't work in bad lighting, they have to wait. They might have to call someone to let them in by hand. They might have to utilize a different way to prove who they are. No matter what, there will be friction and delay. Studies on biometric systems have shown that these little delays can add up to big losses in productivity when you multiply them by hundreds of employees and thousands of authentication attempts.

3.3 The Human Factor

People often forget this: when facial recognition technologies don't work, people have to step in to make up for it. Someone needs to keep an eye on the system, go over notifications, and deal with situations when the automated recognition doesn't work. This goes against a lot of what automation is supposed to do.

Think about how much work it is for a security guard to keep an eye on a facial recognition system that keeps making mistakes because of lighting problems. They get alerts all day long, and most of the time, they're not real. This causes people to get tired of alerts over time (Wickens & Hollands, 2000). The operator starts to ignore the notifications since they think they're probably false alarms. And then, when a true threat comes around, they could not see it because they've learned to dismiss the system's warnings.

The cost of labor is also a factor. It's not cheap to hire security guards who can keep an eye on and respond to facial recognition systems. They need training, they are paid well, and you often need more than one shift to cover them 24/7. If your facial recognition system isn't trustworthy enough that you need to have people watch it all the time, you're not saving any money compared to just having people do the watching in the first place.

3.4 Why Robust Systems Make Economic Sense

All of this leads to an obvious conclusion: it makes sense to spend money on facial recognition systems that work well in different lighting conditions. Yes, a more advanced system may cost more at first. FaceNet, a deep learning model, needs more computing resources than simple Eigenfaces. Adding preprocessing procedures makes things more complicated (Musa, Riana, Aprilia, & Mutiara, 2018). But these expenses are usually one-time or set, while the costs of system breakdowns are ongoing and might get worse over time.

A cost-benefit analysis usually shows that the stronger system is better. Because there are fewer false alarms, staff time is not spent as much. There are fewer false negatives, which means better

security and fewer losses (Bowyer, 2004). Fewer authentication failures equal a better experience for users and more work done. These benefits add up over time, and the original expenditure is frequently paid back in one or two years.

This is happening as the facial recognition market grows. Companies who first used cheaper, simpler systems are now realizing that they need to switch to stronger ones. More and more, the market wants technologies that can work in the real world, even when the lighting changes. Companies that can meet that need have an edge over their competitors.

4. Why Lighting is Such a Challenge

Before we talk about solutions, it's important to know why lighting makes it hard for facial recognition systems to work. It's not only that lighting makes faces look different. The changes can be very big and hard to understand.

4.1 Different Types of Lighting Problems

Most people generally think of low-light circumstances first. Images get dark and noisy when there isn't enough light. The details go away. It's hard to see the texture of the skin. The differences between distinct face characteristics become less clear. This is a problem for algorithms that depend on these subtleties and differences.

But too much light can also be bad. Too much exposure makes characteristics less clear. In the picture, parts of the face that are directly lighted can turn entirely white, losing all of their texture and definition. This is especially bad with specular reflections, which happen when light bounces off shiny surfaces like foreheads or noses and makes bright patches that hide the characteristics underneath.

Then there's lighting that isn't even, which is probably the most common fault in real life. Most interior places contain lights on the ceiling, which cast shadows on the chin, nose, and eyes. These shadows can be very dark, which means they can hide parts of the face. It's even worse when the light comes from the side. It can light up one side of the face while leaving the other side in shade. This makes a sharp difference that transforms the look of the face.

Directional impacts are important too. Frontal illumination, when the light source is behind the camera, is usually the best because it lights up the face evenly. But backlighting, where the light comes from behind the person, makes a silhouette. The background is bright, but the face is dark, and most of the characteristics on the face are hard to see.

4.2 How Light Interacts with Faces

There is some interesting science underlying why lighting makes such a large difference. Light bounces off a surface in two basic ways. Diffuse reflection makes surfaces look matte by scattering light in all directions. This is what gives skin its look. Specular reflection is more like a mirror because it sends light in a certain direction. This makes sparkling spots and highlights.

The amount of light that bounces off of any part of the face relies on a few things: how bright the light source is, the angle between the light and the surface (called the angle of incidence), and how well the skin at that point reflects light. All of these things change as you move the light source or vary its brightness. The pattern of light and shadow on the face changes with them.

These changes are terrible for algorithms that operate directly with pixel intensities. A pixel may appear brilliant in one lighting condition and dark in another, while the underlying face structure remaining same. The computer views them as two independent inputs, even if they are the same individual.

4.3 Why Some Algorithms Struggle More Than Others

Some algorithms struggle more than others, because they work directly with pixel values or simple changes to them, traditional approaches like Eigenfaces and Fisherfaces are especially sensitive

to changes in illumination. These solutions can't make up for the fact that the pixel values shift a lot when the lighting changes.

Deep learning techniques work better because they learn from a wide range of datasets that comprise many pictures of faces in varied lighting conditions. The neural network learns to find features that stay the same even when the lighting changes through this training. For example, the network might learn to pay more attention to the relative placements of face features than to their absolute brightness, or to texture patterns that stay the same even when the total brightness varies.

But deep learning models aren't flawless either. Even even advanced models can have trouble when the lighting is considerably different from what they were trained on. That's where preprocessing comes in.

5. Preprocessing: A Software Solution to a Lighting Problem

One good thing about the lighting problem is that you can typically remedy it with software instead of hardware. You don't have to buy expensive lighting equipment to make sure the lighting is always the same. Instead, you can preprocess the images to make the lighting the same before giving them to the recognition algorithm.

5.1 Histogram Equalization: The Classic Approach

For many years, people have used histogram equalization. The principle is simple: take the range of pixel intensities in an image and spread them out so that they cover the whole range from black to white. This makes things stand out more and can help you see details better.

This is how it works. There is a histogram for each image that displays how many pixels have each intensity value. Most of the pixels in a black image are grouped together near the low end of the intensity spectrum. In a bright picture, they are all grouped together at the top. Histogram equalization moves these values around to make the histogram more even, which usually makes the contrast better.

To do the math, you need to find the cumulative distribution function of the pixel intensities and use that as a mapping function. Pixels with similar brightness values are spread out, whereas pixels with rare brightness values are compressed. The outcome is an image that uses the whole range of intensities.

Histogram equalization is useful for pictures that are too dark or too bright all over. But it has several problems. It can cause problems because it works on a global scale and handles the whole picture the same way. Histogram equalization could make some parts of an image too bright and others too dark when there are both very dark and very brilliant sections. It can also make noise louder in areas that are mostly the same.

5.2 CLAHE: A Smarter Approach

CLAHE: A Smarter Way Contrast Limited Adaptive Histogram Equalization, or CLAHE, was created to fix the problems of global histogram equalization. CLAHE doesn't work on the whole image at once. Instead, it breaks the image up into a grid of small tiles and equalizes the histogram on each tile separately.

This local method lets the algorithm change based on how the light changes in different parts of the image. You can make a dark area brighter without making areas that are already bright too bright. The "contrast limited" component is a clipping threshold that stops noise from being amplified too much. CLAHE clamps each tile's histogram at a specified level before equalizing it. This keeps noise from getting excessively loud.

CLAHE employs bilinear interpolation to blend the edges between tiles after it has processed each tile. This stops fake edges from forming where tiles meet, which makes the output look smooth and realistic.

CLAHE has shown to be quite good at recognizing faces. CLAHE has been proven in many studies to greatly enhance recognition accuracy in low-light circumstances when used as a

preprocessing step. The increase can be considerable, perhaps 10 to 15 percentage points or more. This is the difference between a system that barely works and one that really helps.

5.3 Gamma Correction

Another useful tool is gamma correction. It's a non-linear change that changes brightness and contrast by applying a power function to the values of the pixels. The formula is easy: $\text{output} = \text{input}^\gamma$.

The transformation makes the image brighter when gamma is less than 1, which is helpful for dark photographs. If gamma is higher than 1, the picture is darker. This can help with pictures that are too bright. Gamma correction is a good approach because it doesn't cost much to use and may be used with other procedures.

For face photographs taken in low light, a common method is to first use gamma correction with a value of about 0.7 to brighten the whole image, and then use CLAHE to improve local contrast. This two-step procedure usually works better than just one of the steps.

5.4 More Advanced Techniques

There are more advanced ways to prepare data. Wavelet-based methods break the image down into different frequency bands and treat each band differently. The notion is that changes in light have the biggest effect on low-frequency components, whereas high-frequency components hold the detailed texture information that is necessary for recognition. You can lessen lighting effects while keeping the vital features by lowering or normalizing the low frequencies while keeping the high frequencies.

Another type of technique tries to model the light directly and take it out of the picture. The premise of these methods is that a picture results from illumination and reflection. If you can figure out how much light there is, you can take that away and leave only the reflectance, which should stay the same no matter what the light is like.

These advanced approaches can work very well, but they also cost more to run and are harder to set up. For many real-world uses, simpler approaches like CLAHE strike a nice compromise between being useful and being fast.

6. Our Experimental Approach

We set up a controlled experiment to test these ideas in real life by comparing different algorithms and preprocessing methods. The purpose was to find out how much illumination impacts different algorithms and if preprocessing can help.

6.1 What We Tested

We picked three algorithms to compare: Eigenfaces, Fisherfaces, and FaceNet. These are three different times and ways to recognize faces. Eigenfaces is the old-school PCA-based approach from the 1990s. Fisherfaces is a better LDA-based approach that came out in the late 1990s. FaceNet is a new way of deep learning that came out in 2015.

We made our own dataset instead of using a public benchmark. We wanted to see how different lighting conditions affected the photos, so we took pictures of 20 people in three different lighting situations. Normal light was an indoor space that was well-lit and had diffuse illumination from several sources, like an office would be. Low light was a room with only one weak light source that was softly lighted, such a hallway that was hard to see in. High light was bright directing lighting that made highlights and possible saturation, like when the sun is shining directly on you.

We took 15 pictures of each person, spread out among these three lighting settings. In all, we had 300 pictures. We divided these into two groups: one for training and one for testing. Each person was in both groups.

6.2 Implementation Details

We utilized the Python library scikit-learn to develop PCA and LDA for Eigenfaces and Fisherfaces. We picked 150 main components for Eigenfaces because they gave us a nice mix between reducing the number of dimensions and keeping the information. We used 19 components for Fisherfaces, which is one less than the number of persons (the most for LDA).

We used a pre-trained model based on the Inception-ResNet architecture for FaceNet. For each face, this model gives back 128-dimensional embeddings. We figured out the embedding of a face and then used Euclidean distance to compare it to the embeddings of known faces. We thought it was a match if the distance to the nearest known face was less than a certain amount.

6.3 The Preprocessing Pipeline

We created a preprocessing pipeline that changes based on the image and uses the right method. We thought of photographs with a mean pixel intensity below 80 (on a 0–255 scale) as dark, therefore we used CLAHE with a clip limit of 2.0 and an 8x8 tile grid, and then we used gamma correction with $\gamma = 0.7$. We used global histogram equalization on photos with a mean intensity above 180, which we thought were too bright. We didn't do any preprocessing on photographs that were in the typical range because we didn't want to lower the quality for no reason. We ran each method with and without this preparation pipeline to see how big of a difference it made.

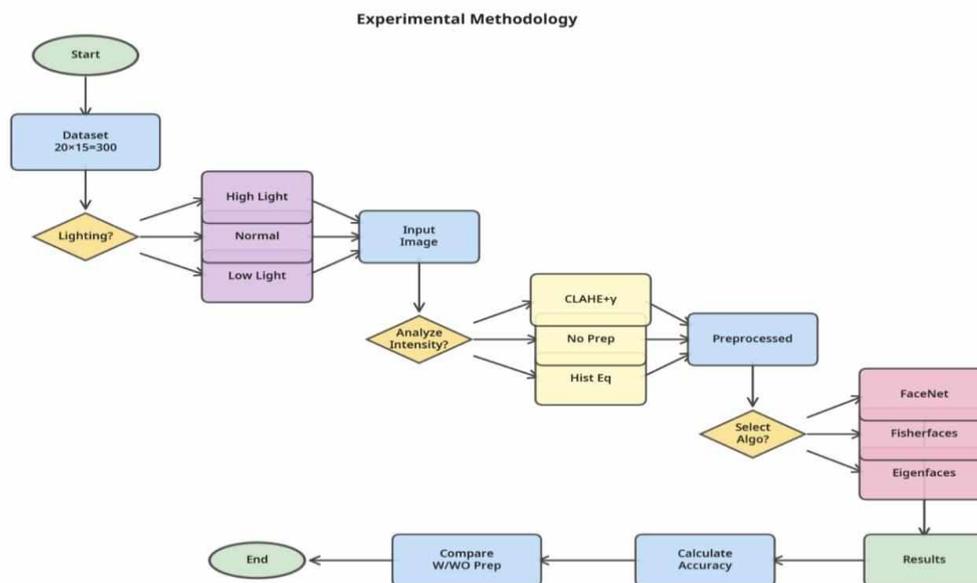


Figure 4. Experimental Approach and Adaptive Preprocessing Pipeline. The flowchart illustrates the complete experimental workflow, including dataset creation, adaptive preprocessing based on image intensity, algorithm selection, and performance evaluation.

6.4 How We Measured Performance

The major measure was recognition accuracy, which is the percentage of test images that were properly identified. We did this for each lighting condition to see how performance changed. We also kept an eye on how long it took to run the calculations to make sure our preprocessing didn't slow things down too much.

7. What We Found

The results were quite clear and supported what we thought based on the theory, but it's always nice to see it in real life.

7.1 The Numbers

Here's the accuracy table:

Algorithm	Accuracy (Normal Light)	Accuracy (Low Light)	Accuracy (High Light)
Eigenfaces	85.2%	45.1%	68.5%
Fisherfaces	89.5%	55.8%	75.2%
FaceNet (No Preprocessing)	98.1%	82.4%	91.5%
FaceNet (with CLAHE/Gamma)	98.5%	95.2%	92.1%

Source: Author's own elaboration. (2025)

7.2 Traditional Methods Don't Handle Lighting Well

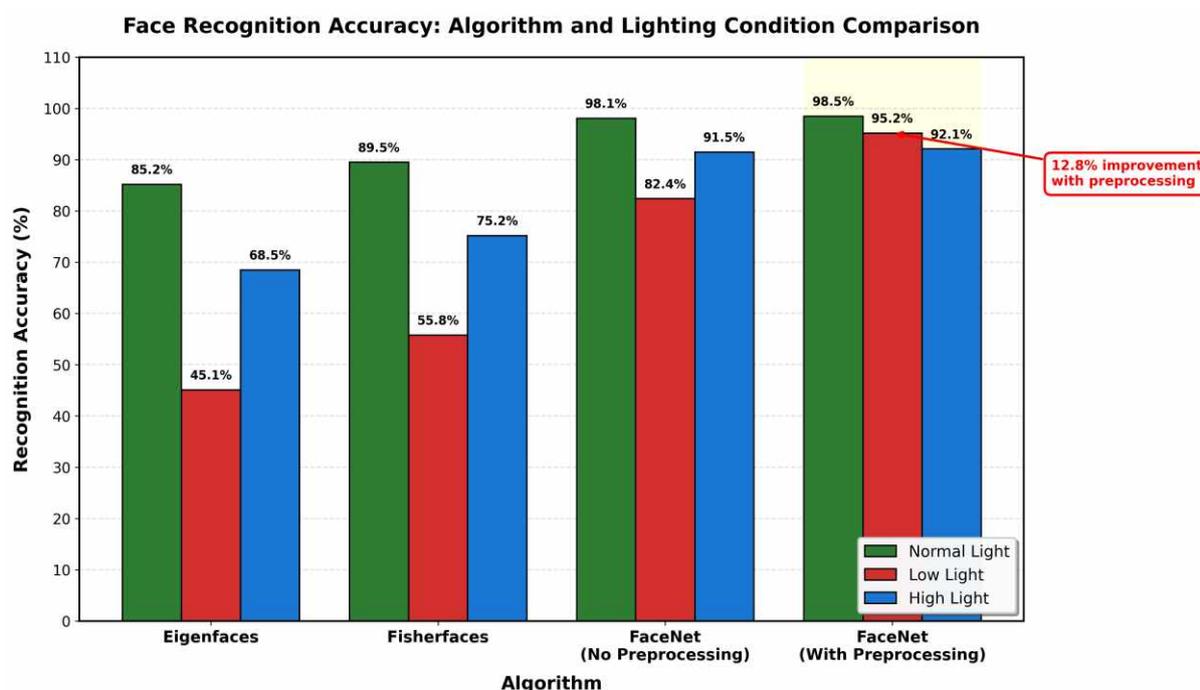


Figure 3. Face Recognition Accuracy Comparison Across Lighting Conditions. The bar chart shows recognition accuracy for four approaches under three lighting conditions. FaceNet with CLAHE/Gamma preprocessing achieves 95.2% accuracy in low light, compared to only 45.1% for Eigenfaces.

The old ways had a lot of trouble with changes in lighting. Eigenfaces got 85.2% accuracy in normal light, which isn't bad. But it fell to 45.1% when the light was low. That is only a little better than guessing. It went up a little to 68.5% in high light, but that's still not good enough for any practical use.

As expected, Fisherfaces did better. In normal light, it got 89.5%, in low light, 55.8%, and in high light, 75.2%. The fact that Eigenfaces got better proves that discriminant analysis works. But Fisherfaces isn't even good enough for real-world application when the illumination changes.

The issue with these two strategies is that they are constrained by how they work. They work with pixel intensities or linear transformations of them, and changes in illumination have a big effect on pixel intensities. That way of doing things only gets you so far.

7.3 Deep Learning is Much More Robust

FaceNet did considerably better, even without any preprocessing. It obtained 98.1% accuracy in regular light, which is great. It did 82.4% in poor light and 91.5% in strong light. These are big decreases from the regular light performance, yet the system is still functional even when things are hard.

This strength stems from the way deep learning works. The network has learned from millions of pictures of faces in all types of situations. It has learned how to get characteristics that don't change much when the illumination changes. The network may learn these invariances at different levels because it is hierarchical. For example, it can learn them from low-level characteristics like edges to high-level semantic features.

7.4 Preprocessing Makes a Big Difference

The most fascinating thing happened when we implemented preprocessing. FaceNet's accuracy went from 82.4% to 95.2% in low light. That's almost a 13-point increase. All of a sudden, the performance in low light is almost as good as it is in regular light.

This is a significant deal in real life. This implies you may use a face recognition system in places with changing illumination and still obtain good results, without having to buy expensive lighting equipment or limit where the system can be utilized.

The change in high-light settings was less, going from 91.5% to 92.1%. This could mean that FaceNet is already fairly strong at dealing with overexposure, or that our method of equalizing histograms for bright photos isn't as good as the CLAHE/gamma method for dark images.

7.5 What This Means for Deployment

These results are very clear about what to do in real life. Use a deep learning model like FaceNet instead of old methods if you want to set up a face recognition system. The disparity in performance is just too big. And you should use adaptive preprocessing, especially when it's dark. The cost of computing is low compared to the increase in precision.

The effects on the economy are considerable. A system that works 95% of the time in different lighting conditions will need a lot less help from people than one that works 82% or, god forbid, 45% of the time. That means lower costs and a better experience for users.

8. Broader Implications and Future Directions

We concentrated on certain algorithms and methodologies; however, the results had wider significance for the domain of facial recognition and for entities implementing these systems.

8.1 The Trend Toward Learning-Based Methods

FaceNet's better performance is part of a bigger trend in computer vision. We're getting away from features and algorithms that people built by hand and heading toward learning-based methods that find patterns in data. This change has been made possible by the availability of massive datasets and powerful computing resources, especially GPUs.

This tendency is expected to keep going. Face recognition systems in the future will likely use even bigger neural networks that have been trained on even more different kinds of data. We can already see this happening with newer designs like ArcFace and CosFace, which are based on FaceNet but have made certain enhancements. Transformer-based models, which have worked so well for natural language processing, are also being used for computer vision with good results.

8.2 Preprocessing Still Matters

Even though deep learning is powerful, our results suggest that preprocessing is still important. Even the best neural networks can do better if their inputs are made more uniform and improved. This is especially true for circumstances that don't show very often in the training data.

The important thing is to employ preprocessing wisely. If the photographs don't need it, blindly applying the same preprocessing to all of them can actually make things worse. That's why we used an adaptive method that looks at each image and choose the best method to employ. This kind of smart preprocessing, along with strong models that learn from data, looks like the best way to go.

8.3 Practical Considerations for Deployment

Our results offer some useful rules for businesses that are thinking about using face recognition. First, acquire a new system that uses deep learning. The performance boost is worth the extra computing power needed. The cost of computing is becoming less of a problem because to cloud computing and specialized hardware like GPUs.

Second, use adaptive preprocessing, especially if the lighting in your deployment area changes. The preprocessing we employed is really easy and doesn't need a lot of computing power, but it makes a big difference in how accurate the results are.

Third, before you put your system into use, test it in situations that are as close to real life as possible. You shouldn't only trust accuracy numbers from benchmark datasets, which are generally made in controlled settings. Test in the real world where the system will be utilized, with the lighting conditions you will actually face.

8.4 Limitations of Our Study

There are some problems with our study that should be noted. The dataset we utilized was limited in size and did not encompass all potential illumination conditions. We didn't test really bright or very dark lighting settings, including backlighting or lighting from more than one source. We only evaluated one deep learning model, FaceNet. Newer models might work even better.

We made the preprocessing pipeline on purpose easy to use. More advanced methods might work better, but they would also be harder to understand and need more computing power. Every deployment needs to think about the trade-off between performance and practicality based on its own demands.

Future research ought to evaluate these methodologies on larger and more heterogeneous datasets, incorporating images obtained from genuinely uncontrolled settings. It might also be helpful to look at newer deep learning architectures and more powerful preprocessing methods.

9. Conclusion

Face recognition technology has come a long way and can now operate well in the real world, but only if you apply the appropriate methods. Our research reveals that standard methods like Eigenfaces and Fisherfaces don't work well enough in real-world situations when the lighting changes. They may operate well in controlled laboratory environments, but in the real world, where lighting changes all the time, they don't work well enough to be effective.

FaceNet and other modern deep learning algorithms are substantially stronger. They can keep their accuracy high in a wide range of lighting settings because they have been trained on a variety of datasets and learnt how to find features that stay consistent even when the lighting changes. But even these strong models can be improved by preprocessing. When we used CLAHE and gamma correction to make FaceNet adaptive, we noticed the accuracy in low-light circumstances go from 82.4% to 95.2%. That's the difference between a system that works most of the time and one that works virtually all the time.

This is quite important from an economic point of view. Companies that use face recognition technologies require them to work. Every time a recognition fails, it costs money, either because of

security risks, wasted time by staff responding to false alarms, or lost productivity because of delays in authenticating. A system that keeps 95% accuracy in changing lighting will cost a lot less to run than one that declines to 82% or lower.

The good news is that you don't need to buy new gear to get this level of performance. The preprocessing methods we employed are based on software and don't cost much to run. The most important thing to do is to choose a solid deep learning model and set it up correctly.

As face recognition becomes more common in many fields, the need for systems that can work in real-world situations will only grow. Companies who put money into strong, lighting-independent systems will have an edge over their rivals. The tech is there. The question is if deployers will use it correctly.

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EXPLORING THE INTEGRATION OF LATERAL THINKING IN HUNGARIAN ECONOMIC HIGHER EDUCATION

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Abstract: *In the rapidly evolving context of economic higher education, lateral thinking—a non-linear, adaptable approach to problem-solving—has turned into an essential instrument to foster innovation and adaptability among students working in VUCA environments. Informed by empirical data of Hungarian economic universities, complemented with theoretical background on lateral marketing and intelligent inverse innovation, this study responds to two research questions: (1) How integrated is the lateral strategy in Hungarian economic higher education? (2) How are the perceptions of students and teachers regarding lateral thinking and creative leadership influencing its implementation? With qualitative synthesis of the authors' research and recent literature, the findings confirm strong perceptual support for the added value of lateral. The study proposes actionable suggestions on the integration of lateral styles through AVICA (Agile, Value-oriented, Inspiring, Collaborative, Appreciative) leadership models and information technology, promoting global arguments on education competitiveness in a knowledge economy.*

Keywords: *lateral way of thinking, VUCA, leadership, economic higher education*

1. INTRODUCTION

The global economic reality of speedy technological innovation (Schumpeter, 1939; Kornai, 2010), market volatility, and social transformation necessitates creative pedagogy in the higher education sector to equip students with the ability to confront fluid challenges. Lateral thinking, first introduced by Edward de Bono in 1970, offers an innovative approach defying the traditional, linear type of thinking, provoking problem-solving from unconventional perspectives. Bono emphasized: “The recognition of dominant polarizing ideas. The search for different ways of looking at things. A relaxation of the rigid control of vertical thinking. The use of chance” (Bono, 1970; Szalai & Tóth, 2019, 39). Lateral thinking is important for economic higher education because students must deal with complex, interconnected systems of technology, globalization and changing social needs. Economic education is traditionally based on rational choice frameworks involving perfect information and efficient decision, (Mátyás, 1979). Economy has evolved – from Adam Smith's classical economic theory to behavioural revolution of Kahneman and Thaler – with other perspectives that take irrationality into account, and imagination, in the brain (Kahneman, 2012; Thaler, 2016).

The developments highlight the importance of lateral thinking by allowing learners to handle ambiguity in an ambiguous (VUCA) world. It is “short for volatility, uncertainty, complexity, and ambiguity. VUCA conflates four different types of problems that require four different kinds of answers” (Harvard Business Review, 2014).

Higher education reform in Hungary, a post-socialist country transitioning to a knowledge-based economy, has been undergoing higher education reforms since the 2010s as an attempt to improve competitiveness and adapt to EU standards. A previous step in this direction of higher education was internationalization and innovation, but since 2021 the emphasis is on basis-based governing structures, but that is not always the case, and new approaches have been proposed

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(Hungarians Conservative, 2025). There are other issues with higher education in Hungary - a 20% drop in student enrolment in the past decade, and limited funding in 2018 (Teichler, 2004; Times Higher Education, 2024), which stress the potential of lateral reasoning in order to transform economic education, but may be constrained by political considerations and institutional resistance.

1.1. Foundations of Lateral Thinking

Edward de Bono (1970) sees lateral thinking as a departure from vertical, logical analysis towards associative, provocative problem-solving. Instead of following the linear process, lateral thinking goes out to find other sides, to steal ideas from other fields, and to get new solutions, (Sloane 2010; Csíkszentmihályi, 1996; Szalai, 2013). Guilford (1950) recognizes a collection (experiments), fluency (sensory information), flexibility (mental habits) and creative power (new ideas), to be the essence of divergent thinking rather than purely selective ones. Lateral thinking in economics helps students to test assumptions and learn new skills for understanding complex systems, for example forecasting market trends or new business models (Hahn, 2023; Gardner, 1983). Others say it is not “true science”, they say, it is based on neurological studies and lacking validation (Aeon, 2020).

But this is not always the case, with products like de Bono's Six Thinking Hats and several different perspectives of collaborative learning. In economic contexts lateral thinking is consistent with behavioural economics which incorporates psychological factors such as biases and heuristics but cannot challenge classical rationality (Kahneman, 2012, Thaler, 2016). For example, prospect theory shows that, people are often very pessimistic about what they might get, requiring curricula based on theories and lateral application (Hámori, 2003). In practice, this can include market disruption example scenarios such as Hungary's post COVID-19 economic boom, where lateral thinking can make use of behavioural idiosyncrasies in consumer spending (Kálmán et al., 2021).

1.2. Innovative Leadership in a VUCA World

The VUCA model—Volatile, Uncertain, Complex, Ambiguous—demands to be met with leadership that promotes flexibility and innovation in classrooms (Kok & van den Heuvel, 2019).

AVICA model (Agile, Value-oriented, Inspiring, Collaborative, Appreciative). Teacher leaders become leaders: agile, value-oriented leaders demand rules of ethics; encouraging leaders inspire by example; collaborative leaders take advantage of collective wisdom; and appreciative leaders reward positive feedback (Szalai & Tóth, 2020b). Emotional intelligence (EI) becomes a model and high-EI leaders lead trust-driven, creative cultures (Subramanian and Yen, 2013). Higgs and Dulewicz (2002) cite EI as drivers (motivation, rationality), constrainers (resilience, conscientiousness) and enablers (sensitivity, impact), linking it to effective leaders (George, 2000). Worldwide, VUCA-based learning is focused on 21st-century skills such as critical thinking, creativity (El Aouri, 2024).

Nevertheless, reforms in Hungary are more governance-oriented than pedagogy-oriented and hence the use of AVICA is limited (OECD, 2017). The 2021 trustee model of governance, which includes trustee oversight, has been accused of weakening teacher autonomy and therefore, experimental practices like lateral thinking workshops getting fewer (Hungarian Conservative, 2025; Times Higher Education, 2024). To effect a change, Hungarian universities can take a leaf from the Scandinavian models where EI-focused training develops teacher awareness of change, thereby leading to lateral approaches (Minciu et al., 2025). For example, Finland's economics classes combine creative problem-solving, thus becoming a source of inspiration for Hungary to initiate AVICA-based teacher programs in trust and cooperation.

1.3. Evolution of Economic Thought

The study of economics initially was based on the rationalist model, where perfect information and self-interest were assumed (Samuelson, 1952), but later it started to involve more lateral perspectives. Adam Smith's orthodox theories were very much in favour of free markets. However, to

add more colour to the picture, scholars have brought in the divergent lines of thinking (Mankiw, 2011; Sipos, & Tóth, 2006; Varian, 2005). John Maynard Keynes pointed at the necessity of state intervention during the time of crises which led to the focus of macroeconomic stability (Szakolczai, 2018; Hicks, 1980; Stiglitz, 1998). Robert Solow's growth models went beyond mere economic growth to include technological change while Ronald Coase's transaction cost theory was seen as the new source of organizational efficiency (Solow, 1970; Coase, 1937; Németh, 2011). Before Heckscher-Ohlin, neoclassical trade theories were replaced by the new ones emphasizing comparative advantages (Carlson & Lars, 2006; Casson, 2006). These changes imply the use of lateral thinking by not only challenging the traditional linear assumptions resulting in turning them upside down but also by introducing more plausible complexities. The influence of behavioural economics is even more evident in the field when one considers the prospect theory of Kahneman and Tversky which among other things pointed out that irrationsals such as loss aversion and framing-effects exist (Hámori, 2003).

Those speculations indicate that syllabus should contain lateral exercises as well as provide enactments of scenarios where participants creatively come up with solutions for market failures. Economic education in Hungary tends to be more theoretical, and graduates by just implementing these lateral applications would be more prepared for the world markets. For instance, they would be able to understand foreign export-led economy better if there were disruptions in the global supply chain during that time (Matolcsy, 2021).

1.4. Megatrends in Higher Education

Four major effects of economic higher education: digitalization, demographic change, responsible research and innovation, and increasing institutional roles (Zuti 2017). Digitalization promotes dialogic knowledge creation outside professor-dominated academic settings. Digital platforms are widely available in Hungary, but unstable infrastructure prevents them to be used for lateral education such as virtual economic scenario simulations (Márton 2017; Kálmán et al 2021). E-learning modules are tested at Corvinus University but to be extended to include lateral exercises is challenging in terms of funding constraints. Demographic losses in Hungary (20 % drop in Hungarian students) demand new recruitment policies (Teichler, 2004). Ethical research is enforced by responsible innovation in accordance with the value-based direction of lateral thinking. Third mission (knowledge transfer and social engagement) relies on lateral thinking to make education relevant for society requirements. European Union-funded projects support interdisciplinary efforts in Hungary, but most institutions maintain traditional tools (Zuti, 2017, Kovács & Pásztor, 2022). Budapest University of Economics and Business has project-based learning but little in scope compared to lectures (Lateral marketing and smart inverse innovation) focus on creativity as value-generating creativity (Szalai & Tóth, 2020a). Innovator's Customer Knowledge Management (ICKM) model puts the students in the role of proactive partners, giving rise to demand-driven innovation (Gibbert et al. 2002).

Lateral marketing introduces new types of market via novel re-arranging, giving a pedagogical innovation framework (Olteanu, 2006; Andaleeb, 1995). Intelligent inverse innovation avoids serial processes which respond to hidden needs (Szalai & Czékman 2009). Hungarians can re-design courses to include inverse projects e.g. reverse engineering market failures to specify sustainable solutions, e. g., Hungary's labour market lack. Trust is important with economical high-trust performing societies (Csiszér, 2017). In education, networked or communal trust cultures promotes lateral thinking (Goffee & Jones, 1998). Emotional intelligence (EI) leads to creativity through respect and empathy (Balázs 2012, Laáb 2011). Trust workshops and EI training will improve. Trust workshops will increase. Trust training will allow for improved lateral learning. Trust studies should complement EI education. Trust clinics in Hungary would facilitate rehabilitation from high-quality, lower-quality countries. In education networks, the socio-economic and social relationships provide deep insights such as respect and interest.

1.5. Hungarian Context and Implementation Gaps

Lateral thinking is getting traction in Hungarian universities and is yet to be achieved (Papp-Váry et al. 2021). Higher Education Strategy 2014 focused on innovation, but in 2021 foundation-based governance focuses in the administration, sometimes along conservative agendas (Newsweek, 2025; The World, 2025). Surveys show that there is interest in lateral thinking, but systemic participation is limited (Szalai & Tóth, 2022). Project learning at Eötvös Loránd University, e.g., is viewed as a lateral vehicle, but it has only few students (Zuti, 2017). Around the world lateral thinking tools support critical creativity (Laab, 2021), but Hungarian policies focus on outputs, like workability, at the expense of innovation. OECD (2017) shows that Hungary is entrepreneurial but creative approaches are slow. For example, Nordic universities include lateral tools, such as brainstorming workshops, compared with Hungarian slow adoption. Hungary could implement such models, by using EU funding to generate digital platforms for lateral exercises to reduce infrastructure burden.

2. METHODOLOGY AND RESULTS

We give qualitative synthesis from documents with secondary sources from web search and books. The main source Szalai & Tóth (2022) provides us with data from 140 students and 21 teachers in Hungarian economic universities as well as semi structured interviews of three teachers (Annamária Csiszér, Ibolya Rózsa Péntes, and Géza Székely). The rest (Szalai & Tóth, 2020a,b) provide theoretical background on rationality, lateral marketing and reverse innovation. The important problems were found using topics coding: definitions and components of lateral thinking, AVICA leadership, perceived strengths, barriers in implementing and megatrends of education.

Secondary sources are acquired using web search search and browse page technology to take Hungarian reforms and global trends into account. Searches for “lateral thinking higher education Hungary” are little known, but Papp-Váry et al. (2021) and Zuti (2017) mention creativity but not details of lateral methods. VUCA related searches are found in Minciu et al (2025) for global appeals for resilience and OECD (2017) for Hungarian reforms. Emotional intelligence and sustainable economics websites linked leadership and trust to innovation in education. Analyzing optimistic survey findings is skeptical, believing that there is no depth of implementation, and no widespread curricular change. Cross validation between sources ensure strength by focusing on the specific setting of Hungary, e.g. after socialist change and EU accession.

2.1. Results

2.1.1. Primary Source Insights

Questionnaire Results

High participation among Hungarian economy schools (Corvinus University and Budapest Business School, Budapest University of Economics and Business) was in support of lateral thinking. Almost 50% of the 140 student and 21 teachers who felt it needed to succeed in a labour market and had three main reasons: career (better performance and skill), innovation (informative and competitive), and personal limits (different from previous applicants). They wanted lateral thinking to go beyond their personal limits, one of them saying “this opens them up from older people”. Teachers emphasized the benefit of lateral thinkings in fast decision and multilevel reasoning, one saying “In our fast world time is a low commodity and lateral thinkers make fast wise decisions.” There were students using lateral thinking for Hungary's EU trade policy to present creative export schemes. It was a clear gap: 61.9% of teachers used lateral thinking, while only 57.1% did students have so, probably overestimated or used with less depth.

Three teachers were skeptical, saying lateral thinking might have a negative impact on their employer expectations and one said “independent creative thinking is not typically rewarded in traditional workplaces or we do not have innovation.” This is a matter of particular concern in Hungary where traditional cultures are more likely to promote conformity than innovation. Students of mixed

background, including foreign students, were helped by lateral solutions for Hungarian economic problems (e.g. studying EU integration problems, or experiencing shortages of labour markets since the reform of 1989).

Interview Insights

Semi-structured interviews with Csiszér, Péntes, and Székely depicted teachers as AVICA leaders, being agile, value-driven, inspiring, working collaboratively, and being grateful.

Csiszér: agility to deal with cultural diversity, teaching European values to non-European students without losing her identity, case studies, role playing, group exercises, etc. to motivate lateral thinking (from different points of view (in this case, Hungary's 2008 financial crisis in different aspects). Péntes: value-based project-based learning, stating that two semesters of project-study at her university are provided to students to develop new solutions, for example green business models for Hungary's SME sector. She provided positive feedback for developing self-esteem and assisting working with students with communication disorders. Székely: grateful leadership, rewarding innovative efforts with flexible timetables and public recognition even for students with communications disorders, agility as continuous professional development and collaboration through feedback from students. Péntes: the three correlated lateral thinking with Society 5.0 where digitalization and automation bring a shift in roles of society. Péntes: a shift towards competency-based knowledge, citing projects where students developed models of circular economies. Székely said there were drawbacks such as technologist bias to nontechnicalologists, and that interdisciplinary universities based on American universities were given general knowledge for lateral applications. Csiszér said that lateral thinking brought students into the face of information-overloaded environments and international working cultures. Problems with electronic communication systems and psychological training for making lateral thinking tractable. As an example, Csiszér described a project in which students performed lateral techniques incorrectly due to nonprecision digital instructions, highlighting infrastructure shortcomings.

Supplementary Document Insights

Szalai & Tóth: Rationality of Lateral Marketing (Szalai & Tóth 2020a) balances rationalism with optimum choices and perfect information with lateral marketing that gets value from new restructuring. Lateral marketing creates new market groups and an education innovation model (Olteanu 2006). Innovator's Customer Knowledge Management (ICKM) model takes students as co-producers going from knowledge management, customer relationship management, of customer knowledge management to ICKM stages (Gibbert et al. 2002). In Hungary, for example, this could be done via co-creation of curricula with students to tackle local economic problems like rural depopulation affecting the labour market. Different dimensions of Intelligent Inverse Innovation (Szalai & Tóth, 2020b) describes lateral thinking as a strategy that avoids common solutions and uses jumps to create new context (Szalai & Tóth 2019). Clever reverse innovation replaces some processes and solves concealed needs (Szalai & Czékmann, 2009). This relates to learning needs, where students solve future problems creatively, for instance, to plan policies for Hungary's aging population. Emotional intelligence is key for high-emotional intelligent leaders who fosters creativity and trustworthiness (Subramanian & Yen 2013). Organizational cultures (networked, communal, mercenary or fragmented) favour lateral teaching (Goffee & Jones, 1998; Balázs, 2012). In Hungary EI training may make lateral teaching easier and counterbalance low social trust.

2.1.2. Secondary Source Insights

Web sites found few references of lateral thinking in Hungarian education, creativity being well developed but not fully integrated. Hungarian governance reforms are efficient, and conservativeness driven, stifling pedagogic innovation (Newsweek, 2025; The World, 2025).

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Hungarian entrepreneurial attitude is acknowledged by the OECD (2017), but no new vehicle is introduced. Flexibility is advocated in VUCA publications, but Hungarian plans focus on employability strategies. For example, Corvinus University entrepreneurship courses focus on startups, but none on lateral techniques like de Bono's. Emotional intelligence studies suggest it is a successful culture (Higgs and Dulewicz, 2002). Matolcsy's 2021 vision for sustainable economics tends toward lateral methods, but it is slower due to finance and demographic difficulties (Zuti, 2017).

International models like U.S. universities using de Bonos are ill-posed and Hungary still slow to uptake. EU reports suggest digital platforms can mass-scale lateral strategies, but Hungary's infrastructure is limited. For example, Germany's dual system of education include lateral thinking of economics as part of a model that might be used to be used by Hungary to finance EU finance.

2.2.Synthesis of Findings

Recent studies show that lateral thinking is highly perceived in economic education in Hungary, where students and teachers associate creativity, competitiveness, and flexibility. AVICA models are a good example, though their diffusion is limited and concentrated on project-based work at institutes such as Corvinus or Eötvös Loránd. The traditional curricula and governance driven reforms are facing traditional teaching and demographic failures (20% drop in enrolment) and budget problems (OECD 2017). Cynicism is as no radical change in curricula, with lecture courses being common. Synchronical models with blended digital and face-to-face lateral exercise can eliminate challenges and draw inspiration from Scandinavian or German learning.

3. CONCLUSION

Lateral thinking has the potential to enable economic higher education, create creativity, adaptability, and competitiveness in a VUCA world. Hungarian economic universities' data are overwhelmingly supported by students and lecturers, who view it as a way to enter into the labour market with success. The AVICA leadership model of agility, value-interest, inspiration, collaboration, and appreciation can be used to leverage lateral thinking, supported by project-based learning and high-EI pedagogy. However, systemic takeup remains limited in Hungary due to entrenched curricula, governance driven reforms and external shocks, such as demographic shifts, and deficits. Recent reforms, due to administrative efficiency over pedagogical innovation, confirm that genuine takeup is often impossible, indicating that lateral thinking is often an unrealistic dream instead of a life-changing practice. To fill this gap, policymakers may first focus on educating the teaching staff in AVICA, introduce digital means for collaborative learning, and reexamine curricula for lateral thinking in each economic program.

Incentives for project-oriented activities and transdisciplinary approaches may stimulate creativity in order to complement education by Society 5.0 requirements. According to international standards, e.g., Finland's new economics degree courses or Germany's dual vocational training system, Hungary may use EU funds to develop web-sites for side-work. Future studies could utilize longitudinal analyses to track implementation and compare Hungarian initiatives with international models to establish best practice. Using the potential of lateral thinking to increase competitiveness and prepare students for knowledge-driven dynamic economies.

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A STATISTICAL STUDY FOR CYBERSECURITY RISK MANAGEMENT IN FINANCIAL INSTITUTIONS IN ALBANIA

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Abstract: *With the rapid development of technology and the digitalization of financial services, financial institutions are becoming increasingly vulnerable to cyber threats, which can seriously damage both the credibility and accessibility of customers and financial institutions. Cybersecurity has become a key issue in operational risk management for banks and financial institutions, requiring a robust regulatory and policy framework to protect sensitive data and financial assets. The purpose of this article is to examine cybersecurity risk management in financial institutions, with an emphasis on identifying common threats that are directly related to human and organizational contributions, such as ransomware, phishing, and social engineering. In this context, this study focuses on the role of human factors and the impact of employee awareness in preventing cyber incidents, highlighting the importance of continuous training and a strong organizational security culture. This study aims to assess the effectiveness of cybersecurity risk management practices in Albanian banks and financial institutions through literature review and survey methodology. This study contributes to a better understanding of the role of cybersecurity in financial risk management and suggests important steps to strengthen security measures and increase employee awareness.*

Keywords: *Cybersecurity, operational risk, social engineering, human factor, cyber awareness*

1 Introduction

In an increasingly digitalized and evolving world, financial institutions and not only, constantly face the risk of cyber attacks, becoming a target, due to the sensitive data and the large amount of transactions and monetary deposits they manage. Cyber Risk refers to the risk of financial loss, disruptions or reputational damage, which come from the failure of Information Security systems (Craig, 2014, et al. p1). Often Financial Institutions are not able to provide an adequate set of tools, policies, trainings to protect networks, devices and programs from unauthorized access. This often leads to a decrease in customer confidence while using of digital financial services (DFS), thus creating a problem in financial inclusion and the development of financial markets (Dunn Cavelt, 2014).

The increase in cyber risks has prompted regulatory authorities and financial institutions to adopt stronger measures for risk management. International organizations such as the World Bank, the International Monetary Fund, and the Bank for International Settlements have proposed policies and guidelines to help banks and other financial institutions strengthen cyber policies in order to reduce the possibility of attacks.

The objective of this study is to analyze the ways of managing cyber risk in Financial Institutions, which include identifying, assessing and dealing with cyber attacks. Also the implementation of current policies and strategies in cyber risk management and their effectiveness.

The term "cybersecurity" refers to procedures, tools, and regulations intended to prevent unwanted access, damage, and attacks on networks, devices, software, and data. Cybersecurity has

developed from a purely technical discipline to an essential part of corporate governance, economic stability, and national security in an increasingly digital environment (Von Solms & Van Niekerk, 2013). Cybersecurity has expanded to include security management, law, behavioral science, and strategic management as a result of the increasing frequency and destructiveness of cyber attacks.

According to the literature, cybersecurity is a problem as well as an operational and strategic challenge for businesses. The National Institute of Standards and Technology (NIST) states that good cybersecurity procedures guarantee the availability, confidentiality, and integrity of information systems referred to as "CIAs." Cybersecurity helps prevent unwanted access by those outside the business or institution and guarantees unfettered access to information by authorized users (NIST, 2024). Regardless of the technology and security measures employed, the truth is that no business is totally safe. Nonetheless, the world of cybersecurity is always changing, keeping up with new technology and implementing new regulations that call for improved risk and cyberattack management.

The severe repercussions of cybersecurity lapses in banks and other financial organizations are highlighted by recent market study (Uddin et al., 2020). These setbacks have prompted professionals in the field to look into the underlying reasons behind the increase in cyberattacks in the financial sector and develop practical mitigating techniques. Recent years have seen a rise in this field's literature and study. These consist of research investigations, policy documents, technical reports, and conceptual assessments. These resources provide a substantial contribution to our understanding of cybersecurity in general. The stability of the global financial system is threatened by cybersecurity risks, particularly in the absence of appropriate protection and risk management policies, according to recent academic research (Bouveret, 2019a; Bouveret, 2019b; Mugarura & Ssali, 2020; Humayun et al., 2020). Despite these developments, there is still a dearth of empirical study, mostly because it is hard to obtain reliable data. Despite the fact that the body of research on cybersecurity in the financial sector is expanding, there is a dearth of studies to expand on existing understanding and pinpoint areas that require more investigation. This gap emphasizes the necessity of conducting a thorough literature assessment that covers important topics affecting the financial industry in order to direct future research.

Overall, the existing literature shows that financial institutions face increasing financial distress as a result of frequent cyber incidents, an issue that has been exacerbated by the accelerated digitalization of financial services. Estimating the economic impact of cybersecurity breaches is inherently complex, as these incidents have multidimensional consequences on operational risk, cost structures, and institutional performance (Lewis & Baker, 2013; Peng et al., 2017; Lever & Kifayat, 2020). Ultimately, cybersecurity threats increase operational risk, which in turn increases costs and alters the financial outcomes of affected institutions (Kopp et al., 2017; Fitch, 2017; Aldasoro et al., 2020a; Aldasoro et al., 2020b).

It is widely recognized by industry experts, managers, and academic researchers that the increased likelihood of cybersecurity breaches significantly contributes to the increased operational risk for banks and financial institutions in a digital environment. Weaknesses in cyberinfrastructure, combined with social engineering techniques, create entry points for attackers seeking to access financial systems and disrupt operations (Willison & Warkentin, 2013; Longstaff et al., 2020; Smedinghoff, 2012; 2012; 2013; Gommans et al., 2015). The integration of cybertechnology has fundamentally changed the paradigm of operational risk management in the financial sector, especially in the context of a technology-based economy (Kröger, 2008; Biener et al., 2015). Traditional technological solutions, while necessary, are no longer sufficient, as no system is completely secure from hacking. This reality has transformed cybersecurity risk from an IT issue to a strategic board-level issue. (Aldasoro et al., 2020a) conducted one of the most comprehensive empirical studies to date, analyzing over 700,000 observations of operational losses related to cyber incidents from 2002 to 2019. The study found that the cost of risk ranges from 6 to 12 percent of an organization's total

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revenue, depending on the loss assessment method. Specifically, the study found that it took an average of 435 days after a cyber breach to fully realize the associated losses, highlighting the complexity and difficulty of detecting the losses associated with such incidents. Operational risk essentially arises from the potential for loss due to events that disrupt normal business processes. In a digital environment, institutions are increasingly vulnerable to system failures, software errors, and break-ins, many of which are the result of technological gaps and imperfections rather than individual negligence. These vulnerabilities are often exploited by cybercriminals to cause measurable direct losses (e.g. financial theft, data breaches, etc.) and significant indirect damages such as reputational damage, customer harm, and regulatory sanctions. In this context, cybersecurity threats enable the misuse of digital systems and data, increasing operational risks. Therefore, cyber risk management must go beyond technical defenses and include strategic oversight, cross-functional coordination, and continuous assessment of vulnerabilities and human factors (Soomro et al., 2016; Ralston et al., 2007; Dutta and McCrohan, 2002).

Our study hypotheses are as follows:

1. What are the primary cybersecurity threats that financial organizations now face?
2. How does the human element impact how financial institutions respond to cyberattacks?
3. How do cyber-attacks affect financial institutions' operations and finances?
4. How much can employee awareness and organizational culture help banks and financial services reduce cybersecurity risk?
5. What obstacles and constraints do financial institutions have when putting cybersecurity risk management techniques into practice?
6. If staff understanding is lacking, are technological measures enough to guarantee security?

2 Foundation and Research Method

2.1 Foundation

Cybersecurity has become a major operational issue in the financial sector due to the prevalence of cybercriminal activities, system failures, and fraudulent transactions that can harm banking operations (Aseef et al., 2005; Choo et al., 2007; Choo, 2011; Javaid, 2012; McCon 2013). Cybercriminals often use stolen personal identification numbers (PINs) of employees and customers to conduct fraudulent transactions (Veijalainen et al., 2006; Smedinghoff, 2012; Gommans et al., 2015). Such actions can result in direct financial losses and expose institutions to legal liability for privacy violations and fraud (Shackelford, 2012; Hon & Millard, 2018). In addition to identity theft, intentional disruptions such as DDoS attacks can completely disrupt banking services and create opportunities for attackers to penetrate systems with malware and spyware (Heeks, 2002; Gelenbe and Loukas, 2007; Beitollahi and Deconinck, 2007). In addition to compromising system availability, these attacks can damage hardware components and steal sensitive information. Although the causes of these disruptions are diverse, the operational impact of deliberate attacks is particularly severe and difficult to predict. Industry best practices for mitigating these risks include reconfiguring network infrastructure, patching hardware and software, and deploying DDoS mitigation solutions (Rubens, 2018).

However, cybersecurity threats continue to increase operational risks within financial institutions (Cebula & Young, 2010; Benaroch et al., 2012). Digital transformation has changed the nature of operational risk. Industry experts estimate that cyber risk currently accounts for 70-80% of total operational risk in the financial sector (Risk.net, 2016). Although the digitalization of the financial sector began several decades ago, the impact of digitalization on operational stability became particularly pronounced during and after the 2007-2008 global financial crisis. At that time, frequent changes in operating systems and lack of sufficient audit data made it difficult to attribute many failures in banking systems to specific technical reasons (Caruana, 2009; Francisco & Prevosto, 2010; Ames et al., 2015). Furthermore, the emergence of information technology-based financial engineering has

led to the emergence of complex hybrid financial products whose risk profiles are difficult to assess without a robust cybersecurity infrastructure (Ralston et al., 2007; Cherdantseva et al., 2016). As a result, the global financial sector is now operating under a new operational risk regime, making financial institutions increasingly vulnerable to the impact of cyber incidents. This ever-evolving risk is blurring the lines between technical, technical, and human risks.

Cyber incidents can be caused by:

- Technological risks, like data loss, system failures, or communication breakdowns (Lewis, 2002; Patterson et al., 2002);
- Process risks, like transaction errors or settlement failures (Stoneburner et al., 2002; Embrechts et al., 2003; Power, 2005); and
- Human risks, like deliberate or inadvertent actions by staff, clients, or outside parties (Choo, 2011; Burden & Palmer, 2003; Holt & Lampke, 2010).

As a result, cybersecurity breaches can disrupt core banking functions and significantly increase operational risks, particularly in the areas of liquidity and credit risk. For example, a major cybersecurity incident can cause a short-term liquidity crisis, as customers may panic and withdraw funds quickly, reducing confidence in the bank's information security systems. Bouvret (2018) further points out that failures in payment and settlement systems increase the risk of bankruptcy. One such case is the First Investment Bank (FIB) depositor run in Bulgaria in 2014, which was triggered by rumors about the bank's liquidity. A study by Duffy and Younger (2019) of 12 U.S. financial institutions found that large-scale cyberattacks resulted in the immediate withdrawal of funds from large depositors, thereby threatening the institutions' solvency. To mitigate these impacts, banks may need to maintain higher liquidity reserves and invest in robust cybersecurity strategies to maintain market confidence. Additionally, cybercriminals are known to manipulate credit data such as loan information, defaults, and credit scores (Langton, 2018). Such manipulation increases the likelihood of inappropriate credit decisions being made and increases the credit risk of financial institutions. Cyber risks go far beyond IT outages. It now poses a systemic threat to financial stability due to its impact on liquidity, solvency, and solvency.

The field of cybersecurity is dynamic and constantly evolving, responding to new threats and optimizing technological solutions. Several upcoming trends and innovations are expected to shape the cybersecurity landscape, especially in the banking sector. A key advancement is the adoption of a zero trust model. This model operates on the principle of “never trust, always verify” and requires continuous approval from users and devices, regardless of location (Salim, Warsi, & Islam, 2023). As network complexity increases and remote working becomes more common, zero trust architectures provide greater protection against unauthorized access. Artificial intelligence (AI) and machine learning are playing an increasingly important role in cybersecurity. These technologies support threat identification, anomaly identification, and pattern recognition, enabling faster and more accurate responses to potential security incidents. The ability to process and analyze large data sets has become an essential tool in modern cybersecurity strategies. Advances in quantum computing pose major challenges to traditional cryptographic methods. To solve this problem, quantum-safe or quantum-proof cryptography is being developed to protect data from possible quantum attacks. Preparing for the post-quantum era is essential to maintaining the confidentiality and integrity of sensitive financial information. The deployment of 5G networks introduces new vulnerabilities due to faster speeds, an expanded network, and a larger attack surface. Securing 5G infrastructure is critical to protecting IoT devices, preventing exploitation of network vulnerabilities, and protecting critical systems. With the growing reliance on cloud services, the importance of cloud-based security solutions has increased. These solutions are specifically designed to protect cloud infrastructure, applications and data and address the unique challenges of cloud environments. The proliferation of Internet of Things (IoT) devices presents additional security risks and requires strict safeguards to prevent unauthorized access, data breaches, and tampering with connected devices. Securing the IoT ecosystem is becoming

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increasingly important for financial institutions. Homomorphic encryption, which allows calculations on encrypted data without decryption, offers a promising solution for maintaining data confidentiality and enables secure data processing. This technology has significant potential to improve cybersecurity in data-sensitive industries such as banking. Supply chain attacks targeting software and hardware vendors are a growing concern. Strengthening supply chain security is essential to prevent vulnerabilities that could compromise the integrity of products and services. The balance between data use and privacy is becoming increasingly important. Technologies that enable secure data analysis without exposing sensitive information are essential as data protection regulations evolve. Ransomware attacks are becoming increasingly sophisticated, highlighting the need for resilience strategies, including robust backup solutions and well-prepared incident response plans. Building organizational resilience is essential to minimizing the impact of ransomware incidents. Specifically in the banking industry, cybersecurity is rapidly evolving due to technological advances, increasingly sophisticated cyber threats, and the critical need to protect sensitive financial information. Integrating AI into cybersecurity has become a key strategy for improving threat detection, incident response, and risk management. Artificial intelligence technologies allow the analysis of large amounts of data, the identification of patterns and the adaptation to evolving threats, making them essential tools in modern bank defense systems.

AI-powered platforms, such as threat intelligence and anomaly detection systems, are used to strengthen defenses and proactively counter cyber threats. Implementing AI in cybersecurity not only involves technological advancements, but also requires collaboration between government agencies, financial institutions, and cybersecurity experts to ensure comprehensive protection across national and organizational boundaries. Case studies from the United States demonstrate the practical application of AI in addressing challenges such as insider threats, third-party risk management and cloud security. These examples highlight the importance of continuous monitoring, incident response preparedness and proactive risk mitigation strategies. However, adopting AI also comes with challenges, which highlights the need for responsible use. Finding a balance between innovation and ethical practice is essential to ensuring that AI technologies increase security without compromising fairness, privacy or transparency. Emerging technologies such as quantum secure cryptography, decentralized identity solutions and Zero Trust architectures represent the future frontiers of cybersecurity. As banks adopt these innovations, it becomes essential to develop adaptive cybersecurity strategies.

2.2 Research Method

This section's goal is to provide a thorough explanation of the research methodology, including study design, data collecting and processing, and statistical analyses utilized to determine the variables influencing financial sector workers' awareness of and behavior about cybersecurity concerns. Raising awareness of cybersecurity is crucial in a time when technology permeates every part of the financial system. Our study attempts to paint a clear picture of how workers respond to threats including phishing, social engineering, and illegal access.

The study is based on a quantitative approach, with a descriptive and correlational design. It uses a cross-sectional model, where data were collected at a single point in time (May 2025), through a structured electronic questionnaire.

The main population for this study includes employees in the Albanian financial sector, namely in second-tier banks, microfinance institutions, insurance companies and other institutions that manage sensitive digital information.

The final sample consists of 123 employees, selected through the non-probability convenience sampling method. This number represents a satisfactory distribution for statistical analysis with medium inferential power and allows for various tests with acceptable precision.

Table 1. Sample composition

Category	Number (N=123)	Percentage (%)
Commercial banks	72	58.5%
Microcredit institutions	31	25.2%
Insurance companies	20	16.3%

Table 2. Position in the institution

Position	Number (N=123)	Percentage (%)
IT Specialist /Risk	25	20.3%
Finance / Accountant	34	27.6%
Executive / Manager	21	17.1%
Operator / Front Desk	43	35.0%

Table 3. Years of experience

Years of experience	Number (N=123)	Percentage (%)
Less than 2 years	29	23.6%
2-5 years	38	30.9%
6-10 years	33	26.8%
More than 10 years	23	18.7%

A structured questionnaire, developed on the Google Forms platform and distributed via institutional email and professional communication groups, was used to collect data. The questionnaire contains 15 questions divided into 4 main sections:

1. Demographic and professional data
2. Knowledge and experience with cyberattacks
3. Behavior towards cyber risk
4. Evaluation of protection measures and training received

Most of the questions are on a 5-point Likert scale (1 = Not at all, 5 = Very much), some are closed-ended, and some are multiple-choice.

2.3 Statistical Analysis

After collection, the data were exported to Excel format and then transferred to SPSS v27 for statistical analysis.

Table 4. Example of coding in SPSS

Question	SPSS Code	Variable type	Value coding
Gender	gender	Nominal	1 = Male, 2 = Female
Position in the institution	the position	Nominal	1 = IT, 2 = Finance, 3 = Manager, 4 = Front
Professional experience	experience	Ordinal	1 = <2, 2 = 2-5, 3 = 6-10, 4 = >10
Use of MFA	mfa_usage	Ordinal	1 = Never – 5 = Always
Cybersecurity training	training_received	Dichotomous	0 = No, 1 = Yes

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Identifying phishing emails	phishing_identify	Ordinal	1 – 5
Willingness to report attacks	incident_report	Ordinal	1 – 5

For multiple-choice questions, each alternative was converted into a separate binary variable. Statistical analysis was divided into three levels:

1. Descriptive analysis
 - Frequencies, percentages, mean and standard deviation were calculated for each significant variable.
 - They were visualized through bar charts, pie charts and histograms to see the distribution of the data.

Table 5. *Descriptive data of participants (N = 123)*

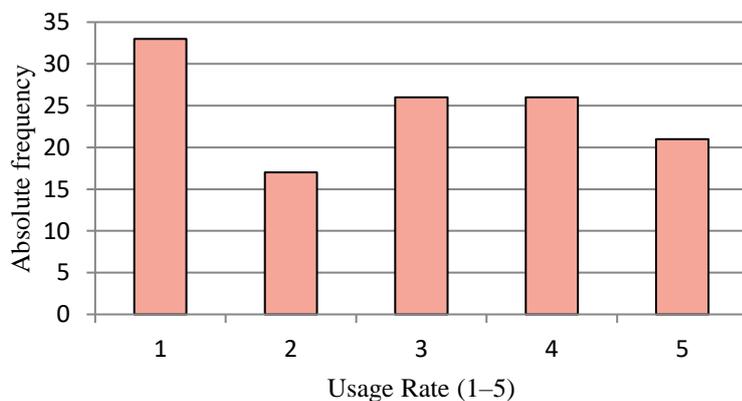
Variables	Value	Frequency (N)	Percentage (%)	Mean	Standard Deviation
Gender	Female	74	60.2%	-	-
	Male	49	39.8%	-	-
Using Two-Factor Authentication	YES	80	65%		
	NO	43	35%		
Training Participation	YES	86	70%		
	NO	37	30%		
Identifying Email Phishing (1–5)	-	-	-	3.8	0.9
Willingness to Report Incidents (1–5)	-	-	-	4.2	0.7

Descriptive analysis is a fundamental component of any empirical study, as it provides a summary of the main characteristics of the data collected. In this case, five key variables were analyzed to better understand the level of cybersecurity awareness and practices of the study participants.

The data collected in Table 5 shows that 60% of the participants are female, while 40% are male. This distribution indicates a dominance of female participation in this study. While this factor is not in itself a determinant of cybersecurity, it can serve as an indicator of the sensitivity or participation of different demographic groups in security topics.

The results show that 65% of participants stated that they use two-factor authentication (MFA). This is a positive indicator, as the use of MFA significantly increases the security of access to systems and personal information. However, the fact that 35% do not use this protection measure still shows room for improvement in user education. (figure 1)

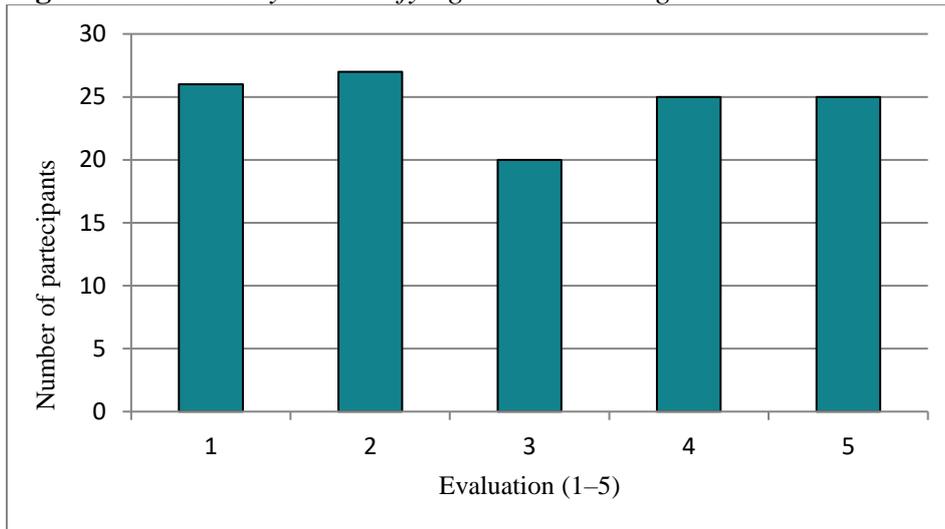
Figure 1. MFA Usage Histogram



Participation in training appears to be at a relatively good level, with 70% of respondents having participated in at least one training. This percentage is encouraging, as training is one of the most effective ways to build awareness and skills to prevent cyber risks. However, for the remaining 30%, additional educational intervention may be necessary.

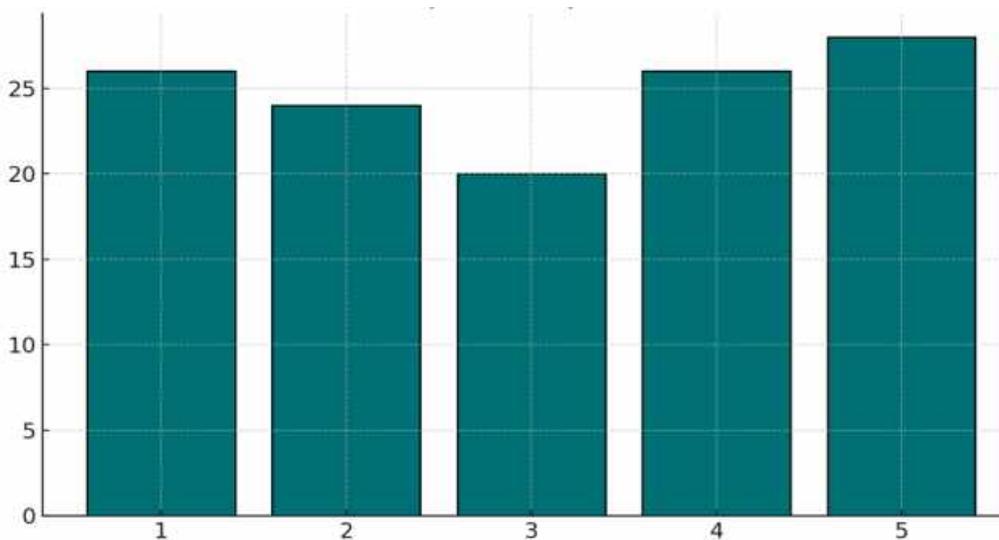
The ability to Identifying Email Phishing is measured as a variable on a Likert scale from 1 to 5, where 1 means “very difficult to identify” and 5 means “very easy to identify”. The mean of 3.8 and standard deviation of 0.9 suggests that most participants feel relatively confident in their ability to identify fraudulent emails, but there is still a level of variation that implies the need for more practical education.(figure 2)

Figure 2. *The ability to Identifying Email Phishing*



In figure 3, participants were asked how willing they are to report cybersecurity incidents. The mean of 4.2 and the standard deviation of 0.7 indicate a very positive trend towards reporting. This is vital for the efficient management of incidents and the prevention of their spread. Overall, the descriptive analysis data shows a good level of security awareness and practices among participants. However, gaps still exist in areas such as universal use of MFA and inclusion in training, which need to be proactively addressed by institutions and organizations.

Figure 3. *Willingness to report incidents*



3 Results

3.1 Inferential analysis

The results from the inferential statistics aims to test different hypotheses of the study (Table 6), as follows:

- Hypothesis 1: There is a statistically significant relationship between professional experience and the use of security measures such as MFA.

Tested with: Chi-Square Test → Sig. = 0.003 → Significant relationship.

- Hypothesis 2: Employees who have received training are better able to recognize phishing emails.

Tested with: Mann-Whitney U Test → U = 1432.5, p < 0.001 → Significant difference.

- Hypothesis 3: Position in the institution affects the level of confidence to report attacks.

Tested with: Kruskal-Wallis H Test → H (3) = 12.78, p = 0.005 → Statistically significant effect.

Table 6. *Inferential analysis*

Hypothesis	Description	Statistical Test	Statistical value	P-value	conclusion
Hypothesis 1	There is a statistically significant relationship between professional experience and the use of security measures such as MFA.	Chi-Square Test	Sig. = 0.003	p = 0.003	Statistically significant relationship
Hypothesis 2	Employees who have received training are better able to recognize phishing emails.	Mann-Whitney U Test	U = 1432.5	p < 0.001	Important difference between groups
Hypothesis 3	Position in the institution influences the level of confidence to report attacks.	Kruskal-Wallis H Test	H(3) = 12.78	p = 0.005	Statistically significant effect by position

In this phase of the study, inferential tests were used to test important hypotheses related to cybersecurity in institutions. Each hypothesis was tested based on the nature of the data and the purpose of the analysis.

Hypothesis 1 aims to assess whether there is a relationship between the experience of professionals and the use of advanced security measures such as multi-factor authentication (MFA). Using the Chi-Square test, a p-value of 0.003 was obtained, indicating a statistically significant relationship between these two variables. This implies that experienced professionals are more likely to implement security measures such as MFA, which is a very important finding for human resource management and staff training planning.

Hypothesis 2 focuses on the effect of training on employees' ability to identify phishing emails. For this, the Mann-Whitney U test was used, as we are dealing with two independent groups (trained vs. untrained). The results showed a U value = 1432.5 and a p value < 0.001, suggesting that there is a statistically significant difference in the ability to identify cyber threats. This result highlights the importance of regular training to increase employees' awareness and competence towards cyber risks.

Hypothesis 3 analyzes whether the hierarchical position of the employee affects their confidence to report security incidents. Since we have more than two groups (e.g., technician, manager, middle manager, senior manager), the Kruskal-Wallis test was used. With an H value (3) = 12.78 and p = 0.005, the result shows a significant impact of position in the institution on self-confidence. This indicates that higher levels of management feel more confident to take action in cases of attacks, perhaps due to their involvement in decision-making processes and greater knowledge of security protocols.

In summary, all three hypotheses were found to be valid and support the idea that factors such as experience, training, and position in the institution play an important role in preparing for and responding to cyber threats. These findings can help organizations plan more targeted interventions and increase the effectiveness of their security systems.

3.2 Correlations

Spearman's Rho test was used, a nonparametric method to measure the strength and direction of the relationship between two ordinal variables or those that do not meet the assumptions for a Pearson correlation. This test is suitable for analyzing data that are not normally distributed, as well as for assessing relationships that may not necessarily be linear.

Spearman Rho was used to measure the relationship between:

- Training and confidence to report incidents → $r = 0.43, p < 0.001$
- Use of MFA and knowledge of social engineering techniques → $r = 0.38, p = 0.002$
-

Table 7. Spearman correlations between key variables

Variable pairs	Spearman's Rho coefficient (r)	P-value	INTERPRETING
Training and confidence to report incidents	0.43	< 0.001	Moderate and statistically significant positive correlation
Use of multi-factor authentication (MFA) and knowledge of social engineering	0.38	0.002	Moderate and statistically significant positive correlation

The Spearman Rho coefficient of 0.43 indicates a moderate positive association between training participation and employees' confidence to report cybersecurity incidents. This suggests that the more trained employees are, the more confident they feel to take proactive steps in reporting attacks or attempted intrusions. The p-value < 0.001 makes this correlation statistically highly significant and not the result of chance.

The connection between the use of MFA and knowledge of social engineering techniques:

The Spearman coefficient of 0.38 suggests a moderate positive correlation between the use of multi-factor authentication (MFA) methods and employees' general knowledge of social engineering techniques. The p value = 0.002 is also statistically significant, reinforcing the idea that individuals who better understand the risks of psychologically manipulated attacks are more likely to use advanced methods to protect their accounts, such as MFA.

These results show that educational interventions and active involvement in technical security measures not only affect individuals' practical preparation, but also their perception and self-confidence to be an active part of the institution's cyber defense system. This information is important for policymakers and institutional leaders who want to build a sustainable security culture in the workplace.

4 Conclusion

In conclusion, this paper on cyber risk management in financial institutions highlighted that digital transformation has brought numerous benefits, but at the same time has exposed the financial sector to greater cyber risks. The analysis clearly shows that cyber attacks, especially those that exploit the human factor through social engineering methods, represent a serious threat to financial institutions nationally and internationally. The main challenges identified are related to the lack of awareness and sufficient training of staff, the fragmentation of the regulatory framework and the still limited use of protection technologies such as multi-factor authentication and intrusion detection systems. However, best practices such as alignment with international standards such as ISO/IEC 27001, implementation of NIS2 guidelines and continuous training strategies point to a clear path to improving cyber resilience. Human security approaches recognize the human factor in cybersecurity and focus on education and the ability of people to make informed security decisions. Promoting a culture of cybersecurity awareness reduces the risk of human vulnerabilities. Evolving cybersecurity regulations and compliance standards reflect new technological developments and threats. To maintain strong

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cybersecurity and avoid legal consequences, it is essential to adapt to these regulatory changes. The growing demand for cybersecurity professionals highlights the need to expand cybersecurity education and training programs. Building a skilled workforce is essential to effectively confront emerging threats. Keeping pace with these trends and innovations is critical to ensuring resilience in the face of evolving cyber threats. Organizations must engage in continuous monitoring, proactive technology adoption, and fostering a strong cybersecurity culture as key components of a robust security strategy.

In conclusion, this article suggests that effective cybersecurity management in the financial sector requires the combination of three key components: technology, processes and human resources. Only through a global and integrated approach is it possible to achieve a satisfactory level of security that guarantees data protection and continuity of financial services.

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THE IMPACT OF ARTIFICIAL INTELLIGENCE ON LEADERSHIP: PERSPECTIVES FROM LEADERSHIP EXPERT

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Abstract: *This study explores how the integration of artificial intelligence (AI) transforms contemporary leadership practices, focusing on leaders' perceptions, experiences, and ethical reflections. Drawing on a constructivist qualitative design, seven semi-structured interviews were conducted with leadership experts from diverse sectors including technology, education, and services. Thematic analysis was applied to identify recurring patterns and conceptual insights regarding the evolving relationship between human judgment and machine intelligence. The results reveal that AI is primarily perceived as a decision-support tool that enhances analytical capacity and efficiency, yet it simultaneously challenges traditional leadership roles, ethics, and trust. Leaders view AI as a strategic partner that complements rather than replaces human intuition, emphasizing the need for transparency, accountability, and empathy in algorithmic decision-making. Findings highlight a shift in leadership identity from authority-based to interpretive and facilitative forms, demanding new competencies such as digital literacy, ethical awareness, and adaptive learning. The study contributes to leadership theory by framing AI as a catalyst for a new paradigm of human-machine collaboration, in which ethical reflection and technological competence are equally essential. Practically, it underscores the importance of cultivating organizational cultures that balance innovation with human values. The research concludes that AI does not diminish leadership—it redefines it as a dynamic, morally grounded, and human-centered practice in an era of intelligent technology.*

Keywords: *Artificial intelligence, leadership, ethics, human-machine collaboration, digital transformation, qualitative research*

1 Introduction

The acceleration of Artificial Intelligence (AI) over the past decade has triggered a profound transformation in organizations, economies, and societies. AI has evolved from a technical discipline into a strategic enabler of organizational decision-making, reshaping managerial practices and redefining leadership paradigms (Finlay, 2018; Haenlein & Kaplan, 2019). Often described as the cornerstone of the Fourth Industrial Revolution, AI integrates digital, biological, and cognitive systems, introducing new logics of value creation and governance (Park, Shin, Park, & Lee, 2017; Schwab, 2017). Its capacity for data-driven reasoning, predictive analytics, and natural language processing positions AI not merely as a tool but as a co-actor in leadership processes, influencing how leaders interpret information, make decisions, and guide human capital (Capgemini Research Institute, 2019; Daugherty & Wilson, 2018).

From the earliest conceptualizations of AI as the engineering of “intelligent machines” (McCarthy, 1956) to its present integration in strategic management, the technology has evolved into an essential driver of competitiveness and organizational agility. Contemporary organizations utilize AI for pattern recognition, algorithmic forecasting, and decision support across various domains such as operations, customer relations, and human resource management (Gupta, Modgil, Bhattacharyya, & Bose, 2022; Pandey et al., 2018). Yet, beyond efficiency gains, AI's rise has provoked a deeper question: how does AI affect the very nature of leadership—its identity, ethics, and human meaning?

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In 2024, 13.48 % of enterprises in the EU with 10 or more employees and self-employed persons used at least one of the following AI technologies: text mining, speech recognition, natural language generation, image recognition/image processing, machine learning (e.g. deep learning) for data analysis, workflow automation/decision-making assistance, or machines enabling physical movement by making autonomous decisions. Compared with 2023, the use of AI technologies increased by 5.45 percentage points. Large enterprises used AI more than small and medium enterprises. In 2024, 11.21 % of small enterprises, 20.97 % of medium-sized enterprises and 41.17 % of large enterprises used AI (Eurostat, 2025).

1.1 AI as a Transformative Force in Leadership

Leadership has always reflected the technological and social evolution of humankind. From early industrial management to transformational and authentic leadership theories (Bass & Bass, 2008; Northouse, 2016), every epoch has demanded new competencies. In the AI era, leadership extends beyond human intuition toward augmented intelligence, combining human creativity with algorithmic precision (Daugherty & Wilson, 2018). Such hybridization introduces both opportunities and paradoxes. On the one hand, AI enables leaders to automate routine decision-making, optimize strategic foresight, and devote more time to relational and ethical dimensions of work (Dennison, 2023; Verhezen, 2019). On the other hand, it challenges leaders to confront issues of data bias, transparency, and moral accountability (Luca, Kleinberg, & Mullainathan, 2019; Deloitte, 2019).

The leadership of the future thus depends on a dual capability: technological competence and humanistic wisdom. Verhezen (2019) defines this synthesis as wise leadership—a form of stewardship that integrates cognitive intelligence, emotional sensitivity, and ethical reflection. Leaders in the AI era must navigate the interplay between algorithmic systems and human judgment, ensuring that technological advancement reinforces rather than replaces human values. This balance requires cultivating empathy, adaptability, and self-awareness—qualities that remain beyond the reach of machine cognition (Lemaignan, Warnier, Sisbot, Clodic, & Alami, 2017).

1.2 Historical and Theoretical Context

Human civilization has consistently reinvented the meaning of leadership alongside technological progress. The first three industrial revolutions were defined by steam, electricity, and computing; the fourth by cyber-physical intelligence (Park et al., 2017). As Haenlein and Kaplan (2019) explain, AI systems today range from narrow AI—designed for specialized tasks—to visions of general or superintelligent AI, capable of reasoning beyond human boundaries. These developments amplify not only productivity but also ethical and existential questions, as raised by Lane (2022): if machines can think, what remains distinctively human about leadership?

In this context, scholars emphasize that leadership identity is dynamic and influenced by contextual and developmental forces (Miscenko, Günter, & Day, 2017). Leader identity evolves through self-perception, experience, and interaction with organizational systems—now including AI as a significant agent of change. As organizations increasingly rely on algorithmic decision support, leaders must redefine their roles, autonomy, and sources of legitimacy (Lingam & Vanishree, 2024; Peifer, Jeske, & Hille, 2022). Leadership becomes a process of orchestrating human-machine collaboration, where trust, communication, and purpose are reconstituted through technological mediation.

1.3 Challenges and Ethical Considerations

AI adoption also exposes leaders to new ethical dilemmas. Algorithmic decision-making can perpetuate structural biases or erode transparency if not properly governed (Luca et al., 2019). Ethical leadership in this context involves creating governance frameworks that safeguard fairness, accountability, and human dignity (Capgemini Research Institute, 2019). Moreover, the integration of AI necessitates organizational culture shifts that promote learning, openness, and ethical reflection

(Park et al., 2017; Deloitte, 2019). As Finlay (2018) and Dennison (2023) argue, the most successful organizations will be those whose leaders bridge the gap between technological literacy and moral responsibility—cultivating a climate where innovation serves both economic and social progress.

1.4 Research Gap and Purpose of the Study

Despite abundant literature on AI's technical applications, empirical studies examining its influence on leadership practice and identity remain scarce. Most existing research focuses on technological adoption, process optimization, or performance metrics rather than on how AI transforms leadership cognition, ethics, and behavior (Günter et al., 2017; Shadman, 2023). In response to this gap, the present study investigates the impact of AI integration on leadership from the perspective of leadership experts, exploring both opportunities and concerns associated with this transformation.

This qualitative research, grounded in a social constructivist paradigm (Creswell, 2007; Moustakas, 1994), employs semi-structured interviews with experienced leaders across sectors. The study aims to (1) identify perceived benefits of AI in leadership processes, (2) examine emerging challenges and ethical implications, and (3) determine strategies leaders use to integrate AI responsibly into their decision-making. By capturing leaders' lived experiences, the research contributes to a deeper understanding of how AI reshapes leadership identity, competence, and organizational culture.

1.5 Significance and Contribution

The significance of this research lies in its dual contribution to theory and practice. Theoretically, it advances the discourse on AI-driven leadership evolution, extending leadership theory into the domain of intelligent technologies. Practically, it provides actionable insights for executives, educators, and policymakers striving to implement AI ethically and effectively. The findings will illuminate how leaders perceive the balance between human agency and algorithmic decision-making, offering guidance for developing ethical, adaptive, and visionary leadership models in the age of intelligent transformation.

Ultimately, as Finlay (2018) asserts, “those who can harness AI to solve business problems will thrive at the expense of their competitors.” Yet, the true challenge for contemporary leadership is not technological adoption but human alignment—ensuring that intelligence, whether artificial or natural, serves a shared purpose of innovation, responsibility, and human flourishing.

2 Theoretical Background

The theoretical framework of this study builds upon established theories of leadership and contemporary research on artificial intelligence (AI) as an emerging force in organizational transformation. This section examines the evolution of leadership concepts, the development and typology of AI, and the intersection between technological progress, ethics, and leadership identity. By synthesizing these dimensions, it provides the conceptual foundation for understanding how AI influences leadership practices in modern organizations.

2.1 Leadership Theory and Evolution

Leadership has evolved alongside the social, economic, and technological development of human civilization. Early theories—such as trait and behavioral models—focused on identifying the inherent characteristics that differentiate effective leaders from followers (Bass & Bass, 2008; Northouse, 2016). As understanding of organizations matured, new paradigms emerged, emphasizing relational, situational, and moral dimensions of leadership.

The rise of transformational and authentic leadership in the late 20th century marked a paradigm shift from authority-based to values-driven leadership (Lovelace, Neely, Allen, & Hunter, 2019). Leadership became understood as a social process—not merely a position of power but an evolving interaction shaped by followers, context, and culture. According to Miscenko, Günter, and

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Day (2017), leader identity develops dynamically through reflection, feedback, and self-perception, suggesting that leadership is not fixed but constructed through experience.

This dynamic perspective aligns with constructivist approaches to organizational research (Creswell, 2007), recognizing leadership as a process of continuous adaptation to environmental and technological change. As the organizational environment becomes increasingly digital and data-driven, traditional leadership competencies must expand to include technological literacy, ethical awareness, and the ability to manage human–machine collaboration.

2.2 *Artificial Intelligence: Definitions and Dimensions*

Artificial Intelligence (AI) represents the most significant technological innovation shaping contemporary management and leadership. It is defined as “the science and engineering of making intelligent machines” (McCarthy, 1956), encompassing algorithms and systems capable of performing tasks that typically require human cognition—such as reasoning, learning, perception, and decision-making (Haenlein & Kaplan, 2019).

AI can be classified according to its scope and autonomy:

- Narrow AI, which performs specific functions within defined parameters (e.g., chatbots, voice assistants).
- General AI, capable of abstract reasoning and adaptive learning,
- and the theoretical Artificial Superintelligence, which surpasses human cognitive abilities (Yao, Jia, & Zhou, 2018).

Modern organizations increasingly rely on AI-driven analytics, machine learning, and predictive algorithms to enhance strategic decision-making, operational efficiency, and innovation capacity (Finlay, 2018; Gupta, Modgil, Bhattacharyya, & Bose, 2022). However, AI is not solely a tool for optimization—it is a catalyst for redefining leadership roles and responsibilities, introducing new ethical, cognitive, and emotional challenges.

2.3 *The Fourth Industrial Revolution and Organizational Transformation*

The Fourth Industrial Revolution (4IR), as conceptualized by Schwab (2017), integrates digital, biological, and physical systems into a unified technological ecosystem. Within this transformation, AI serves as the driving force that connects automation, data analytics, and human decision-making (Park, Shin, Park, & Lee, 2017).

AI adoption requires more than technological capability—it necessitates a new culture of quality, innovation, and ethical leadership (Park et al., 2017; Lima & de Castro, 2019). Organizations must shift from linear hierarchies toward networked, adaptive structures where leaders orchestrate interactions between humans and intelligent systems. This evolution compels leaders to address tensions between efficiency and humanity, control and empowerment, and automation and creativity (Dennison, 2023).

Moreover, as Lin (2022) and Deloitte (2019) highlight, the success of digital transformation depends not merely on infrastructure or software, but on leadership culture—the ability to guide people through uncertainty while maintaining trust and ethical integrity. Leadership in the 4IR therefore requires a combination of technological vision and humanistic stewardship.

2.4 *Leadership in the Age of Artificial Intelligence*

The convergence of AI and leadership studies has given rise to new frameworks that conceptualize leadership as a symbiotic relationship between humans and machines. Daugherty and Wilson (2018) describe this phenomenon as “human + machine collaboration”, where leaders utilize AI to expand analytical capacity, creativity, and foresight.

Under this paradigm, leadership becomes augmented rather than automated—a process in which AI enhances, rather than replaces, human decision-making. Verhezen (2019) argues that true effectiveness in the AI era depends on wise leadership, a model integrating rational analysis, emotional

intelligence, and ethical awareness. This echoes Deloitte's (2019) call for a new kind of leader: technologically literate, ethically grounded, and socially empathetic.

Empirical evidence supports these conceptual insights. Studies by Peifer, Jeske, and Hille (2022) and Lingam and Vanishree (2024) demonstrate that AI influences leadership identity by reshaping decision authority, information flows, and interpersonal dynamics. As AI systems mediate communication, performance evaluation, and resource allocation, leaders must renegotiate their autonomy and legitimacy. Consequently, leadership in the AI era is best understood as adaptive orchestration, where human empathy, ethics, and creativity harmonize with machine intelligence.

2.5 Ethical, Psychological, and Cultural Dimensions

The ethical dimension of AI-driven leadership is central to understanding its organizational implications. As Luca, Kleinberg, and Mullainathan (2019) emphasize, algorithmic decision-making can perpetuate bias and opacity if not governed responsibly. Ethical leadership, therefore, demands frameworks that promote transparency, fairness, and accountability (Capgemini Research Institute, 2019).

Psychologically, AI affects how leaders and followers perceive control, competence, and trust. Algorithmic systems may influence feedback loops, evaluation standards, and identity formation—factors previously shaped by human judgment (Miscenko et al., 2017; Günter, Miscenko, & Day, 2017). This reconfiguration requires leaders to cultivate emotional intelligence and empathy, ensuring that technological systems serve human development rather than constrain it.

Culturally, AI adoption entails profound change. As Park et al. (2017) and Deloitte (2019) note, successful integration depends on cultivating a learning-oriented and ethically conscious culture, where experimentation and critical reflection are encouraged. Lane (2022) advances this debate by questioning the boundaries of consciousness and artificial reasoning, urging leaders to reaffirm human distinctiveness in an era of intelligent automation.

2.6 Conceptual Synthesis and Research Gap

The synthesis of leadership theory and AI research reveals both potential and fragmentation. While prior studies extensively document AI's technical and operational benefits (Finlay, 2018; Gupta et al., 2022; Shadman, 2023), fewer explore how it reconfigures leadership cognition, ethics, and identity. The literature remains limited in explaining the subjective experience of leaders navigating AI adoption in real-world contexts.

This study addresses that gap by exploring how leadership experts perceive AI's influence on their work, values, and decision processes. Anchored in the social constructivist paradigm (Creswell, 2007) and phenomenological inquiry (Moustakas, 1994), the research views leadership as a lived and evolving phenomenon. By integrating insights from leadership theory, organizational ethics, and technology studies, this framework positions AI not as a replacement for human leadership but as a partner in shaping a new, ethically grounded, and intelligent form of leadership.

3 Methodology

The methodological design of this study reflects the aim to explore how artificial intelligence (AI) influences leadership practices from the perspective of leadership experts. Rooted in a qualitative and constructivist paradigm, the research seeks to capture the subjective meanings, experiences, and interpretations that leaders ascribe to their interaction with AI in the context of managerial decision-making.

3.1 Research Paradigm

This study adopts a social constructivist paradigm (Creswell, 2007), which assumes that reality is constructed through human experience and social interaction. Knowledge, in this sense, is not discovered but co-created through dialogue, reflection, and context.

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Given that leadership and AI are both dynamic and socially embedded phenomena, this paradigm allows for a nuanced understanding of how leaders interpret technological change and integrate it into their professional identity. The interpretive nature of constructivism enables the researcher to focus on the subjective dimension of leadership, recognizing that perceptions of AI are influenced by cultural, ethical, and experiential factors.

3.2 Research Design

The study employs a qualitative research design based on semi-structured, in-depth interviews with leadership professionals. The qualitative approach is particularly suitable for exploring emerging and complex phenomena such as the impact of AI on leadership, where contextual understanding and individual interpretation are critical (Moustakas, 1994; Creswell, 2009).

The design follows the principles of grounded theory, which emphasizes generating theoretical insights from the data rather than testing predetermined hypotheses. The process involved iterative data collection and analysis, allowing categories and themes to emerge naturally from participants' narratives (Glaser & Strauss, 1967).

The interview guide was developed based on a comprehensive review of literature on AI and leadership (Finlay, 2018; Verhezen, 2019; Peifer et al., 2022) and focused on five core thematic areas:

1. perceptions of AI in leadership,
2. changes in decision-making processes,
3. ethical and emotional challenges,
4. organizational adaptation, and
5. future leadership competencies.

3.3 Participants

The research sample consisted of seven interviewees, all of whom occupy leadership positions across different sectors, including information technology, education, and service industries. The selection of participants was purposive, targeting individuals with substantial managerial experience and exposure to AI-related technologies in their work environments.

The initial research plan envisioned ten interviews; however, after seven interviews, theoretical saturation was reached—meaning that additional interviews no longer produced new insights or themes (Creswell, 2007; Marshall, Cardon, Poddar, & Fontenot, 2013). Qualitative research prioritizes depth over breadth, and as Marshall et al. (2013) suggest, a sample size of 5–25 participants is sufficient for achieving data richness in semi-structured interviews.

The age of participants ranged from 30 to 59 years, with the majority (three participants) between 40–49 years, two between 30–39 years, and two between 50–59 years. This distribution represents primarily mid-career leaders with substantial professional experience and openness to technological change.

All participants were male, which reflects the ongoing gender imbalance in higher leadership roles both in Slovenia and globally (Daugherty & Wilson, 2018; Deloitte, 2019).

In terms of education, five participants held master's degrees, one held a doctorate, and one had a higher education diploma. This indicates a highly educated sample, ensuring informed and reflective responses regarding AI and leadership.

Participants' roles varied across the organizational hierarchy: one was a department head, two were middle managers, three were executive directors or board members, and one was a self-employed consultant. The diversity of roles provided a multilevel perspective on leadership—from strategic to operational levels. Most participants had over ten years of managerial experience, positioning them as experts capable of offering mature reflections on leadership transformation in the era of AI. This diversity of perspectives contributed to a comprehensive understanding of how AI is reshaping leadership behavior, ethics, and organizational culture.

3.4 Data Collection

Data were collected through semi-structured interviews, allowing participants to express their experiences freely while maintaining focus on key research themes. The interviews were conducted in person or via secure online platforms, depending on participant availability and geographic location.

Each interview lasted between 45 and 60 minutes, and all were recorded with participants' consent to ensure accuracy in transcription and analysis. Questions were open-ended, inviting participants to discuss their views on AI's role in decision-making, communication, ethics, and human-machine collaboration. The interview questions, as presented in the Slovenian project documentation, served as a flexible guide rather than a rigid script, enabling deep exploration of themes while allowing new insights to emerge organically. All transcripts were anonymized to ensure confidentiality.

3.5 Data Analysis

The collected qualitative data were analyzed using the principles of thematic analysis, which is one of the most suitable methods for exploring patterns of meaning across textual data (Braun & Clarke, 2006). The goal of this analytical approach was to identify, organize, and interpret recurring ideas and perspectives regarding the influence of artificial intelligence (AI) on leadership practices.

The analysis followed a manual, iterative process, emphasizing immersion in the data and continuous reflection. Each interview transcript was read multiple times to ensure a comprehensive understanding of participants' experiences and viewpoints. The researcher made analytic notes and short memos, highlighting phrases, metaphors, and statements that captured essential perceptions related to leadership transformation, ethical considerations, and collaboration with AI systems.

Through progressive comparison of the transcripts, similar ideas were grouped into initial conceptual categories, such as AI as a decision-support tool, ethical and emotional dilemmas, trust in algorithms, and transformation of leadership roles. These categories were further refined through a process of interpretive synthesis, which sought to connect the participants' insights into broader conceptual themes.

The final stage of the analysis involved defining and naming the core thematic dimensions that emerged across all interviews. These included:

1. The integration of AI in managerial decision-making.
2. Perceived ethical challenges and trust dynamics.
3. The redefinition of leadership identity and authority.
4. Collaboration between human intuition and machine intelligence; and
5. The emerging competencies required for future leaders.

Each theme was supported by direct quotations from participants to ensure transparency and authenticity of interpretation. These quotations were anonymized and referenced numerically (e.g., Participant 3), preserving confidentiality while illustrating the depth and nuance of the participants' reflections.

The analysis process was guided by reflexivity—a continuous awareness of the researcher's role in interpreting meanings—and aimed to maintain a balance between description and interpretation. Rather than quantifying responses, the analysis sought to capture the richness, complexity, and diversity of subjective experiences among leadership experts as they navigate the integration of AI into their organizational environments.

This interpretative approach aligns with the constructivist orientation of the study, which recognizes that meaning is co-created through interaction between the researcher and participants (Creswell, 2007). The outcome of this process is a set of empirically grounded and conceptually coherent themes that form the basis of the Results and Discussion section presented in the following chapter.

3.6 *Validity, Reliability, and Ethical Considerations*

To ensure trustworthiness and rigor, the study adhered to the criteria proposed by Lincoln and Guba (1985):

- Credibility was ensured through prolonged engagement with the data and triangulation across participants.
- Transferability was supported by providing thick descriptions of context and participant characteristics.
- Dependability and confirmability were reinforced through detailed documentation of coding procedures and researcher reflexivity.

Ethical integrity was maintained in accordance with the European Code of Conduct for Research Integrity (ALLEA, 2017). All participants were informed of the research objectives, assured of anonymity, and granted the right to withdraw at any time. Consent was obtained prior to recording interviews.

The research posed minimal ethical risk, as it explored professional perspectives rather than personal or sensitive issues. Nonetheless, care was taken to ensure that participants' identities and organizational affiliations remain confidential.

All participants were informed about the research objectives, procedures, and the voluntary nature of their participation. Prior to each interview, they provided written informed consent confirming their willingness to participate and to have the conversation recorded for research purposes. The consent forms explicitly stated that participation was anonymous, that responses would be used solely for academic analysis, and that participants retained the right to withdraw from the study at any point without any consequences.

3.7 *Summary*

In summary, this study employs a qualitative, interpretive, and grounded approach to explore how AI impacts leadership from the standpoint of experienced professionals. The methodological design emphasizes contextual depth, ethical integrity, and analytical rigor, thereby ensuring that the findings provide both theoretical insight and practical relevance.

The next section presents the Results and Discussion, highlighting the key themes derived from the interviews and interpreting them through the theoretical lenses established in the previous chapter.

4 *Results and Discussion*

The analysis of seven semi-structured interviews revealed five overarching themes that describe how leaders perceive and experience the influence of artificial intelligence (AI) in their organizations. These themes capture both the transformative potential and the ethical and human challenges associated with AI integration in leadership practices. Illustrative quotations are used throughout this section to represent the diversity of perspectives rather than to quantify responses.

4.1 *AI as a Support in Managerial Decision-Making*

All participants recognized AI as a valuable analytical tool that assists in decision-making and strategic foresight. The technology was perceived as enhancing leaders' cognitive capacity by processing large volumes of data and identifying trends that inform complex business decisions.

"AI helps me structure decisions more efficiently and reduces uncertainty." (Participant 2)
"It saves me time by sorting through data and showing what really matters for our clients." (Participant 5). Most participants described AI as a complement to human judgment, not as a replacement. They emphasized that leadership still requires moral reasoning, emotional sensitivity, and contextual understanding that AI cannot replicate.

"Even the best algorithm can't sense the emotions in a meeting or the mood of a team." (Participant 4)

These observations are consistent with Finlay (2018) and Daugherty & Wilson (2018), who argue that AI amplifies, rather than replaces, human decision-making through human + machine collaboration. Leaders thus perceive AI as an intelligent assistant, one that improves objectivity and efficiency but still depends on human interpretation and values.

4.2 Ethical Challenges and Trust in AI

Ethical concerns were mentioned by nearly all participants, particularly regarding data privacy, algorithmic transparency, and bias. Many leaders expressed uncertainty about the fairness and reliability of AI-generated insights, especially when algorithms influence performance evaluation or hiring decisions.

“The biggest risk is trusting a system we don’t really understand.” (Participant 3)

“I always ask: who is responsible when AI makes a wrong prediction—the tool or the leader?” (Participant 6)

Several respondents also pointed out that ethical responsibility ultimately lies with human leaders. As one participant emphasized:

“Leaders must stay accountable; AI should never be the excuse for a bad decision.” (Participant 1). These reflections confirm Luca, Kleinberg, and Mullainathan (2019), who warn against uncritical reliance on opaque algorithmic systems. Ethical leadership, therefore, becomes central to responsible AI adoption. As Verhezen (2019) notes, wise leadership demands not only analytical intelligence but also moral discernment and humility. Participants agreed that transparency and education are vital to maintaining trust in AI-assisted decision-making.

4.3 Transformation of Leadership Identity and Style

Most participants observed that the integration of AI has changed how they understand their leadership identity. The traditional image of the leader as an authority figure is being replaced by one of a facilitator, interpreter, and communicator between technology and people.

“Leadership today is more about translating information than giving orders.” (Participant 4)

“I see my role shifting from decision-maker to sense-maker.” (Participant 7)

Participants described the emergence of a new leadership style characterized by adaptability, openness, and collaboration. Many also reported that AI encourages more data-informed discussions within teams, which can enhance inclusivity and shared ownership of decisions.

“You can’t lead through intuition alone anymore—teams expect evidence.” (Participant 5)

These insights echo Miscenko, Günter, and Day (2017), who propose that leadership identity evolves through reflection and context. Similarly, Deloitte (2019) emphasizes that the digital age demands augmented leadership—leaders who combine analytical reasoning with emotional intelligence. The findings thus indicate that AI does not diminish the human aspect of leadership but reshapes it toward a more relational and interpretive form.

4.4 Human–Machine Collaboration and Organizational Adaptation

Another central theme concerned how organizations adapt to AI integration. Participants agreed that technology itself is not the primary challenge—organizational culture is. Successful implementation depends on open communication, trust, and willingness to learn.

“Technology isn’t the problem. People’s fear of it is.” (Participant 5)

“We needed to explain that AI isn’t replacing anyone—it’s helping us work smarter.” (Participant 7)

Most respondents highlighted that leaders must play a bridging role, guiding teams through digital transformation and fostering understanding between human and technological systems. This involves continuous learning, empathy, and transparent dialogue.

“Our main task is to help people see AI as an opportunity, not a threat.” (Participant 3)

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These findings mirror Park et al. (2017), who argue that the Fourth Industrial Revolution requires cultural innovation alongside technological advancement. They also align with Lingam and Vanishree (2024), who show that trust and learning are decisive factors for effective human–machine collaboration. Overall, participants emphasized that the human element—communication, trust, and ethics—remains the foundation of successful AI adoption.

4.5 Future Leadership Competencies

Participants were nearly unanimous that the rise of AI necessitates a new set of leadership competencies. The most frequently cited were:

- Digital and analytical literacy,
- Ethical and social responsibility,
- Adaptability and resilience, and
- Empathy and communication across human–machine interfaces.

“Future leaders won’t need to code, but they must understand what algorithms mean for people.” (Participant 2). “Being human will become the leader’s main competitive advantage.” (Participant 6)

Several participants also highlighted lifelong learning as a critical requirement. AI evolves rapidly, and leaders must be prepared to constantly update their understanding of both technology and its ethical implications.

These perspectives are consistent with Peifer, Jeske, and Hille (2022), who emphasize interpretive and relational intelligence as core to leadership in the AI era. Similarly, Daugherty and Wilson (2018) argue that collaborative intelligence—the ability to combine human intuition with machine precision—will define successful leadership in the future.

4.6 Summary of Key Insights

This study demonstrates that leaders perceive AI as a dual-edged transformation: a source of strategic advantage and a catalyst for ethical and human reflection. Five key insights summarize the findings:

1. AI enhances but does not replace human leadership, serving as a strategic and analytical support.
2. Ethical leadership and trust are essential for responsible AI integration.
3. Leadership identity is evolving toward facilitation, interpretation, and collaboration.
4. Organizational culture determines the success of AI adoption more than technology itself.
5. Future leadership depends on continuous learning, digital literacy, and human empathy.

These results reinforce the theoretical propositions of Verhezen (2019), Finlay (2018), and Daugherty & Wilson (2018), confirming that the future of leadership lies not in technological substitution but in human–machine symbiosis. AI compels leaders to reimagine their roles—not as controllers of intelligence but as stewards of ethical and collective wisdom.

5 Discussion and Conclusion

The findings of this study reveal that the integration of artificial intelligence (AI) into leadership is not a purely technological evolution but a paradigmatic transformation in how leaders think, decide, and relate to others. The qualitative insights gathered from seven leadership experts confirm that AI serves as both an enabler and a disruptor—enhancing analytical precision while challenging established notions of authority, ethics, and identity.

This discussion integrates empirical results with the theoretical perspectives developed in earlier sections, offering a multidimensional interpretation of what leadership means in the age of intelligent machines.

5.1 Theoretical Implications

From a theoretical standpoint, this study advances leadership research by demonstrating that AI accelerates the shift from individual-centered to relational and interpretive models of leadership. Traditional leadership theories—grounded in traits, behavior, or transformation (Bass & Bass, 2008; Northouse, 2016)—conceived leadership as a primarily human process. However, the emergence of AI challenges this anthropocentric view.

The data show that leaders no longer act solely as decision-makers but as sense-makers, mediating between human and machine cognition. This reconfiguration supports the theoretical propositions of Verhezen (2019) and Daugherty & Wilson (2018), who describe a new hybrid paradigm of collaborative intelligence. In this model, leadership involves orchestrating the interplay between human insight and algorithmic reasoning.

Furthermore, the study contributes to the discourse on leadership identity (Miscenko, Günter, & Day, 2017), revealing that leaders reconstruct their self-concept through interaction with AI. Leadership identity becomes dynamic and situational—anchored not only in experience and ethics but also in the ability to interpret data, evaluate algorithms, and maintain human authenticity in a technologically mediated environment.

This research thus supports a constructivist understanding of leadership as a social process shaped by context, meaning-making, and adaptation (Creswell, 2007). It bridges classical leadership theory with the emerging field of AI ethics and digital humanism, enriching the conceptual vocabulary with notions such as algorithmic trust, interpretive agency, and ethical reflexivity.

5.2 Practical Implications

The study also offers several practical implications for organizations and leadership development. First, the results underscore that AI should be viewed as a strategic partner, not merely a technological asset. Leaders must cultivate digital literacy sufficient to understand how algorithms generate insights, but also ethical literacy to evaluate their implications.

Training programs for leaders should therefore integrate technological, analytical, and ethical dimensions—teaching leaders not how to code, but how to question, interpret, and ethically deploy intelligent systems.

Second, the findings indicate that organizational culture plays a decisive role in AI implementation. Technological change without cultural readiness leads to resistance and mistrust. Leaders should thus focus on communication, transparency, and participatory education, enabling employees to see AI as an ally in improving work quality rather than a threat to employment.

Third, the research points to the growing importance of empathy and emotional intelligence in the digital age. As algorithms assume analytical tasks, leaders must reinforce the human dimensions of trust, compassion, and meaning-making—dimensions that no machine can replicate. This echoes the argument of Verhezen (2019) that the future of leadership lies in wisdom, not control.

Policymakers and business schools could integrate AI ethics and digital literacy into leadership education programs. National or EU-level initiatives (such as the Digital Europe Programme) could play a role in standardizing such competencies, ensuring that future leaders combine technological proficiency with moral integrity.

5.3 Ethical Considerations

The findings reaffirm that ethical leadership is the cornerstone of responsible AI integration. Participants emphasized the necessity of transparency, fairness, and accountability. Leaders must act as custodians of ethical governance, ensuring that algorithmic decisions respect human dignity and do not perpetuate bias.

This echoes the call of Luca, Kleinberg, and Mullainathan (2019) for leaders to understand the mechanisms behind AI systems rather than rely blindly on their outputs. In practice, this means

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embedding ethics-by-design principles in AI governance and promoting open dialogue between technologists, managers, and employees.

By doing so, leaders can create organizations that are both technologically advanced and ethically resilient, capable of innovation without sacrificing moral integrity.

5.4 *Limitations and Directions for Future Research*

Like all qualitative studies, this research has limitations that open avenues for further inquiry. The sample size was deliberately small, focusing on seven experienced leaders to achieve depth rather than breadth of insight. While this approach yielded rich data, future studies could expand the participant base across industries and cultural contexts to enhance transferability.

Moreover, the data were analyzed interpretively without the use of specialized software such as NVivo; future research could apply systematic coding techniques or mixed methods to triangulate findings quantitatively. Comparative studies could also explore differences in leadership adaptation between AI-intensive industries (e.g., IT, finance) and human-centered sectors (e.g., education, healthcare).

Finally, longitudinal research could track how leadership identity evolves over time as AI systems become more autonomous and embedded in organizational life. Combining qualitative interviews with surveys would also allow for comparative analysis across industries and demographics.

5.5 *Conclusion*

In conclusion, this study confirms that artificial intelligence is not diminishing leadership—it is redefining it. AI challenges leaders to become interpreters of complex systems, ethical guardians of technology, and architects of human–machine collaboration. The essence of leadership in the AI era lies not in mastering technology but in mastering the relationship between technology and humanity.

Leaders of the future will thrive not because they outthink machines, but because they bring meaning, values, and empathy to intelligent systems. As Finlay (2018) observed, those who harness AI to solve problems ethically and creatively will shape the organizations of tomorrow.

Ultimately, the rise of AI reaffirms a timeless truth: leadership remains a profoundly human endeavor. Technology can extend our cognitive reach, but only wisdom, compassion, and moral courage can guide progress toward a just and sustainable future.

Acknowledgement

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A COMPARATIVE STUDY ON EPISODES OF FINANCIAL TURMOIL: INSIGHTS FROM THE DOTCOM BUBBLE, 2008 CRISIS, AND CRYPTOCURRENCY ERA

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Abstract: *This paper examines the recurring dynamics of financial crises through a comparative case study of the Dotcom bubble, the 2008 global financial crisis, and the ongoing cryptocurrency era. The objective is to investigate whether cryptocurrencies represent a genuine financial revolution or a repetition of past speculative manias. Using a qualitative methodology, the study applies a behavioral finance framework to analyse biases such as herding, overconfidence, and FOMO, and combines this with the evaluation of market data, including IPO trends, interest rates, and volatility indices.*

The results reveal strong equivalents across all three cycles. In each case, investor sentiment amplified volatility, and speculative assets obscured true risk. Weak regulation left markets vulnerable to collapse. Today's ICOs are a reflection of IPOs in the Dotcom bubble, meanwhile the regulatory faults in 2008 find similarities in decentralized finance (DeFi). Moreover, the evidence challenges the Efficient Market Hypothesis, which markets illustrate collective perceptions instead of objective fundamentals. The findings suggest that financial markets repeat inefficiencies in new forms. Cryptocurrencies risk becoming another phase in the history of financial instability without coordinated regulation, investor education, and macroprudential monitoring.

Keywords: *investor sentiment, DeFi, Dotcom bubble, 2008 Financial Crisis, Cryptocurrency*

1 Introduction

Today's finance undoubtedly changes from traditional finance to a new era. The big examples of these are cryptocurrencies and derivatives. People try to learn topics related to the cryptocurrency field and make investment decisions to get capital gain from their trading. In this article we dive deep into the similarities between Dotcom and the 2008 financial crisis and today's cryptocurrency era.

To begin with, the shift in how we perceive and engage with financial systems is becoming more visible with every passing day. What was once dominated by banks and centralised institutions is now being challenged by blockchain-based innovation and decentralised finance. But with every revolution comes the question: Are we genuinely moving forward, or are we circling back to the mistakes of the past? In the late 1900's and beginning of 2000's, two main shocks gave the investing world a great lesson or perhaps not. Twenty-five years ago on Monday, a multiyear US stock rally hit its peak and began a precipitous decline that would wipe 77 percent off the value of the Nasdaq by the time it finally cratered two years later (Fan, Y. 2022). These days, the dotcom bubble has become shorthand for irresponsible enthusiasm for new technology and blind greed.

This historical reference is more than just a case study, it also serves as a warning. The dotcom boom deceived investors with dreams of wealth fueled by innovation, but when the excitement faded and fundamentals failed to support valuations, the collapse was inevitable. This is the kind of irrational optimism we must watch for in today's digital assets.

1.1 Historical Background

After experiencing the dot-com bubble and the 9/11 attacks, the U.S. economy was facing significant uncertainty marked by slowed economic growth. The Federal Reserve drastically lowered interest rates from 6.5% to 1% in early 2001 to early 2003, in hope of encouraging borrowing, investment and spending. This became the direct cause of the radical increase in U.S. mortgage lending as real estate became easier to afford (Wentao Zhang, 2024). Reckless lending led to record numbers of loans in default (Federal Reserve Bank study, 2008). As they are bundled together, the general losses resulted in many financial institutions failing and requiring a governmental bailout.

The outcome was a full-blown financial crisis that shows how policy reactions to one bubble can mistakenly lead to the next crisis. These domino effects reveal the interconnected nature of global finance and how human behavior increases systemic risks. Now the question is: "Are we seeing the same foundation being laid in the crypto world?" Today the consistency in the spreading of cryptocurrency is reminding us of some of these past global shocks' early periods. Since the inception of Bitcoin in 2009, the crypto market has expanded exponentially, and among the hundreds of metrics, the CMC 200 Index stands out as a representative benchmark, capturing the performance of the top 200 cryptocurrencies by market capitalization. The crypto market recently faced a significant crash, which caused anxiety in the market (Solactive, 2019). What were the reasons for this sudden downturn, and what deeper issues lie beneath the surface?

Just like the early days of internet stocks or subprime mortgages, digital assets today enjoy both massive interest and minimal oversight (Floridi, 2024). The rapid expansion in the number of tokens and platforms, many of them built on hype and speculative narratives, makes it difficult to separate real innovation from short-term mania. In the Dotcom bubble, volatility reflected the overvaluation of an imagined digital future. The hidden fragilities of an over-leveraged financial system were masked by an illusion of financial innovation and market confidence in 2008. In today's crypto era, volatility is not only about rapid price changes but also reflects the deeper instability of trust in evolving technologies, unpracticed governance models, and divided global regulation. What we're witnessing is a unification of the conditions, such as psychological exuberance, institutional ignorance, and the lack of regulatory focus that reflect past crises but now operate in a more decentralized and globally interconnected ecosystem. This makes the current financial world particularly vulnerable to systemic shocks. Bitcoin is not the New Gold, it is a comparison of volatility, correlation, and portfolio performance (Klein et al., 2018). The popularity of cryptocurrencies has risen significantly since Nakamoto (2008) introduced the concept of Bitcoin. Cryptocurrencies embody innovative technology, high security architecture, prosperity in functionalities, and investment opportunity as an asset, which makes them attractive for computer scientists, venture capitalists as well as investors. However, the decentralization and unregulated markets add an additional layer of uncertainty to their pricing and projection of application.

1.2. Theoretical Overview

Decentralised finance (DeFi) is an emerging financial system using blockchain and cryptocurrencies that aims to reduce costs and speed up processes (Rakesh, 2025). However, it warrants worry, especially in some developing and emerging countries, which have major risks towards crypto-induced shocks, have active crypto-markets with few regulations. The widening regulatory gap between countries negatively affects the convergence of international financial institutions and standard-setting bodies (Guo & Zhang, 2024). The contradiction between the nature of cryptocurrencies and the regulatory obligations forms a unique dilemma for regulators (Kanu, 2025). Without a unified global framework, countries remain exposed to cross-border financial risks, particularly when speculative booms end in sudden busts. For fragile economies, this could lead to financial disaster. This paper examines the question of "Are we truly standing on the edge of a financial revolution with cryptocurrencies, or are we unknowingly caught in a digital repetition of past financial

manias?”. In order to understand and reveal this question, we are going to use the behavioural finance concepts to show the overconfidence and herd behaviour of the market participants with a case study approach. The goal is to determine lessons that remain applicable today, understanding why rational investors often fail to learn from history and how the future of finance may be shaped by such biases.

Some fundamental questions about the validity of the Efficient Market Hypothesis, which assumes that markets always reflect all available information, are also raised with these behavioral inefficiencies. In reality, what markets often reflect is not the objective truth, but collective perception, which is often objectively flawed. As Howard Marks stated: “I believe the market accurately reflects not the truth, which is what the efficient market hypothesis says, but it accurately and efficiently reflects everybody’s opinion as to what’s true.” Ultimately, the lessons of the past are not just history, they are warnings disguised as new digital faces. We’ve seen bubbles before, and they always look revolutionary until they burst. Whether crypto turns out to be a new era or a digital déjà vu depends on whether the world can finally learn from its own economic storytelling.

2. METHODOLOGY

2.1 Research approach

This study applies a qualitative research method based on content analysis of media reports and literature review to examine the underlying causes and consequences of financial crises, to assess their relevance for today’s cryptocurrency markets, and to learn how to avoid similar mistakes in today’s world. The focus is on two historical cases, which are the dot-com bubble and the global financial crisis of 2008, because they represent two distinct but influential periods of speculative behaviour and systemic collapse. The idea behind using a qualitative case analysis lies in the nature of the research question. The objective of this study is to analyse patterns, behavioural biases, and institutional dynamics across crises and evaluate how these lessons can be applied to the current crypto boom.

2.2 The role of biases

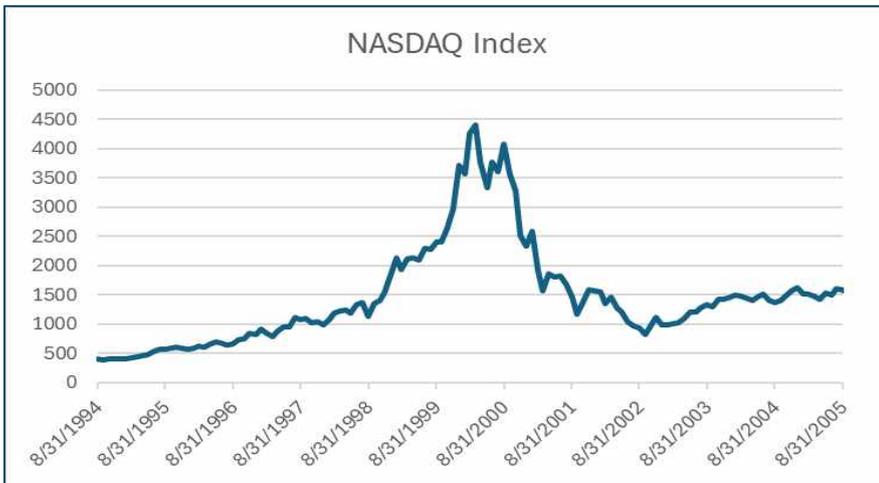
The Dotcom bubble and the 2008 financial crisis reflect how financial frenzies are not directly about the assets themselves. However, it is about behavioural patterns that distort investor judgment, and some of them also appear in today’s cryptocurrency boom (Shiller, 2000). The Dotcom bubble shows how multiple behavioural biases can interact to create unsustainable market euphoria. This could be further proven by the high volatility during that period. As can be inferred from Figure 1, NASDAQ market valuation reached ecstasy levels- approximately 400 points all the way to 4397.84 points during the peak. We can admit these results with a multitude of behavioural biases. Firstly, let’s begin with herding behaviour. As investors followed the crowd into internet IPOs, which quickly evolved into a collective fear of missing out (FOMO), a belief that sitting on the sidelines meant losing the opportunity of a lifetime (Hirshleifer, 2001). This urgency was amplified by overconfidence, as both retail investors and analysts convinced themselves that even the simplest association with the internet gives immunity from traditional valuation rules (Ofek & Richardson, 2003).

When early success stories like Amazon or eBay appeared to validate this optimism, sample size neglect set in. A few examples of success were wrongly generalized to other start-ups with unproven business models. This exaggerated belief in innovation and incorrect generalization, which had masked the fragile fundamentals, was revealed with the collapse.

Ten years later, the 2008 financial crisis happened through an interestingly similar sequence of psychological errors. As families and investors bought homes largely because rising prices suggested that “everyone else” was doing the same, the rush into real estate was again driven by herding (Shiller, 2008). This led to normalcy bias, where both lenders and regulators assume that housing prices could only continue climbing in spite of clear warning signs. On Wall Street, the creation of mortgage-backed securities developed an illusion of control. Complex financial engineering was believed to disperse and contain risk, when it only concentrated on vulnerabilities (Gorton, 2010).

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Figure 1. NASDAQ Index (1994-2005)

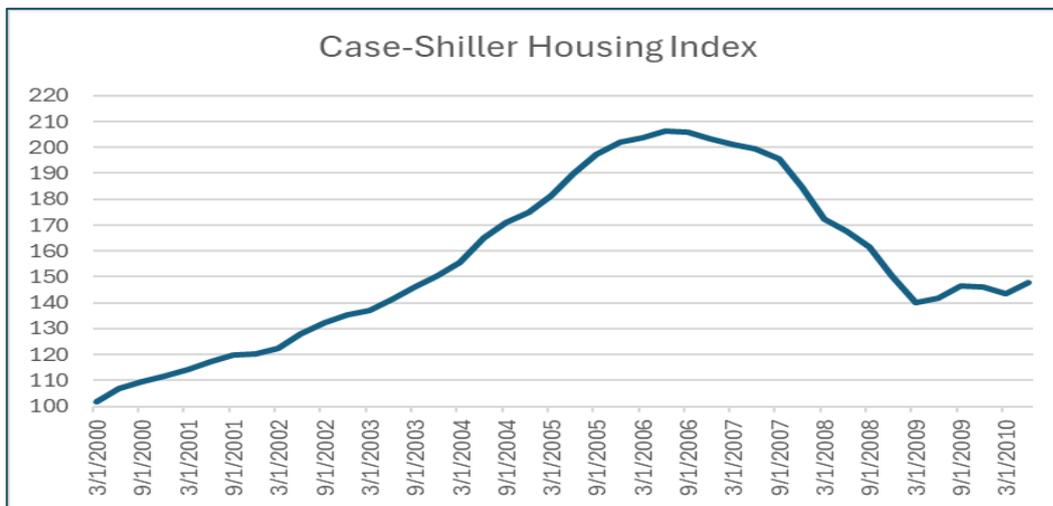


Source: Bloomberg Data 07.10.2025

As housing prices continued to increase, overconfidence also started to increase due to financial institutions underestimating the possibility of collapse as illustrated in Figure 2. Similar to Dotcom, sample size neglect also played a role, as a short history of stable mortgage performance was mistaken for proof of long-term security (Kahneman & Tversky, 1974). The crash revealed how the combination of biases had built a false appearance of stability on top of unsound models.

Figure 2. Case-Shiller Housing Index (2000-2010)

Case-Shiller Housing Index (2000-2010)



Source: Bloomberg Data 07.10.2025

Today’s cryptocurrency boom reflects many of the same behavioral patterns, which are shown through digital finance. The explosive rise of Bitcoin and other tokens has triggered widespread herding, as retail investors ran into exchanges and platforms (Baur et al., 2018). The reason for the surge itself was not derived from proven intrinsic value, instead, it was a sign of credibility. This has given rise to widespread FOMO, since investors feared missing the “next Bitcoin,” which drives speculative activity in ICOs, NFTs, and DeFi projects (Ante, 2021). The belief in blockchain technology just guarantees financial revolution mirrors the overconfidence of past eras.

On the other hand, speculative trading strategies reveal a dangerous illusion of control, and it is assumed that risk can be managed in extreme markets with limited oversight. At the same time, a persistent normalcy bias tricks stakeholders, even after repeated crypto crashes. While sample size neglect leads people to believe that short-term surges in token values can reliably forecast long-term sustainability. To sum up, these biases illustrate that the underlying factors remain the same without depending on the form, whether they are internet startups, mortgage securities or digital assets.

2.3 Investor sentiment and volatility

Behavioral biases shape individual decision-making. Their collective outcome is the most visible in the relationship between investor sentiment and market volatility (Thirumala et al., 2023). Investor sentiment during the Dotcom boom reached the highest levels of optimism, as enthusiasm for internet technologies hindered rational assessments of profitability (Ofek & Richardson, 2003). This euphoric sentiment transformed into extreme volatility on Nasdaq. It resulted with rapid surges in valuations, which were often followed by equally sharp corrections due to faltering confidence. In the 2008 financial crisis, sentiment shifted from exuberance in housing markets to sudden fear after mortgage defaults began to rise. Years of comfort were converted to panic. It produced some of the most volatile months in modern financial history.

Figure 3. IPO Deal Count (1990-2005)

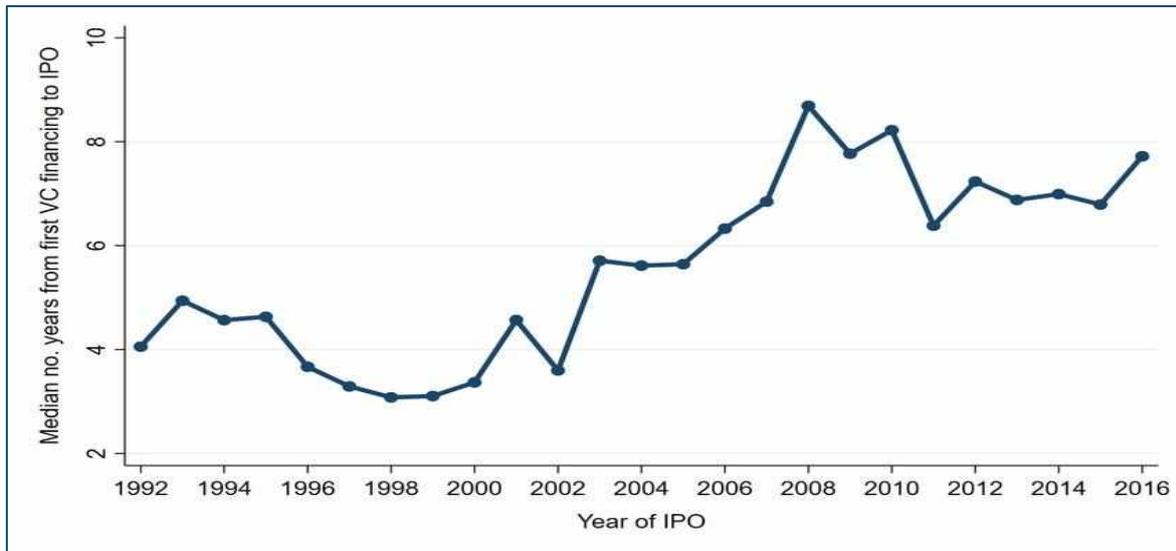


Source: Bloomberg Data 07.10.2025

As we can infer from Figure 3, the surge of IPO deals between 1999 and 2002 was a result of market euphoria (Loughran & Ritter, 2004). The confidence behind companies with a Dotcom suffix was so strong that every new start-up could have an IPO with just a single website and a deceptive marketing strategy. The rising trend of the Dotcom craze even influenced the decisionmaking of the most prestigious financial institutions. The credibility of established financial institutions, which underwrote these deals reinforced the speculative atmosphere (Ofek & Richardson, 2003). The most notable example would be Amazon.com, where it lost 90% of its share price over a period of 2 years (Rick Dagley, 2013).

To supplement the idea, The Median age of IPOs in the same period was one of the lowest in history (Figure 4). It illustrates the difference between normal market periods versus the Dotcom era. As we can see from above, in the period between 1996 and 2000 the median age of IPOs was less than 4 years, even some companies went public as soon as 16 months into their lives (Michael Ewens, 2020). By contrast, today's IPO landscape reflects a more cautious approach. Now, companies remain private for much longer, with the median age of IPOs exceeding 10 years (Liz Dunshee, 2025).

Figure 4. Median age of IPOs



Source: Michael Ewens (2020)

Overall, these patterns emphasize how the Dotcom IPO boom was not only about inflated valuations but also about the fast entry into public markets. Deal counts rose as capital flooded into amateur firms. The immaturity of companies that are going public illustrated how investor sentiment dictated market behaviour rather than fundamentals. When the bubble collapsed, the rapid decline in deal volume mirrored the loss of confidence. It shows how IPOs can serve as an indicator for speculative excess during financial uncertainty. This link between sentiment, immaturity, and volatility is not unique to the Dotcom period but has recurred in later financial manias, especially in the cryptocurrency markets (Ofek & Richardson, 2003).

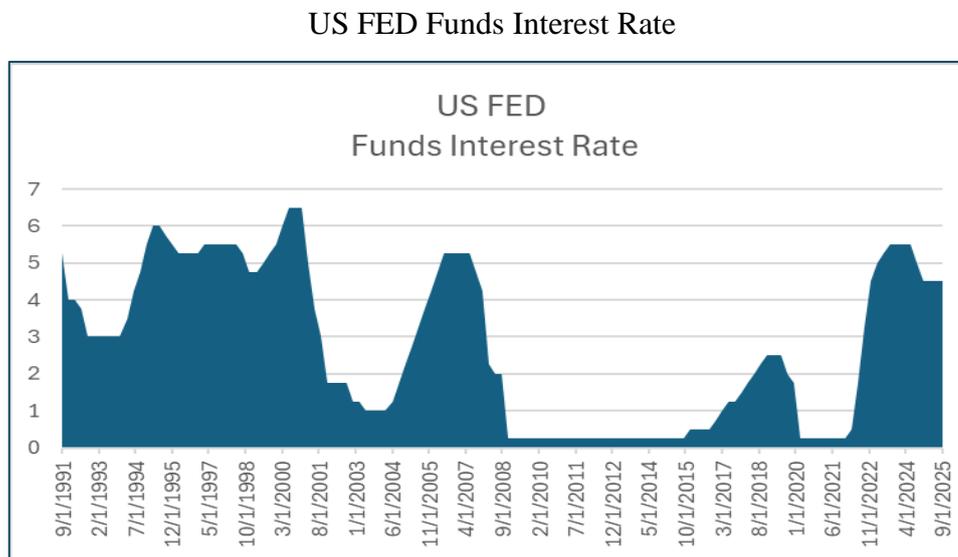
In today's cryptocurrency markets, sentiment is even more volatile, which is amplified by the dominance of retail participation and the lack of regulatory structures. Technological milestones or high-profile endorsements enhanced periods of optimism (Baur, Hong, & Lee, 2018). Asset prices soar because of those periods. Conversely, regulatory announcements or security breaches can trigger significant downturns swiftly (Guo & Zhang, 2024). The evidence from these cases claims that investor sentiment acts as a powerful factor. When it turns positive, it boosts growth far beyond fundamentals, and when it turns negative, it causes rapid collapse. Therefore, volatility is not a byproduct but a crucial feature of financial manias that reflects the fragile foundation of confidence in speculative markets. In this respect, the Dotcom IPO wave and the cryptocurrency boom are not separate stories, but chapters of the same book.

The IPO frenzy of the Dotcom era is quite similar to the surge of initial coin offerings (ICOs) and token launches in cryptocurrency markets (Ofir, 2020). It is the same in a sense that internet startups in the late 1990s were able to attract capital with little more than a business plan and a website, many crypto projects have secured funding based on little more than a white paper and speculative promises of technological disruption. The short maturity of Dotcom IPO firms, which are often just a few years old, mirrors the fast nature of ICOs. It leads to concerns about sustainability and long-term value. In both cases, public markets overflowed with hollow projects, which strengthened volatility. If we can compare the Dotcom IPO boom with the rise of ICOs, it becomes clear that speculative capital markets repeat themselves under different names. Thus, when we view them together, IPOs and ICOs serve as parallel expressions that repeatedly sacrifice stability for the promise of rapid growth.

2.4 The impact of Regulation and applications on DeFi

While both the Dotcom bubble and the cryptocurrency boom highlight the threats of unchecked market enthusiasm, the 2008 global financial crisis revealed a different dimension of instability. It showed the systemic consequences of insufficient regulation. Before the crisis, innovation of mortgage-backed securities and complex derivatives exceeded the capacity of regulators to supervise (Barberis, 2012). Although risk was dispersed in theory, it was concentrated in practice. As a result, financial institutions and investors were exposed to high risk. As the chart of U.S. Federal Reserve interest rates shows, monetary policy further magnified these dynamics. The extreme reduction of rates from 6.5% in 2001 to nearly 1% by 2003 created a rush in mortgage lending (Figure 5). Subsequently, the increases prior to 2007 added stress to a fragile housing market (Congressional Research Service, 2009). When defaults began to rise, the lack of effective safeguards caused the collapse. The regulatory gap of 2008 forced governments into bailouts to stabilise the system. The lessons from the crisis helped us to shape how we think about financial oversight today and the test of regulatory effectiveness on new innovations.

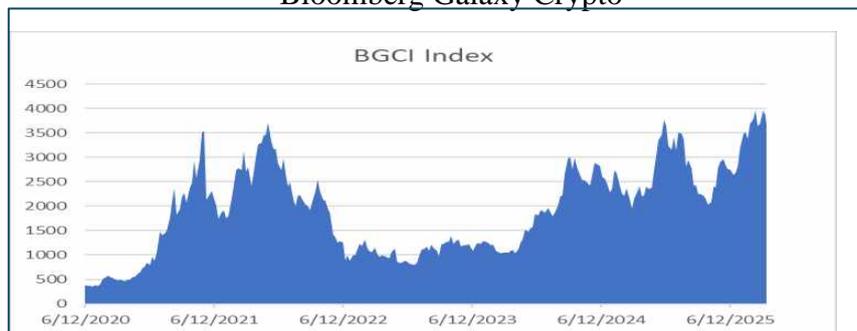
Figure 5. US FED Funds Interest Rate



Source: Bloomberg Data 07.10.2025

Today's decentralised finance (DeFi) environment repeats many of these vulnerabilities in a new technological form. Whereas the period of 2008 demonstrated the dangers of excessive faith in financial engineering within a regulated system, DeFi represents the complete opposite. It represents an intentionally unregulated system of innovations that remains unchecked. DeFi operates outside traditional oversight, which offers innovation and accessibility, but also invites fragility. It shares similarities with the 2008 crisis due to regulatory gaps and monetary policy that creates systemic risk. In addition, crypto markets follow U.S. monetary conditions as well. Rising interest rates resulted in big downturns. This is clearly reflected in the BGC Index (Figure 6), which shows sharp peaks in 2021 followed by steep declines as liquidity conditions tightened. Each subsequent rally and correction mirrors a shift in global monetary policy, which demonstrates that sentiment-driven crypto assets are highly sensitive to external shocks. This process emphasises how decentralised systems are affected by global liquidity cycles. We see that markets are left vulnerable to major failures without appropriate measures. It points to the constant tension between innovation, speculation, and regulation. These weaknesses also provide a significant perspective for questioning broader financial theories. When we think about constant market failures because of either regulatory gaps, investor sentiment, or policy shifts, they force us to think about the overall effectiveness of financial theory (Naifar, 2025).

Figure 6. *Bloomberg Galaxy Crypto Index*
Bloomberg Galaxy Crypto



Source: BloombergData 07.10.2025

2.5 The Efficient Market Hypothesis

The Efficient Market Hypothesis (EMH) assumes that asset prices fully and rationally reflect all available information. Nevertheless, the historical record of the previous crises and today's cryptocurrency era provides a compelling counterargument. The Dotcom IPO frenzy showed that markets rewarded immature firms based on hype instead of fundamentals (Ofek & Richardson, 2003). On the other hand, the 2008 collapse revealed how financial instruments caused systemic risk in spite of abundant data. In the crypto era, volatility in indexes like the BGC indicates that prices respond to shifting sentiment and regulatory uncertainty rather than to intrinsic value (Naifar, 2025). We repeatedly saw that markets often showed not the actual value but just the projection of the market sentiment. As Warren Buffett says, "When the price of a stock can be influenced by a 'herd' on Wall Street with prices set at the margin by the most emotional person, or the greediest person, or the most depressed person, it is hard to argue that the market always prices rationally. In fact, market prices are frequently nonsensical."

These patterns affirm that financial markets are not neutral mechanisms of efficiency. However, recurring inefficient markets, where speculation and incomplete information push cycles of boom and bust.

2.6 The role of media and reports

The role of the news media in the stock market is not a simple tool for investors who are reacting to economically important news, meanwhile, the media actively shapes public attention and sentiment (Shiller, 2000). A notable example of this phenomenon occurred in December 1996, when former Chairman of the Federal Reserve Board Alan Greenspan introduced the famous phrase of 'irrational exuberance' during a speech at the height of the dot-com bubble. His warning to the market participants that stock markets might be overvalued reflected growing concerns about speculative excess (Jorion, 2009). Later, this phrase was inspired by Yale professor Robert J. Shiller, which became a central theme in Shiller's 2000 book "Irrational Exuberance" (Shiller, 2000) He described these bubbles as less driven by fundamentals, but more by psychological contagion. News of rising prices stimulates interest, boosted by stories of easy wealth, and attracts a wider audience despite doubts about real value. This standard was evident in the dot-com era, when internet-based companies with little or no profits were going up to massive valuations before collapsing. Shiller's insights also reached their peak in the 2008 Global Financial Crisis. Overinflated housing prices powered by media hype and investor overconfidence, subsequently crashed and triggered a global economic downturn. The same thing is visible today in the cryptocurrency market, where media attention and online communities enhance rapid price increases, attracting new investors who are motivated by both fear of missing out and the allure of quick profits. Most of the time, these emotional extremes are developed

through the Crypto Fear and Greed Index. This index uses data and sentiment graphs in order to track whether the market is dominated by optimism and overconfidence (greed) or anxiety and risk aversion (fear) (Alternative.me, n.d.). Similarly in previous bubbles, such indicators support Shiller’s opinion that investor psychology continues to drive asset valuations, and it raises questions about whether today’s crypto boom represents sustainable growth or another case of irrational exuberance.

3. RESULTS

In this section, we present the findings of our comparative study across three major cycles of financial instability, which are the Dotcom bubble, the 2008 financial crisis, and the ongoing cryptocurrency era.

From Table 1 we can observe recurring dynamics of speculation with the help of analysing investor sentiment, behavioural biases, regulatory conditions, and monetary policy. They have structural similarities. However, each crisis is distinct in its instruments: internet IPOs, mortgage-backed securities, or decentralised tokens.

Crypto markets can be characterised as highly volatile with accompanying boom and bust cycles. A lack of stringent regulatory frameworks promotes opportunistic behaviour among investors. As regards investor sentiment, periods of dotcom bubble and 2008 GFC are characterised by optimistic approach and overconfidence. The crypto markets, on the other hand, demonstrate volatile optimism affected by many factors such as decentralised flow of information and loss aversion.

Compared to the Dot-Com Bubble and the 2008 Global Financial Crisis, which made equities in tech companies and real estate the primary asset classes, the current crypto market represents digital assets, such as tokens, as the main asset class.

When it comes to the response of monetary policy across periods, the Fed did not implement any significant action to overcome the Dotcom Bubble and kept interest rates at low level; however, in the 2008 Global Financial Crisis, we observed a comprehensive intervention in the form of quantitative easing and bailouts. For the cryptocurrency era, in general we find out the mixed responses across the countries. Some central banks decide to launch digital forms of national currency while others prefer to keep a close eye on monitoring existing systemic risk. The Fed is also assessing and exploring the implications of establishing central bank digital currencies (CBDC). Despite the potential range of benefits, such as improvement in efficiency, some risks can be imposed on credit markets. Besides that, cryptocurrencies have not been widely used means of payment in the United States (Federal Reserve System, 2022).

Table 1. Results of comparative content analysis

Dimension	Dotcom Bubble (1995–2002)	2008 Financial Crisis	Cryptocurrency Era (2009–Present)
Primary Asset Class	Internet stocks / IPOs	Mortgage-backed securities, housing	Cryptocurrencies, ICOs, DeFi tokens
Investor Sentiment	Optimism around internet IPOs	Confidence in perpetual housing growth	Volatile optimism tied to tech milestones, fear of regulation
Behavioural Drivers	Herding, FOMO, overconfidence	Normalcy bias, illusion of control, overconfidence	Herding, FOMO, overconfidence, normalcy bias
Market Characteristics	IPO surge, immature firms, Nasdaq –77%	Housing boom, mortgage surge, record volatility	Sharp peaks and crashes in CMC 200 / BGCI
Role of Regulation	Limited IPO oversight	Weak mortgage/derivative oversight; post-crisis reforms	Minimal oversight; fragmented regulation
Monetary Policy Impact	Interest rate cuts, fostered liquidity	Low rates (2001–2003), later hikes stressed system	Crypto downturns linked to Fed tightening cycles
Collapse Trigger	Overvaluation, weak firms	Rising defaults, securitization failures	Regulatory crackdowns, liquidity tightening
Aftermath / Lessons	Collapse of most Dotcoms	Global crisis; bailouts, reforms	Volatility persists; risks unresolved

4. DISCUSSION

The comparative analysis of the Dotcom bubble, the 2008 financial crisis, and the cryptocurrency era focuses on repeating patterns in financial instability. As we mentioned above, the common features of these crises are repetition of human behavior instead of the specific form of the asset. History's lessons continue to reflect in today's financial landscape by linking these elements.

4.1 Key Lessons

First of all, investor psychology is in the core position between the indicators. Herd behavior and FOMO continue to fuel speculative surges from Dotcom IPOs and mortgage-backed securities to ICOs and meme tokens. Overconfidence and normalcy bias prevent rational assessment of risk, whereas the illusion of control instills false confidence into fragile systems.

Second, financialisation obscures true risk. In 2008, complex instruments created an illusion of safety. Today's innovation is often aligned with tokens, DeFi platforms, and new crypto derivatives, but they can mask hidden risks. Volatility and collapses reveal how risk was just renamed rather than eliminated. This consistency demonstrates how each new financial innovation is a risky vehicle for the same vulnerabilities. Such inefficiencies underscore why regulation became a decisive factor in forming market stability.

4.2 Regulatory Solutions

Several countries started to apply different strategies to manage crypto-related risks. Azerbaijan has introduced taxation on cryptocurrency earnings, which treats them in the same way as other forms of capital gains in order to generate revenue (Tax Code of the Republic of Azerbaijan, 2025). It helps to discourage excessive speculation. This was one of the first regional attempts to bring crypto under conventional tax structures. In the United States, crypto transactions are subject to capital gains tax. Since 2024, new IRS reporting requirements have further tightened oversight of exchanges (IRS / Treasury press releases, 2023). In addition, the European Union has launched its MiCA (Markets in Crypto-Assets Regulation) framework. MiCA represents one of the first attempts to create a comprehensive regional framework (Hogan Lovells, 2023). In India, the government has imposed a 30% tax on crypto income and a 1% tax deducted at source (TDS) on transactions (Lexology / Chase Advisors, 2023). These examples collectively demonstrate that taxation and oversight can help limit speculation, but they also reveal the shortcomings of individual national responses in a global market. This makes international coordination critical if we want the regulation to succeed in decreasing systemic risk.

4.3 Avoiding Future Crises

Building on these lessons, we can assume several steps that are essential to avoid another systemic collapse. Regulation needs to reach a balance with global standards for crypto assets, where the protection of crypto investors' risks and financial innovation do not limit each other. Additionally, investor education is needed to counter the psychological roots of bubbles. We need to raise awareness of biases such as herding and FOMO that repeatedly alter the decision-making of investors. Finally, macroprudential monitoring should be strengthened. It is a necessity to recognize that liquidity cycles and monetary policies have powerful influence on speculative assets like cryptocurrencies. In general, these measures emphasize that avoiding future crises requires a multi-layered approach. Ideally, this process will be finished with integrating regulation, education, and policy oversight into a coherent framework.

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