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AN ANALYTİCAL ASSESSMENT OF THE TURKİSH DEFENSE INDUSTRY AND ITS ECONOMİC IMPLİCATİONS

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Abstract: *The pursuit of strategic autonomy has been a key driver in shaping Türkiye's defense policy, with a focus on reducing dependence on others through the advancement of its domestic military capabilities. While benefiting from NATO membership and access to global technologies, Türkiye has emphasized the creation of a sovereign defense ecosystem. This article makes an overall evaluation of Türkiye's defense industry through an examination of its historical trajectory, strategic role, structural transformation, sectoral performance indicators, and economic role in a wider senseThe study aims to interpret the shifting pattern of the sector by analyzing export-import performance, labor trends, and its effects on technological and industrial development. A qualitative-descriptive approach was employed, founded on policy document analysis, scholarly literature, and statistics data analysis.The results emphasize Türkiye's improvements in integrating indigenous production, enhancing exportation capability, and aiding economic sustainability through its defense programs.*

Keywords: *Defense autonomy, national security industry, economic contribution, arms trade, industrial development*

1. INTRODUCTION

With the start of the Turkish defence industry in the 1960s, a twisted and circuitous, yet successful, path has been taken. Beginning with a mechanisation programme, amateur attempts at defence production slowly branched out to the fields of ammunition, land systems, ship and sub-unification, avionics, missiles and aircraft. Since the late 1990s, these efforts have been augmented further through the transfer of higher technology know-how, as the underlying weaknesses have been smoothed to some extent. Since the late 1990s, defence expenditure and investment levels have increased in a more compliant manner in relation to GDP levels.

Despite defence expenditure increasing tremendously, most of the investment and procurement still has to be made out of defence imports; aimed at meeting the postponed or unsatisfied needs due to the earlier weapon choice decisions of the military. In an attempt to facilitate an integrated defence procurement system that would create shorter substantive and procedural lead times, there must be an independent, non-partisan and high-level procurement authority. But governmental expansion projects have to be imposed over the procurement authority. There should be no other inter-agency co-ordination cost incurred as a result of an extended capability in policy and programme definition-decision making fields. The procurement authority that can become effective and qualify can be done only by utilizing

capable bureaucrats from the defence inner circles and not those promoted from the defence industry, trade and procurement circles.

In the context of currently existing, partially procedural procurement procedures,Türkiye will not be any more advantageous by just implementing such a procurement authority when comparable countries are being taken into consideration in her own perspective. While attempting to improve a procurement environment, respective alterations, reforms and fundamental modifications should/can be made on the aforementioned fronts.

In this context, although Türkiye's defense industry has made significant strides towards reducing dependence on foreign technologies and capabilities, the need for systemic reforms and a more integrated strategic approach remains. The restructuring of procurement processes, optimization of decision-making mechanisms, and enhancement of technological production capacity are essential for ensuring sustainable progress. The developments within the defense industry hold strategic importance not only from a security perspective but also in terms of economic growth, technological advancement, and the broader trade balance.

This study aims to provide a comprehensive description of the Turkish defense industry by its structural evolution, institutional framework, performance indicators, and economic contributions. The study refers to the contribution of the defense industry to industrialization, jobs, technological growth, and its effect on trade balances, both pre-2000 and post-2000.

Methodologically, qualitative-descriptive analysis is continued through the implementation of national and international statistical data, policy reports, and industry reports. Comparative analysis is applied to assess historical change in the industry, while economic indicators are quantitatively analyzed to observe the overall influence on industrial manufacturing, research, and technological innovation. Through this method, complete insight into the strategic and economic dimensions of Türkiye's defense industry is achieved.

2. Structural Overview and Historical Evolution of Türkiye's Defense Sector

The Turkish defence sector has made significant progress over the last 10–15 years, with an astounding yearly growth rate of 10 %. The "defence industry in Türkiye" defines the governmental organizational structure, laws, and the manufacturing sectors which produce defence systems and subsystems for the Turkish Armed Forces (TAF), law enforcing units, and relevant governmental agencies

Today, the Turkish defence industry extensively covers the design, development, production, and integration of air-, ground-, and sea-based defence systems and subsystems by an extensive range of national and international industries, companies, and manufacturers. The defence industrialisation initiatives and activities conducted by the defence and military authorities of Türkiye between the 1940s–1960s, establishment of the Turkish Armed Forces Foundation (TAFF), investments in weapons and munitions production facilities, the establishment of the Defence Industry Undersecretariat (DIU), defence industry development projects, and sanctions on defence export and co-production collaborations played crucial roles in the rapid growth of the Turkish defence sector. (Saygılı, 2022: 40)

Following the formation of the Defence Industry Executive Committee in 1989, major regulations were implemented to speed defense sector activities, and selected defense

enterprises were assisted with R&D activities. In this context, the regulations governing joint ventures and co-production agreements entered into with foreign defense manufacturers and suppliers were rewritten, and all prohibitions on technology and know-how transfers were removed.

Meanwhile, the list of companies and manufacturers excluded from tenders, contracts and collaborations in the defence field in Türkiye was revised, with the exclusion of many national defence manufacturers and suppliers either acknowledged as a result of misconducts, or strong commercial competitors to the Türk Savunma Sanayi A.Ş (TARAS). Additionally, in 1995, the defence industry industrial development and R&D project manager and products supplier status was granted to TARAS by the Council of Ministers of Türkiye (Wiśniewski, 2015).

Despite a rapid growth in the capabilities of the Turkish defence industry, it still has several weaknesses which may pose obstacles to its further development. Firstly, production and procurement plans only cover a few years, are not publicised and lack transparency, making it difficult for the defence industry to adopt appropriate long-term strategies. Secondly, domestic companies are at a disadvantage in many cases, especially when trying to win foreign contracts from the licensed production of Turkish designs. The Turkish manufacturing costs are substantially higher than the costs of US centres due to wider wage, material and defence R&D cost differentials. (Uzun, 2007: 5) Despite many publicised successes, most Turkish designs either follow joint-venture solutions offered by US companies or are derived from other systems produced in co-production with the same companies. So far, there is no trace of originality or inventiveness in Turkish designs.

3. Conceptual Framework: Defense and Defense Industry

The beginning of 2022 marks a period of significant geopolitical turmoil. A conflict in Europe poses numerous basic questions regarding the continent's future, security, and the function of NATO, its current source of stability. Meanwhile, the Turkish Defense Industry, a significant part of the Turkish economy and a key factor in its long-term strategic growth, reaches a tipping point.

The current global and regional upheaval presents both chances and problems for a country that has undoubtedly become NATO's most talked-about and toughest fighter, and to which NATO allies must pay more attention. While full quantitative assessments of a country's military industry must incorporate a variety of elements, the current work takes a more simplified, static approach. Gaps in the hard-core topic of the Turkish defense industry will provide the earliest insight into how the Turkish defense industry may be seen by others.

Over-reliance on imported platforms has been a constant cautionary note against Türkiye since the late 1950s. As a result, technological limitations from the perspective of imports, bilateral in-platform co-productions, technology transfers, and multinational endeavors have always been a consideration when evaluating the Turkish defense industry. From this perspective, the current state of the Turkish Defense Industry can be readily assessed. A catalogue of the current Turkish defense industry landscape is compiled here for the first time, which includes current platforms from all known suppliers.

All well-known and publicly-seen platforms and systems such as vehicles, missiles, radars, helicopters and drones have been included. Outdated planning boards above the simple

level of detail in evaluating the Turkish defense industry have seldom been seen in the academic discourse on the Turkish defense industry. Gaps in the hard-core matter of the Turkish defense industry will provide the initial insight into how the Turkish defense industry might be perceived by others. (Tübitak, 2003: 9). A clearer assessment of the state of the affairs, and a better understanding of the concepts that are shaping it, may change the perception of the Turkish Defense Industry and its associated factors in the eyes of the interested parties.

4. Strategic Importance and Fundamental Characteristics of the Defense Sector

The defense sector is a strategic sector in Turkey's economy. It is regarded, alongside the military, as a key tool for preserving and strengthening sovereignty. The defense sector is vital to a country not only militarily, but also politically and economically. Today, numerous ISC (Intelligent Transportation Systems) industries, including automotive, shipbuilding, and aviation, are recognized as sensitive and strategic.

In addition to civil aviation opportunities, there are dual-use technologies that can be used for defense purposes.Türkiye is sovereign in many of the activities performed in the field of defense industry; however, major firms design and manufacture optimal solutions. Moreover, nonconflict in long-term agreements may require strategic co-production of segments in an international defense supply chain (Wiśniewski, 2015).

A country must independently and consistently make sure that it has the strategic and essential component design and production capabilities of the products it produces and uses within its borders. Domestic relevance and background are generally required by the major firms, as they must effectively keep their profits in their countries in an enduring context. (Ziylan, 2004: 91)

Therefore, a country which wants to be in contention must ensure that it possesses a sufficient amount of stocks within its borders. On the other hand, even if the indigenous production capability becomes unnecessary, the price impacts of war or crisis on imported end products would result from an indigenous production strategy, which is a capability for a country’s defense industry. A country which can produce a warplane may also be able to produce a bus for logistics. The offset financing with the indigenous production joined with a co-production agreement may cost much less than direct subsidies.

The cohesion and uniqueness of the government’s and defense companies’ strategies must be regarded for the success of the ISDs (Integrated Supply Chains). Anomic and instant trade may not satisfy a country’s defense needs as well as long-term investment. On the other hand, defense procurement contracts, which are dominated by a firm which is mainly a service firm, may necessitate the long-term investment of a country.

The source of procurement contracts must be aware regarding what information, which brings dependency, are to be given. Furthermore, the technological offsets of the military contracts generally have a higher premium and requirement than dual-use technologies. The incorporation of defense firms in long-term global supply chains, later on, changing to defense industries, is also possible. The assurance of a local supply chain in a long-term context is central to defense needs and a defense industry.

5. Sectoral Statistics and Performance Indicators in Türkiye's Defense Industry

Manufacturers of defence products are companies, state-owned or private, whose main area of activity is production or services for military purposes. Companies which were privatized in the 1990s, and are now private joint-stock ones and which used to be joint state-private stock companies are also included in the defence industry. (Donaldson, 2013, p. 21).

Effective in the 1996 fiscal year, defence procurement budget is no longer included in the general budget. In addition to this, except military vehicle projects, an alarming amount of the past problems with exceeding the defence procurement budget have been solved. In addition to these regulations, some international agreements were signed with countries or companies in order to facilitate both exports and joint work on the assignment and adaptation projects. These agreements which are classified as Close Cooperation in Defence Industry (CCDI) and Under Joint Cooperation in Defence Production (UJC-DP) are expected to increase the share of the defence industry in export revenues and local production (Wiśniewski, 2015).

In this context, beginning with the 1990s, a serious transformation process has been started in the defence industries of both developed and developing countries. (Sidhu,2024) This transformation has three main aspects: reorganization of state-owned defence industries, privatization of state-owned companies or establishing private joint-stock companies as substitutes, and relaxation on the state control of private companies which are producing former defence weapons. The defence industry must be viewed as an important sector of the national economy.

Companies in this sector generate significant profits, invest heavily in advanced technologies and employ large numbers of skilled workers. These contributions benefit economic growth, industrial and technological development, as well as social welfare. For states that do not face an imminent military threat, the economic role of the defence industry is as important, or perhaps even more important than the military one. The Turkish Defence and Aerospace Industry Manufacturers Association compiles data on the performance of the sector annually.

The turnover breakdown of Turkish defence and aerospace companies by year shows that companies operating in the defence electronics subsector had first place in most of the years examined in terms of turnover generation. The turnover distribution by subject shows that most of the turnover is coming from the procurement of goods and services for the military, while a small, yet considerable part comes from the civilian domains. The highest turnover per employee has been recorded in the defence aerospace subsector.

6. Trade Dynamics: Export-Import Revenues, Orders, and Employment

Türkiye's defense industry has witnessed a remarkable rise over the past decade, in which the value of defense projects and manufacturing has surpassed $1 billion. In 2006-08, the defense industry grew by 35% a year on average, while its exports amounted to $128.1 million in 2006, $166.6 million in 2007, and $226 million in 2008. (Wiśniewski, 2015)

In spite of a booming industrialization effort accompanied by an impressive export performance,Türkiye's defense industry is not yet strong enough to meet fully the demand of the armed forces and is still subject to restrictions imposed by foreign partners. The country imported about $4 billion worth of military hardware in 2007 alone, much of it from the U.S. and the European nations.

Türkiye has long been in search of more self-sufficiency in the military sector and alternative markets for defense purposes. The recent takeover of foreign interests in the Turkish defense industry is therefore not a healthy sign forTürkiye's strategy of establishing a sustainable military-industrial complex. The Turkish defense industry is currently focusing on export markets for avionics parts of F-16 fighter planes, sundry parts and systems for C130 Hercules transport aircraft, and Shikra unmanned aerial vehicles.

It remains vide to conduct a detailed assessment of the structural, functional, and operational characteristics ofTürkiye's relatively young defense industry, while considering restrictions dampening the sector's growth, prospects of emerging non-Western markets, public support and contribution to technological development and modernization, shadow military firms, revisions in the national military policy, etc.Türkiye's newly found economic power and growing defense expenditure are further conducive to an industrial growth spurt. The Turkish economy can support the defense industry with scientific and technical manpower, while the military has a vital requirement for systems incorporate possessing indigenous technology (Wiśniewski, 2015).

7. Comparative Evaluation: Pre- and Post-2000 Phases of the Turkish Defense Industry

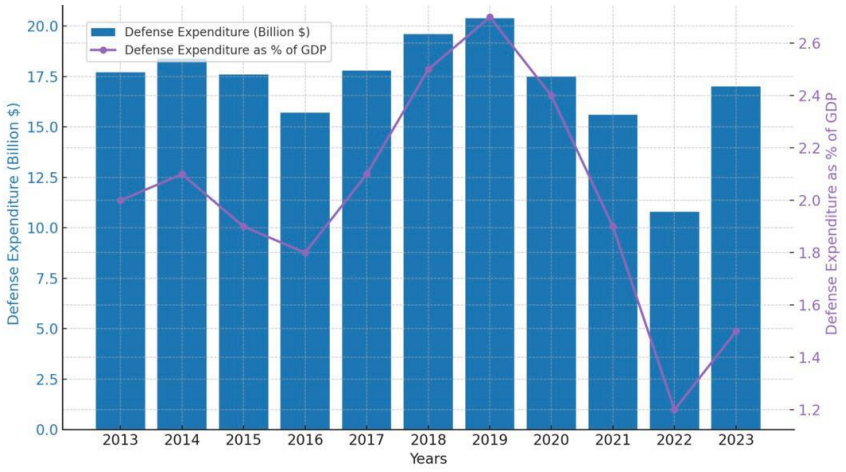
The Turkish defense industry is analyzed through two different perspectives: On one hand, it is evaluated in the international arena through comparative macroeconomic indicators; on the other hand, its domestic and industrial development is solved on a more detailed and microscopic level. Numerous indicators and statistics have been included to interpret the comparative pre-and post-2000 phases of the Turkish defense industry in both international and domestic perspectives.

Since World War II, the rapid growth of the defense industry has been addressed with detailed analyses on broad macroeconomic parameters and comparative evaluations of the pre- and post-2000 industrial and comprehensive defense systems. The rising capability and efficiency of the Turkish defense industry that is shaping the contemporary interpretation and notion of a nation-state, particularly after the events of 11 September has been discussed in detail in various aspects, perspectives, and domains (Wiśniewski, 2015).

With this extensive academic interest regarding the defense industry, a relatively unstudied and unexplained area has been tried to be filled. The hitherto-created indicators and framework of evaluation have been adopted on the Turkish defense industry with the aim of delivering an analytical evaluation of Türkiye's performance in the broad defense industry throughout the years up to now. The Turkish defense industry has witnessed tremendous and rapid developments in various aspects, dynamics, dimensions, and domains since its early establishment even though its comprehensive development level is still below the expected level compared to its ambitions and objectives.

Since 2000, a more intensive, affluently funded, and better articulated perspective of defense and defense industry development has been introduced and prevalently applied in order to fill the existent gaps in the Turkish defense industry's capability and efficiency structure. These efforts led to tremendous outcomes and yielded rising trends and advancements in all of the aspects, performances, capabilities, and efficiency levels which are the subject of this study.

Graphic 1- Türkiye's Defense Expenditure and GDP Share (2013-2023)

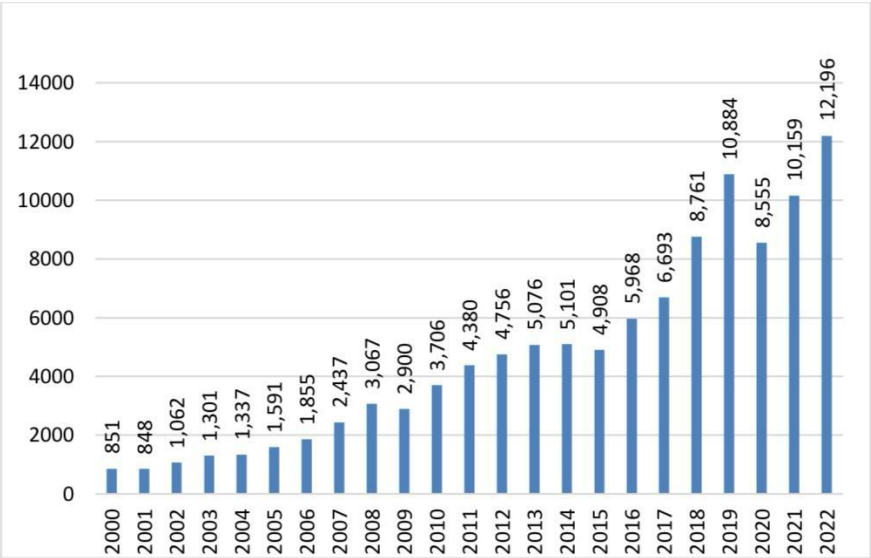


Source: SIPRI

In 2001, Türkiye's defense spending was approximately $7.2 billion, constituting 3.6% of its GDP, largely due to a significant dependence on imported military equipment. By 2002, this proportion increased to 3.8%. However, in the subsequent years, the government reported a shift as domestic production capabilities expanded. By 2023, defense expenditures had risen to $17 billion, yet their share of GDP decreased to 1.5%, attributed to the widespread adoption of domestically developed military technologies

As a result, the Turkish defense industry has shifted from a lower to higher competitive and capability levels in the aforementioned aspect.These extensive advancements in the Turkish defense industry both enabled and financed a more comprehensive and extensive approach to defense and security.

Graphic 2 - Total Defense Industry Turnover Figures between 2000-2022 (Million $)



Source : (SASAD,2022)

Based on the data from Defense and Aerospace Industry Manufacturers Association Performance Report 2022presented in SASAD's 2022 report, the Turkish defence industry experienced a significant increase in turnover between 2000 and 2022. Specifically, in 2022, the sector's total sales revenue rose by 20.05% compared to the previous year. In addition to the growth in domestic sales revenues, there was also a 36.32% increase in foreign sales revenues, indicating substantial progress of the Turkish defence industry in international markets. (Yılmaztürk,2023: 143-150)

In order to meet the newly awakened and emerging demands of the complex multilateral operating environment, the Turkish defense and security policies have redefined the context and the content of defense and security. The classical notion of a nation-state has been redefined and shaped through the original development of national defense capabilities and capacities. The Turkish defense and security policies started to focus on the development and procurement of sophisticated defense systems and weaponry in order to design and be capable of conducting a more extensive and comprehensive engagement strategy.

However, In 2023, Türkiye was 22nd globally in defense spending, allocating $15.8 billion for the military budget. It increased by 37% from the previous year and a 59% increase over the past ten years, according to the Stockholm International Peace Research Institute (SIPRI). Even expanding in absolute terms, military spending represented 1.5% of the GDP of Türkiye and 0.6% of global military spending. (Kenez, 2024)

8. Economic Implications of the Turkish Defense Sector

Economic efficient spending might contribute to good influence on advanced defense technology, security, level of exports, new employment opportunities, and army being a force to deter. Non-productive defense spending might, however, result in adverse influence on imports, foreign dependency, higher taxation and borrowing, loss of skilled personnel, and cost of opportunities (Deger, 1986).

Following an unfortunate series of sovereign debt crises throughout the 2000's – the outbursts of which were duly accompanied by widespread societal unrest – the Turkish economy has since climbed its way back to relative respectability through a combination of ambitious reform and protectionist policies. The US crisis is not only a factor of defence expenditure comfort but also an important aspect of the competition amongst firms in the Turkish Defence Sector (Wiśniewski, 2015).

With defence expenditure hovering around a satisfactory 2.2% of GDP there is little doubt that Türkiye's position in the international arms market is set to rise and with this rise will come economic growth and important sectoral reforms across the Turkish economy. It has indeed been indicated elsewhere thatTürkiye's growing involvement in the international arms market will warrant a pocket of exports. Coupled with strong performing strategic firms this is sure to accelerate economic growth in tandem with deft industrial policy reform.

Additionally, it remains to be seen how the BRICs correspond toTürkiye's current development strategy. Should, on the one hand, the Turkish Defence Sector be able to wrestle in one of these nations then its defence aspirations will be aligned with the rest of its aspirations. Alternatively, if these powers oppose greater Turkish involvement in the arms market then it may find itself entrapped in a new defence dependency, albeit a different one.

Thus the future for the Turkish economy is one awash with opportunity and peril, necessitating a deft comprehension of the current world in which it operates.

- 8.1. Contribution to Industrialization

Turkish defence policy explicitly highlights the requirement for extensive industrial cooperation to accompany foreign acquisition of weapon systems. It is also noted that, at least officially, "making as much of a system, where design installations and integration work is concerned, inTürkiye, and producing the components to a greatest extent through local defence industry, followed by assembling the system with local capabilities" are requirements for weapons technology acquisitions inTürkiye (Wiśniewski, 2015).

However, the Turkish defence policy, until recently, could not provide a viable strategy to advance the indigenous defence industry. The reasons for the insufficiently developed indigenous defence industry inTürkiye have been highlighted in the earlier sections. At present, alongside the threats, new opportunities are appearing with respect to the main forces affecting the advancement of the Turkish defence industry. (Demir, 2020)

Table 1. Selected Turkish defence exports to European countries, 2019–present

Turkiye: selected defence exports to European countries, 2019–present							
Contract date	**Recipient**	**Equipment**	**Type**	**Quantity**	**Value (USD millions)**	**Contractor**	**Deliveries**
January 2019*	Ukraine	*Bayraktar* TB2	CISR Medium UAV	6	69	Baykar	2019
December 2019	Hungary	*Ejder Yalcin* 4×4	PPV	10	n.k.	Nurol Makina	2020–21
December 2020	Hungary	*Ejder Yalcin* 4×4	PPV	40	n.k.	Nurol Makina	2022–23
December 2020	Ukraine	*Ada*-class (MILGEM)	Corvette	2	n.k.	STM	Likely 2025–26
2021	Kosovo	*Vuran* with *Alkar*	120mm SP mortar	3+	n.k.	ASELSAN BMC	2023–24
May 2021	Poland	*Bayraktar* TB2	CISR Medium UAV	24	268	Baykar	2022–24
c. 2022	Kosovo	OMTAS	Man-portable anti-tank missile	n.k.	n.k.	Roketsan	2023
November 2022	Kosovo	*Bayraktar* TB2	CISR Medium UAV	est. 5	n.k.	Baykar	2023
December 2022	Albania	*Bayraktar* TB2	CISR Medium UAV	3	n.k.	Baykar	2024
2023	North Macedonia	*Boran*	105mm towed artillery	18	n.k.	MKE	2025–31
April 2023	Romania	*Bayraktar* TB2	CISR Medium UAV	18	321	Baykar	n.k.
October 2023	Estonia	NMS 4×4	AUV	230	75.71	Nurol Makina	From 2025
October 2023	Estonia	*Arma* 6×6	Wheeled APC		140.61	Otokar	From 2025
July 2024	Bosnia-Herzegovina	*Kirpi* II	PPV	4	n.k.	BMC	2025
November 2024	Romania	*Cobra* II	AUV	1,059	929.6	Otokar	2025–30
November 2024	Croatia	*Bayraktar* TB2	CISR Medium UAV	6	73.91	Baykar	n.k.
December 2024	Portugal	Auxiliary Oiler Replenisher and Logistics Ship (AOR+)	Fleet replenishment vessel	2	134.03	STM	2028

Source: Military Balance+, milbalplus.iss.org

*First of several contracts. APC = Armoured Personnel Carrier; AUV = Armoured Utility Vehicle; CISR = Combat, Intelligence, Surveillance and Reconnaissance; SP = Self-Propelled; PPV = Protected Patrol Vehicle; UAV = Uninhabited Aerial Vehicle

Table 1 highlights Türkiye's selected defence exports to a number of countries in Europe since 2019, marking the growing country presence within the regional defence market. The data demonstrate a wide diversification of the type of defence equipment exported, ranging from unmanned aerial vehicles (UAVs) such as the Bayraktar TB2 to armoured vehicles (e.g., Ejder Yalçın, Cobra II), artillery systems (e.g., the Boran howitzer), and naval ships such as corvettes and replenishment ships.

Of these, the Bayraktar TB2 UAV has been a flagship export, acquired by various European nations like Poland, Romania, Albania, and Kosovo. This indicates increasing worldwide interest in Turkish-produced drone technology. In addition, the inclusion of advanced land and naval systems in export orders shows a shift towards a broader and more advanced range of defence products.

These steps reinforce Türkiye's growing role as a competitive European defence industry supplier, supported by its focus on building domestic output capabilities and technology development. Furthermore, the rising number of European beneficiaries also further signal upgraded defence collaboration between Türkiye and some of the NATO and EU member countries. (Waldwyn, 2025)

In recent years, a significantly more favourable domestic environment for the defence industry has gradually emerged. There has been a significant expansion in the size of the armed forces and the number of frames within its responsibility. Turkish firms have qualified the industry to undertake larger system responsibilities.

With respect to exports, within a relatively short period of time, the Turkish defence industry succeeded in substantially increasing arms exports from a couple of hundred million dollars annually to a level where the exports exceed one billion dollars. The development of the Turkish defence industry and the prospects in this regard are at least very rare in the contemporary arms industry context.

At least for the time being, or until 2030, the Turkish defence industry possesses a subjective opportunity to expand into defence production, which is relatively easily sellable, through a development strategy aiming at the export of the smaller systems and subsystems, provided that the internal constraints and eventual threats do not block this opportunity.Türkiye’s possession of these opportunities, in terms of their timing and specification, is rare in the contemporary international arms industry context.

- 8.2. Strengths and Limitations

Türkiye’s defence policy strongly relies on the military-industrial sector. This defence policy forges far-reaching linkages between foreign policy and the defence industry. Defensive policy appears on the one hand as ensuring external security and on other hand as the development of defence sector.Türkiye’s geopolitical position has affected its perception of external threats. The establishment of a well-developed military industrial enterprise is being perceived as a very important component of strategic independence.

In evaluating threats to security, special attention is put on internal threats to stability. A prediction is made that in the current decade the prevention of internal threats to security will be paramount in national defence policy. The defence industry has long been at the centre of-Türkiye’s security. The achievement of full autonomy in the procurement of large-scale armaments and the establishment of a well-developed military-industrial enterprise appear to be the most important components of strategic independence. However, the arms embargo imposed onTürkiye has exposed limitations in producing advanced weapons systems independently. Domestic production options were virtually exhausted, andTürkiye was left with only one alternative: foreign suppliers.

Anti-Americanism in Turkish political circles was cyclical, and the defence industry faced a formidable task to mitigate damage caused by hostile perceptions. Problematization of dependence on external sources for security ledTürkiye to attempt to maximize the national capability of self-reliance. A period of extensive military cooperation began in 1950. The main purpose of NATO membership and military co-operation was to deter aggression. The requirement for extensive industrial cooperation to accompany foreign acquisition of weapon systems is an important feature of official Turkish policy.

Turkish defense industry is looking to establish regional arms industry co-operation within the region, as a part of the current export drive strategy. The future development of the Turkish defense industry perhaps has two major threats, which are associated with its two main drivers of growth - export demand and domestic demand. The outlook for the Turkish economy over the next few years seems to be uncertain. A critical assessment of the internal drivers proves that the Turkish economic trends could significantly affect the defence sector in the next five years. The defence industry has to deal with the economic status which is unfavorable regarding local demand.

- 8.3. Impact on Research, Development, and Technological Advancement

Military Science and Technology Research, Development and Technological Advancement. The defence sector has also accomplished successful designs in the field of harnessing defence industry tools with an open system approach, achieving substantial technological know-how and capability transfer in partnership with defence industry companies and institutions. Academic institutions working on defence matters have made breakthroughs in projects on modelling and simulating advanced avionics, radar, simulation of missiles, helicopter flight dynamics, civilian aviation aspects and fire control systems. In all of these, the defence industries and their institutional partners with extensive experience in relevant fields had substantial support to accelerate indigenous capabilities before realistic engagements with national security concerns. (Yenturk, 2014, p. 4)

Design and development work is carried out with professional competence for defence system representation and simulation. Defence industries focused centre design contractors for modelling and simulation are supporting the adaptation of these tools according to the requirements of the recent projects. (Tübitak Sage) Besides the defence industries, some government agencies also engage in designing and developing diverse training and mission rehearsal simulation products in hardware and software. Aboriginal academic organizations have been able to deliver projects. Design and development of an integrated flight simulator for a modern trainer aircraft have been achieved.

Air combat simulation capabilities' aircraft model and mission locations have been enhanced. There has been some advancement in the software and content areas of 3D scene generation and management. The simulator is now integrated fully with the aircraft model created at one of the original software companies leading to a homogeneous scene management and model compatibility. Both companies have similar successful histories in training the customers with reliable information and with much experience of continuously running develop-and-fix scenario for training.

The development of an open systems architecture avitors training environment is achieved. It is foreseen that this environment shall become modelling and simulation capabilities' centre with reliable and controllable engine for dynamic mission rehearsals and robust system training for civil aviation ground handling systems. To sustain effectiveness in the field of operation, advanced simulation and modelling tools are being evaluated. The system will provide high-fidelity representations of the operating environment for both the physical and text simulation domains.

- 8.4. Effects on Economic Stability

The Turkish defence industry that has begun to be shaped with the Turkish importation of Armoured Amphibious Assault Vehicles from the US in 1975, has gone through a tremendous development process from the assemblage based period on foreign sub-systems at the beginning, to the manufacture and generation of an independent defence technology true to the national assets. Since the late 1980's, the Turkish defence industry has been on its way to defence self-sufficiency, with the full understanding of the economic and strategic needs of the new millennium.

Defence technology has begun to be regarded essential for achieving the technological level required for the independence of the nation's technological infrastructures, as well as for improving the economic efficiency of the concentration of resources on the national priorities. In this regard, the defence technology transfer policy coupled with the establishment of a defence technology oriented infrastructure was paved the way for the defence sector to flourish through both fostering defence expenditure and lengthy offset contracts on production and technology transfer of a wide variety of defence sub-systems.

The establishment of a technology oriented defence industry has been considered crucial in the sense that it would enable indigenous high-technology manufacture, as well as the much needed technology generation capability (Wiśniewski, 2015).Türkiye's defence industry has been one of the rare sectors to have continuously expanded in production and capability since the late 1990s. Built on shaky ground through decades of assembly contracts and technology transfer agreements, during the late 1970s and early 1980s, the self sufficiency rate has improved with exports acquisitions having risen to USD 1 billion in this period. (Kopits, 1987)

However, as the geopolitics surroundingTürkiye rapidly change, and economic pressures increase, the country's defence procurement landscape is forced to be reshaped. The requirement for extensive industrial cooperation to accompany foreign acquisition of weapon systems is an important feature of official Turkish policy.

The Turkish defence industries are still state-owned (although in accordance with the majority of other sectors, some companies such as TAI or Aselsan have been listed among publicly-traded Turkish companies). Defence equipment manufacturing is the most technology-intensive type of production inTürkiye after automotive, with the highly qualified workforce, which can engage in the international supply chain of most types of aerospace and military electronics projects. There are three processes by which defence industries are created: (1) indigenous design and manufacture of simple systems only, (2) importation of capital

systems and equipment for licensed manufacture of same, and (3) transfer of advisory licences for production techniques, upgrades, modular and refurbishment services.

Nevertheless, defence industrialisation could be counted as successful only if it is accompanied by efforts at the establishment of a national defence technology base. In this regard, Turkish experience differed markedly from the typical pattern of military-industrial evolution among other newly industrialising countries. The record of defence industrialisation in Türkiye evolved through a much less gradual process.

9. Conclusion

Internationally, Turkish defence industry will have stringent competition in gaining access to third-country markets. However, the potential is extremely high for Turkey to develop an efficient export development strategy. The defence market is becoming multipolar with a shifting interest from the North to the South with high dynamism. Emerging new defence expenditure patterns are seen, and sophisticated defence products and defence systems with roots in complex technologies are being purchased, particularly by countries with rapidly growing economies.

Even though Türkiyes top defence industry manufacturers make not perhaps produce a great number of excellent international products annually, the success in the development of the defence industry will indeed give positive contributions to national security and defence. The Turkish defence industry is thoroughly integrated into the democratisation and normalisation process of social and economic life, national unity has finally been achieved, and an independent foreign policy formation. But what will be needed in the longer term is a transition from a narrowly defined, state-centered defence effort to competition on the home and foreign market, which is tied to the promotion of entrepreneurial behavior, the growth of civilian control, and a change of style towards defence policy. Without this transition, there is an increasing risk that the ability to establish a base of producers of advanced defence products will be lost and economic and societal costs associated with huge imports of weapons and equipment will be incurred instead.

If defence exports and foreign participation by indigenous companies in defence programs abroad are made mandatory to the defence industry sector as some political goal, then this may lead to greater insularity of the defence sector and along with it ultimately to the limitation of its growth over the long run. The destiny of the defence sector and military-technical cooperation significantly relies on the geopolitics and geoeconomics situation under which the Turkish Republic has developed its defence and military policy. The strength of the Turkish defence industry relative to other "emerging" ones stems from the acquisition by national enterprises of major licences for the manufacturing of advanced armament systems.

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GREEN BANKING INITIATIVES IN AZERBAIJAN: CONTRIBUTION OF FINANCIAL SYSTEM

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Abstract: *Based on existing academic literature, green banking can primarily evolve along three directions: green product development, green corporate social responsibility, and green internal processes This study qualitatively evaluates the commitment of seven top-performing banks in Azerbaijan to green banking initiatives and categorizes their activities across these dimensions. The results of the content analysis illustrate that the banks under study demonstrated the strongest commitment in the areas of green products and corporate social responsibility. The adoption of green banking practices is anticipated to expand within the banking sector of Azerbaijan in the foreseeable future. Moreover, this article empirically examines the impact of environmental performance, primarily related to the internal processing category of business operations and assessed by resource consumption, on the profitability of the top two banks in Azerbaijan. The results reveal that, after controlling for bank size, environmental indicators do not exert a statistically significant impact, either positive or negative, on the profitability of these banks. Notably, energy consumption and GHG emissions exhibited the most considerable negative association, while only water consumption demonstrated a positive relationship with profitability. These findings support the tenets of Legitimacy theory and align with the findings of previous studies.*

Keywords: *green banking, green finance, sustainable development, commercial banks, profitability.*

1. INTRODUCTION

Society is coping with the complex problems of climate change. Nowadays, people are analysing global warming and its effects on humanity. Reducing carbon emissions and dependence on hydrocarbon fuels, and ensuring an appropriate transition to renewable energy sources, are the main requirements. With this goal in mind, many countries and companies have declared their commitments to achieve zero carbon levels by 2050. However, given that the transition is not limited to the energy sector alone, but also covers agriculture, industry, tourism, and many other sectors, this approach emphasizes the need for systematic environmental management for sustainable and inclusive development.

This goal serves the interests not only of society but also of many stakeholders, such as private companies responsible for pollution, financial institutions like banks, and policymakers. All parties play an important role in the development of society. Although banking activities do not have a direct physical impact on the environment, the external impact of bank customers' activities should be taken into account. Therefore, there is a need for banks

to follow the "green" trend in their development strategies. This strategy should be reflected in various banking operations, including investment and financing decisions.

Going green brings plenty of benefits to the community and nature. For example, the decline in paper waste due to switching many transactions to online channels helps reduce deforestation. Digitalization, on the other hand, reduces the risk of errors (Kesavan, 2018).

Environmental management in the banking sector is similar to risk management. Environmental risk management can be organized according to relevant guidelines (Hoque et al., 2019). With this method, banks take into account both investment and environmental risks in their decision-making processes. Banks also intensively adopt in-house environmental management. The key aspects of these activities include:

- Reduction in utility, paper, and stationery consumption.
- Use of renewable energy.
- Waste management.
- Green travel for employees.
- Reference to ethical banking.

The main objective of this study is to review the green banking practices implemented in commercial banks in Azerbaijan, as well as green banking policies and practices observed across the globe, for comparative analysis. Meanwhile, the research emphasizes the role of the financial system in the green transformation of banks. Additionally, the article evaluates the environmental performance of banks. This study aims to contribute to academic literature by investigating how the environmental costs borne by banks affect their profitability in Azerbaijan.

1.1 Green banking: Literature review

The banking sector can enhance environmentally sustainable and socially responsible investment by performing an intermediary function between economic development and environmental protection (Lalon, 2015). The key features of green banking include the implementation of online banking, reduction of costs and energy usage, and a subsequent increase in GDP. Banks should adopt significant green banking policies to demonstrate their commitment. Among various policies, one worth mentioning is the support of eco-friendly projects via green finance. The effectiveness of green finance initiatives across different regions—including Europe, Asia, and the Americas—was discussed by Sule et al. (2024). In the authors' opinion, a combination of regulatory clarity, cross-sector collaboration, and technological advancements turns green finance into a powerful tool to address climate change and support sustainability. Case studies included practical applications of green finance products, such as green bonds and sustainability-linked loans. For example, there was successful financing of clean energy projects, such as wind farms, through green bonds in Mexico.

Nawaz, Sirajudeen, and Khan (2020) claim that providing loans to firms that care about the environment would ensure more appropriate use of natural resources. As a result, we could expect the emergence of a more socially responsible corporate world. By implementing this policy, banks can reject loan applications from businesses that seek high profits without

considering environmental damage. On the contrary, banks can promote low-interest loans to environmentally friendly businesses.

Another external aspect of green banking is the issuance of eco-oriented banking products. For instance, implementing green card products driven by technological innovation can improve customer awareness of their ecological footprint. Kondyukova, Shershneva, and Savchenko (2018) mentioned the case of Russia's Tinkoff Bank, where a bank card helped collect over 500,000 rubles for environmental programs in 2017. Using the card for daily purchases contributed to nature protection by transferring 0.75% of each purchase to the World Wildlife Fund.

When it comes to internal processes, greening banks becomes possible through the establishment of "electronic branches" and "E-drive" technology. For example, the electronic document management system applied at Sberbank resulted in annual savings of 40 tons of office paper. There are also many other green financial services emerging in the financial sector. Joshi and Jain (2024) discussed several offered in India, such as green bonds, green mortgages, and green car loans. These products can influence customer behavior by encouraging the purchase of energy-efficient homes and fuel-efficient vehicles. Baicu (2021) noted that customers benefit from buying energy-efficient homes through lower interest rates, reduced heating/cooling costs, and higher market value. Green banking practices also positively influence bank profitability (Putri et al., 2022). By supporting green banking, banks demonstrate environmental commitment and enhance their public image. It is possible to reduce credit risk, improve asset quality, and increase enterprise value through environmental management.

Successful green banking implementation involves technological progress, operational improvements, and customer behaviour changes (Nath et al., 2014). Ozili (2023) tested the hypothesis that fulfilling Sustainable Development Goals (SDGs) can improve bank profitability by enabling access to low-cost clean energy, healthy and well-educated employees, decent workplaces, good infrastructure, better equality, and a climate conducive to sustainable banking operations. The study found a statistically significant negative relationship between SDG 13 (Climate Action) and bank profitability, as measured by return on assets (ROA). Other studies also note a negative correlation between environmental impact and financial performance in banks (Bressan, 2024). Bătae et al. (2021) found a positive relationship between emission/waste reductions and the financial performance of 39 European banks from 2010 to 2019. These results support the basic principles of Stakeholder Theory and the Resource-Based View.

Environmental performance can be measured by both monetary and non-monetary indicators. Dragomir et al. (2022) examined the impact of ESG performance on the financial performance of 333 banks across different regions. The authors used ROA and return on equity (ROE) as financial indicators and the natural logarithm of total assets as a control variable for bank size. Key environmental factors included resource usage, waste reduction, and emissions. The study found that environmental performance had a negative impact on ROE, and the impact on ROA was also negative, though statistically insignificant.

1.2. Theoretical Framework: Financial System and Green Banking

Organizations that embrace green banking often recognize their dependence on the social environment. This means their choices are not always driven by pure economic self-interest but also by social norms and what is deemed acceptable within their context. From a theoretical perspective, scholars apply the ideas of institutional theory to the study of multinational corporations (MNCs) (Kostova, 2013). The implementation of green banking practices does not just represent a change in banking operations; it also involves a cultural shift within the bank. Green banking necessitates the development of a distinct business ideology that emphasizes environmental issues and potential benefits.

The study by Bukhari, Hashim, and Amran (2019) contributes to the green banking literature by developing an institutional theory-based framework to evaluate how green banking is adopted. The framework proposes four determinants that impact the adoption of green banking:

- Top management pressure
- Customer pressure
- Competitor pressure
- Community pressure

Top management pressure and customer pressure are recognized as compulsory factors exhibited by banks in the adoption of green banking practices. The study by Mishra (2023) highlights that stakeholder demand, environmental interest, and brand image are the major drivers for the adoption of green banking in Nepal. Legitimacy theory supports this argument by stating that organizations aim to operate within societal norms and expectations. Particularly, as proposed by Dowling and Pfeffer (1975), it has a significant relationship with environmental performance. It implies that society expects organizations to operate in an environmentally responsible manner. This behaviour includes minimizing pollution, conserving resources, and engaging in sustainable practices. According to Legitimacy theory, companies will pay attention to these evolving environmental norms to be accepted as legitimate. Otherwise, refusal or avoidance of this strategy may lead to loss of the company's reputation, stakeholder relationships, and even cancellation of its license to operate. It implies that strong environmental performance can stand as a significant source of legitimacy.

The Sustainable Banking Network (SBN) represents a group of banking regulators and associations from 24 emerging markets and focuses on establishing frameworks for environmentally and socially sustainable lending (IFC, 2015). Based on general experience, common barriers preventing sustainable banking have been identified in a survey by the IFC across 25 countries. These challenges include issues of definition and measurement for sustainable banking, implementation of sustainable banking practices in core business, creation of business drivers for sustainable banking, promotion of information flow, and building capacity among regulators and banks. A survey conducted by the IFC across 25 emerging markets indicates that the commitment of senior management is essential to provide company-wide support and build robust frameworks for environmental and social risk management, as well as sustainable banking.

The relevance of private investments in financing the transition to a green economy has also been emphasized after the Paris Agreement. The role of climate policy and regulations in enhancing green investments has become a subject of analysis. Adequate assessment of climate

risk is a major factor contributing to the attraction of private capital flows. More than a hundred financial supervisors, encompassing central banks and financial regulators, have recognized the importance of climate risk. Consequently, after their involvement, investors are encouraged to disclose and evaluate climate-related risks.

Since the Paris Agreement (PA), there has been an expectation for the financial sector to play a significant role in the decarbonization of the economy. The green investment gap remains a decisive factor preventing the achievement of climate mitigation ambitions (Monasterolo et al., 2024). This gap can be reduced by enacting green regulatory policies that include the macroprudential regulation of financial institutions.

Firstly, we distinguish between the Green Supporting Factor (GSF) mechanism and the Dirty Penalizing Factor (DPF) mechanism. According to the GSF, banks are allowed to lower risk weights assigned to assets under green projects. Therefore, this mechanism fosters the transition to a sustainable economy as it requires banks to hold less capital for green loans. However, the absence of a standardized taxonomy for green activities represents a potential drawback to this mechanism, as it could lead to inaccurate assessments and the underestimation of the financial risks tied to green investments. As an example, the National Bank of Hungary set preferential green capital requirements in 2019 and 2020, offering the option to reduce capital requirements for certain categories of green assets, such as energy-efficient housing loans, loans to corporates or municipalities for renewable energy projects, electromobility, sustainable agriculture, or investments in green bonds. The second mechanism, called the Dirty Penalizing Factor (DPF), is another policy tool used to increase green investments. Compared to the GSF, the DPF requires financial institutions to hold more prudential capital for high-carbon assets exposed to climate transition risk.

The next set of policies related to green financial systems are the Green Portfolio Rewards (GPR) and Green Monetary Policies (GMP). Specifically, GMP can take two forms:

- Green Collateral Frameworks: Through green collateral frameworks, the central bank establishes acceptable upper and lower bounds for the proportions of high-carbon and low-carbon assets in a portfolio.
- Green Asset Purchase Program, also known as Green Quantitative Easing (GQE), targets low-carbon assets. GQE can be classified as a tool that shifts the central bank's balance sheet toward green bonds.

Vulnerability and sensitivity to climate change can also impact countries' preferences for imposing green financial policies. This hypothesis was tested by Gupta, Cheng, and Rajan (2022). The authors examined the determinants of green financial policy and found a positive and significant coefficient for climate vulnerability. Furthermore, the research confirms the hypothesis that the financial independence of central banks matters for the intensity of green financial policy. According to statistical results, larger central banks are less likely to implement green financial policies, ceteris paribus. In contrast, smaller central banks, particularly in developing countries, devote more attention to green financial policies.

The Central Bank of Azerbaijan (CBA) plays a key role in promoting sustainable finance in the economy. The CBA developed the Roadmap for Sustainable Finance for 2023-2026 to strengthen the contribution of the financial sector to the country's sustainable development. This Roadmap aims to encourage the provision of sustainable financial flows by considering climate-related and environmental risks alongside social and governance (ESG)

factors. It supports the integration of climate-related and ESG factors into the risk management and decision-making processes of financial institutions concerning finance and investments. The CBA distinguishes four pillars for Sustainable Finance Roadmap (SFR) and proposes relevant actions for each pillar. Pillar 1 addresses the need to raise awareness about climate-related and ESG risks. Pillar 2 involves relevant government agencies and stakeholders under the CBA's leadership developing a taxonomy for sustainable finance. One benefit of establishing a taxonomy is the introduction of a standardized framework for organizations to develop sustainable finance policies.

Given the profound role of the financial sector in the transition to a sustainable economy, the CBA recognizes the transformation of the financial sector toward sustainable finance as a strategic priority. In March 2025, the CBA, in cooperation with the British Embassy in Azerbaijan, the British Standards Institution (BSI), and the Azerbaijan Banks Association (ABA), organized a training session on carbon accounting for the banking sector within the framework of the "Carbon Accounting and Accountability in Financial Institutions" project. The primary goal of the event, held on March 3-6, was to facilitate the ability of banks to develop carbon accounting strategies for their financed emissions in accordance with international standards.

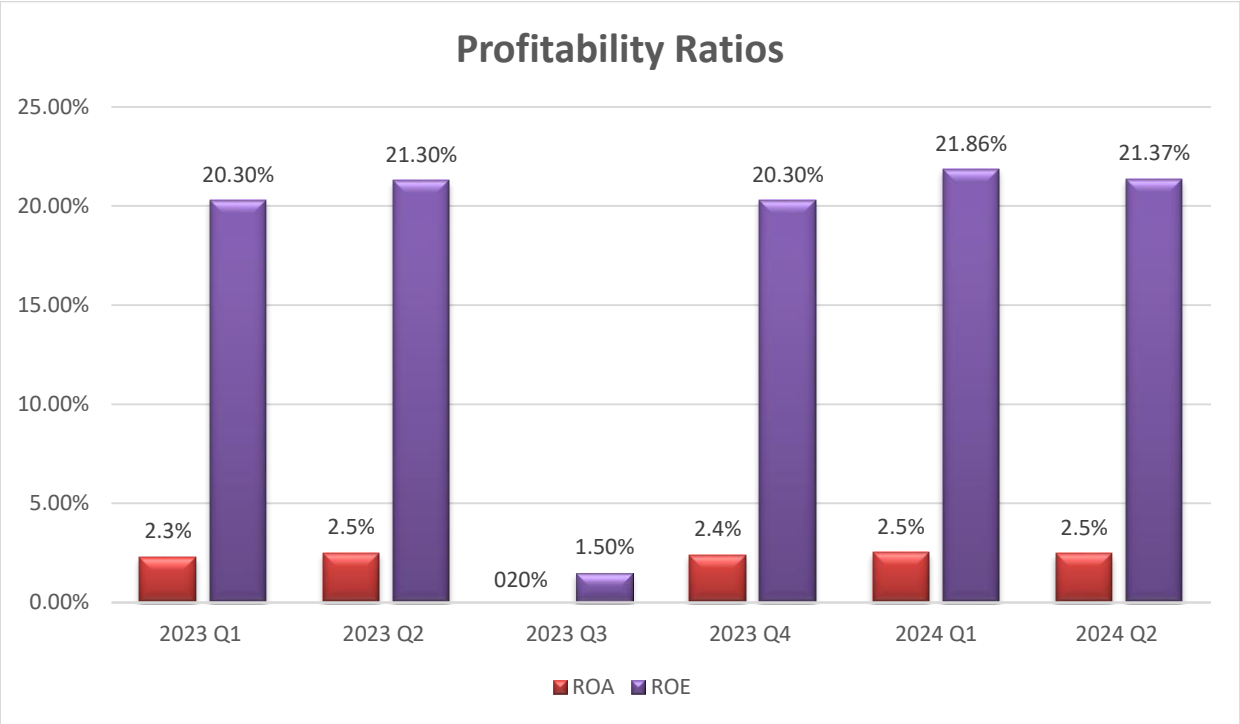
The key challenges preventing long-term green financing include limited awareness, a shortage of policies and instruments, and insufficient capacity within financial institutions to manage climate-related risks (World Bank, 2023).

Azerbaijan's financial system is characterized as bank-based, with a small role for non-bank financial intermediation. According to the CBA, the banking sector has demonstrated positive dynamics in profitability indicators (CBA, 2024). In the first half of 2024, the banking industry generated a net profit of AZN 614M. Return on Equity (ROE) stood at 21.86% and Return on Assets (ROA) reached 2.54% for the first quarter of 2024 (Figure 1). The ROA remained stable due to rising interest income. Net interest income followed an upward trend, increasing by AZN 145M from the first half of 2023 to AZN 1,379M in the first half of 2024 (Figure 2).

Despite the positive profitability across all banks in the sector, profitability was concentrated. Three banks, which account for 63% of total assets, generated 68% of the sector's net profit in the first half of 2024. A similar pattern was observed in 2023 when 71% of the sector's net profit was concentrated in three banks, which together hold 63% of the sector's assets.

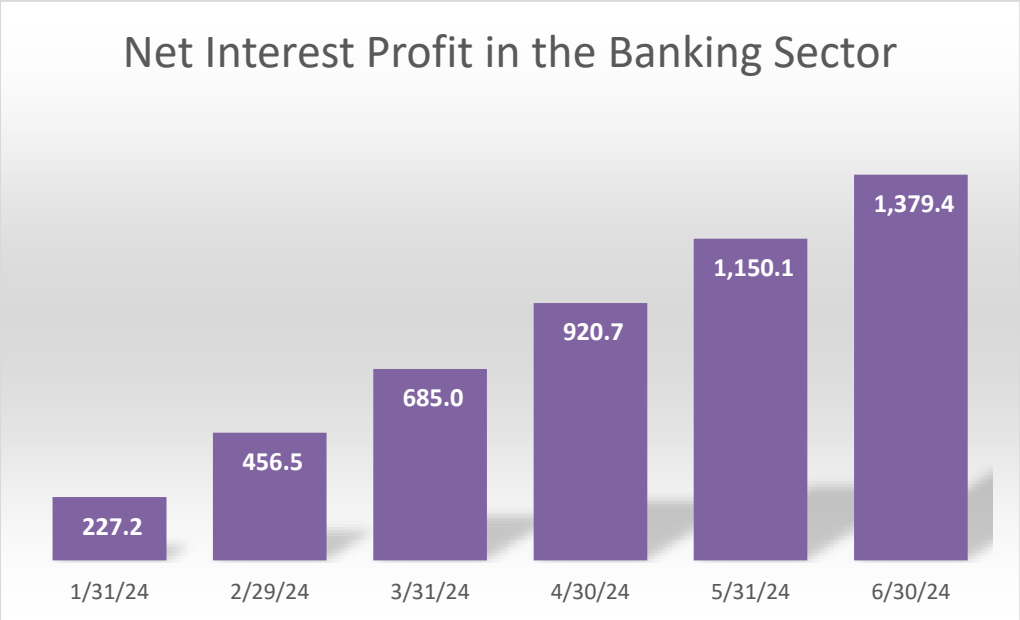
A detailed review of the loan portfolio of banks reveals that business loans were the prevailing type of loans issued, showing an increasing rate between March 2023 and March 2024 (Figure 3). Digitalization in the banking sector is another trend. Currently, most banks have successfully transitioned to providing services through internet and mobile banking applications. The volume of transactions conducted via internet and mobile banking is growing rapidly (Figure 4).

Figure 1. *Profitability Indicators in the Banking Sector*



Source: CBA

Figure 2. *Net Interest Profit in the Banking Sector in 2024.*



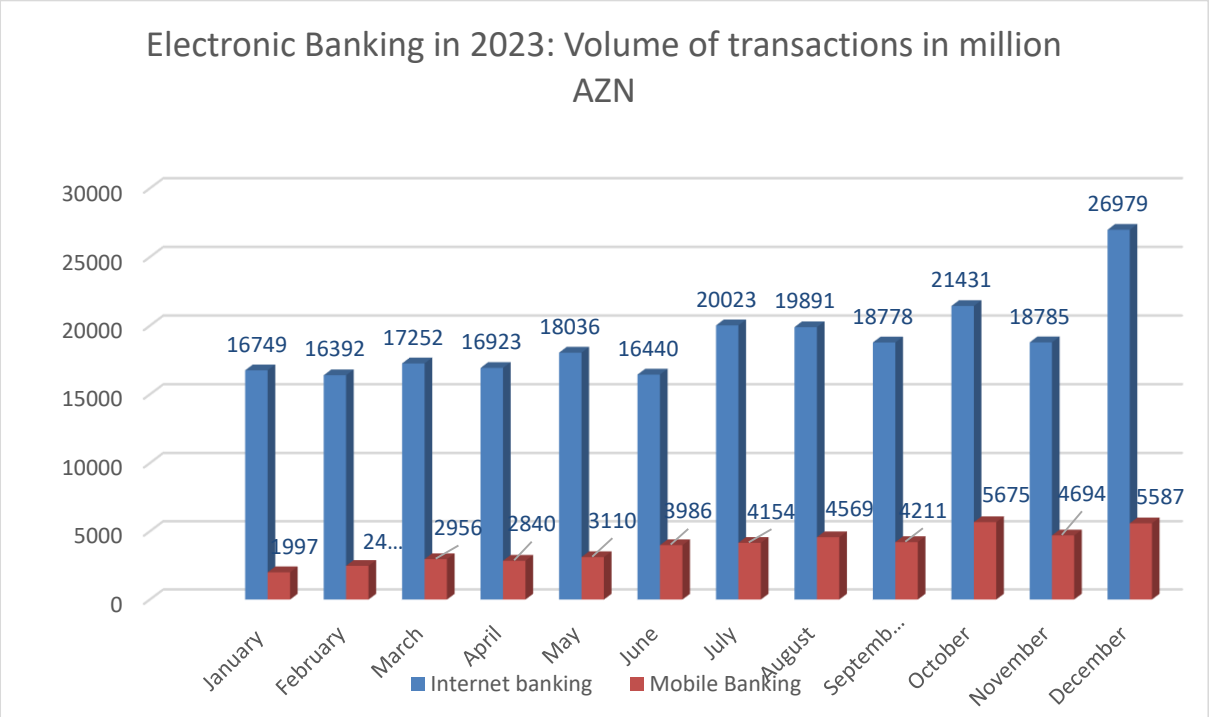
Source: CB**A**

Figure 3. *The Structure of Loan Portfolio of Banks*



Source: CBA

Figure 4. *Electronic Banking in 2023*



Source : CBA

2. Methodology

The banking sector of Azerbaijan includes both public and private banks. As of December 31, 2024, there are a total of 22 banks, of which two are state-owned and the remaining twenty are private. A wide range of green initiatives can be observed among both state and private banks in Azerbaijan. This study explores the green banking practices of seven banks, selected based on their net profits (Table1). The initiatives undertaken are classified into three categories:

- green product development,
- corporate social responsibility
- internal processes.

The research method employed for analysing green banking initiatives is content analysis. The primary purpose of this research is to review the adoption of green banking initiatives by commercial banks in Azerbaijan. To assess the commitment of the banking sector to sustainable banking practices, we use various reports from the Central Bank of Azerbaijan and other major commercial banks. The article uses secondary data from annual reports and sustainability reports published between 2021-2023, in addition to news and press releases uploaded from official websites within the date range of 2021 to 2025.

Table 1. Net Profit of Banks (in thousand AZN) for 2023

Name of Bank	**Net Profit**
Kapital Bank	242 209
ABB	358 399
PASHA Bank	225 712
Xalq Bank	64 641 464 (in AZN)
Bank Respublika	38 815
Access Bank	39 838
Unibank	31 071

Source: Financial Statements of Banks
Note: For Xalq Bank it is shown in AZN

Our research question focuses on the relationship between environmental performance and the profitability of banks, which will be investigated through multiple regression analysis. To address this, we utilized annual data from the financial statements of the two banks for the years 2021–2023, as well as the sustainability reports of these banks to collect data on their environmental indicators. The financial ratios used to measure profitability in the study were calculated based on data from the financial statements of relevant banks. The time span was selected based on the availability of data for environmental indicators.
Table 2 illustrates the variables with their symbols and descriptions applied in the study.

Table 2

Name of Variable	**Symbol**	**Description**
Dependent Variable	ROA	Net Profit / Total Assets
Return on Assets		
Independent Variables		
Water Consumption	Watercons	Logarithm of water consumption
Waste generated	Waste	Logarithm of generated waste
Energy Consumption	Energycons	Logarithm of energy consumption
Total GHG emissions	Carbon	Logarithm of GHG emissions
Control Variable	Size	Logarithm of Total Assets
Bank Size		

Source: Design of authors

Despite being strongly balanced, panel data analysis does not provide reliable estimates due to scarcity of data. Single-equation model was estimated using ordinary least squares (OLS) method. To reduce omitted variable bias, we also incorporated additional control variable "Bank Size" that also affects financial performance. Bank size is measured by the natural logarithm of the book value of total assets.

The sample captured two best-performing banks, ABB and Kapital Bank, based on their net profit for 2023. The regression model can be represented as follows in equation (1):

$$ROA_{it} = \beta_1 Size + \beta_2 Watercons + \beta_3 Waste + \beta_4 Energycons + \beta_5 Carbon + \varepsilon_{it} \quad (1),$$

where *i*- represents the group (i=1,2) and *t*- represent time (t = 1,2,3) , ε_{it}- idiosyncratic error term.

3. Results

First of all, we represent and summarize the results of content analysis for green banking initiatives held in Azerbaijan. The list of conducted activities grouped for each bank separately in bullet points.

I. Kapital Bank

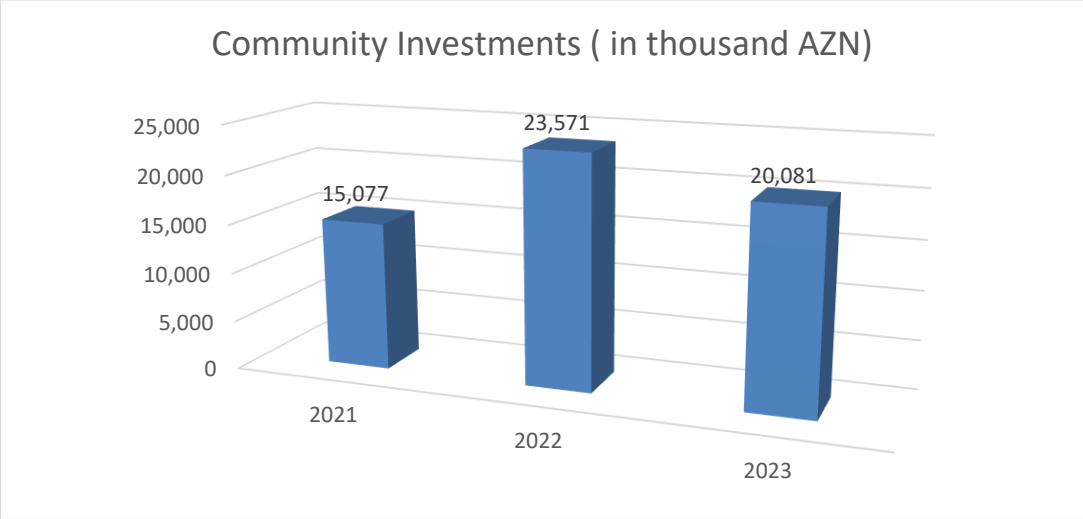
Kapital Bank represents one of the largest financial institutions in the country. The bank proactively demonstrates its environmental commitment through participation in various sustainability projects and promotes green banking initiatives in its business model. The statements below summarize these activities:

1. Green corporate social responsibility

- Establishment of Red Hearts Foundation: Kapital Bank targets to increase community and environmental wellbeing in the society by integrating corporate social responsibility (CSR) principles into daily business operations. The Red Hearts Foundation intends to focus on community engagement, animal welfare, and environmental protection. The bank arranges educational workshops, training sessions, and awareness campaigns for community engagement. Investments in the community have grown steadily during recent years (Figure 5).

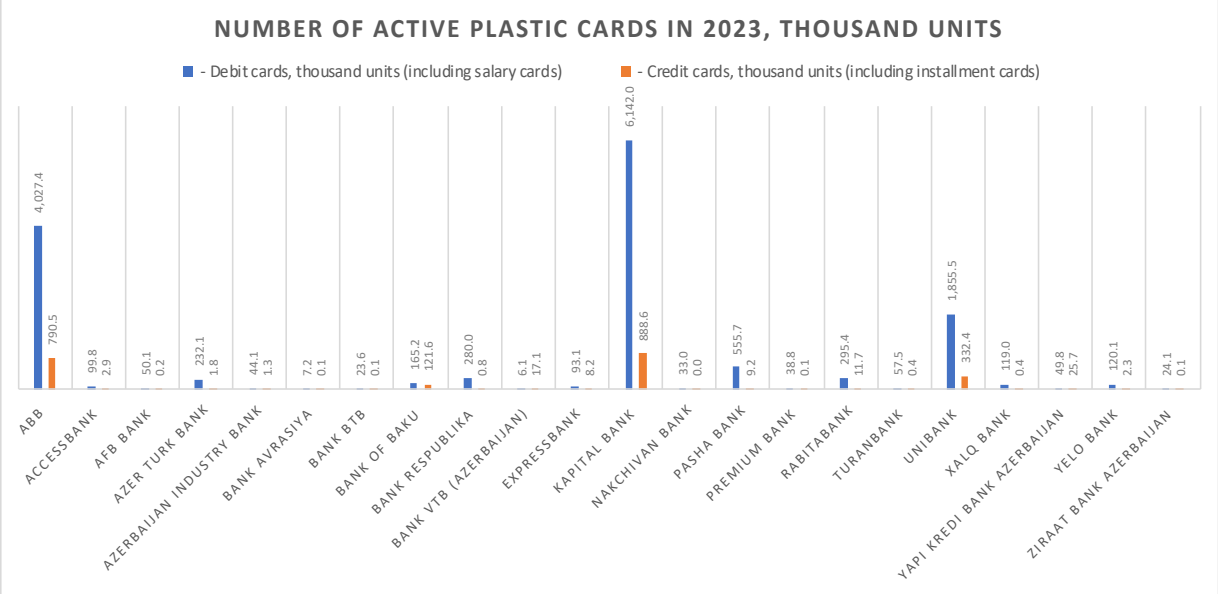
- The next initiative of Kapital Bank in the field of environmental protection and environmental improvement was related to tree planting campaigns. Birbank introduced the "Green Deposit" campaign in the Year of Solidarity for a Greener World in October 2024. According to this campaign, anyone who places a deposit via the Birbank app will have a chance not only to earn interest but also to contribute to environmental sustainability. For every customer aged 18 and above who applies for a digital deposit, a tree will be planted in their name, alongside that electronic certificate as a token of appreciation will be provided.
- Digital Banking: Kapital Bank presented Birbank digital centres that offer various advantages to customers such as elimination of paperwork and self-service mode.

Figure 5. *Community Investments in Kapital Bank*



Source : Kapital Bank Annual Sustainability Report (2023)

Figure 6



Source: ABA (2023)

2. Green product development

- On June 8, 2023 Kapital Bank participated in syndicated loan project of Türkiye İş Bankası with sustainability-linked objectives with total amount of $224 million to be used according to ESG criteria.
- In general, among the main strategic directions Kapital Bank recognizes financing of green projects, significant discounts on eco-friendly car loans, efficient use of eco-resources, and implementation of projects aimed at reducing waste.
- The bank developed the "Digital Deposit" product, allowing customers to open and manage deposit accounts entirely online through the Birbank mobile application. The Bank also is a leader in the number of actively used plastic cards (Figure 6).

3. Green internal processing

- The bank is successful in organizing internal process automation. There is a significant decline in the amount of paper waste and energy consumption generated from automating administrative processes. Tough waste management practices help to reduce the environmental footprint linked to business operations. For instance, The Archive department applies paper recycling while Marketing and HR departments work closely with external stakeholders to ensure corporate social responsibility initiatives to give prompt waste management practices.
- Kapital Bank reached the implementation of ESG initiatives that represent part of green internal processing, such as applying 3R principles in waste management, implementing a discrimination-free workplace, and initiating inclusive education.

II. ABB

Bank ABB is one of the leading banks in the country. The Bank puts effort to improve ESG performance within the organization. The list of main achievements presented below according to classifications:

1. Green corporate social responsibility

- ABB achieves enhancement of operational efficiency via technological advances. The bank pursues digitized accounting documents and paperless branch initiative which suggests digitized loan processing. Moreover, the practice of digital ID cards is also implemented.
- To support environmental sustainability goal, the Bank introduced Tam DigiCard which is issued digitally. This card offers a wide range of transactions without commission.
- The Bank took part in several tree-planting campaigns. One of them was organized by IDEA Public Union and the Ministry of Ecology and Natural Resources. The trees were planted on a 51-hectare area allocated in Mushfigabad settlement.
- The bank while establishing the Khankendi branch took into account the declaration of Karabakh and East Zangezur as a zone of green growth. The building of the Khankendi branch was built according to green banking concept. Solar panels were placed on the roof of the building and the facade and advertising boards of the Khankendi branch are illuminated with renewable energy.

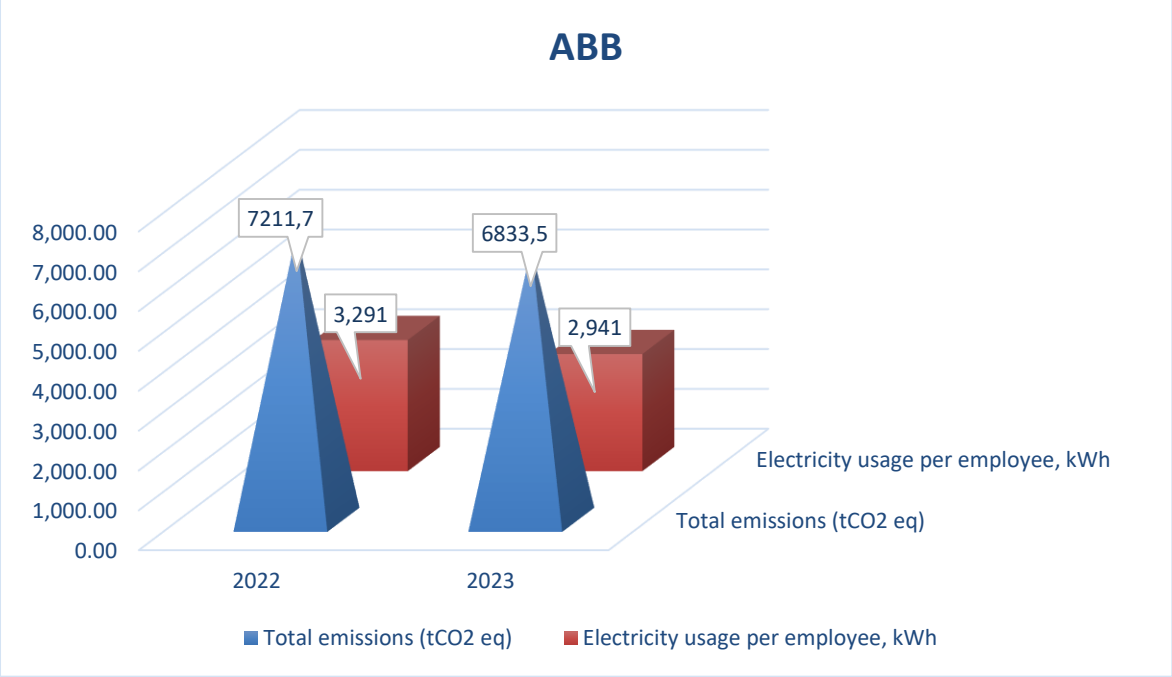
2. Green product development

- The bank supports provision of financing for the sustainable projects. Sustainable loan can be with 2 types of labels: green label and social label. Green label projects should aim to support direct or indirect reduction in GHG emission, efficiency of energy/ resource consumption, transition to a circular economy and protection, restoration and promotion of natural resources and healthy ecosystems.
- ABB launched a new green product called the TamEco card that was made from recycled plastic collected from the oceans in 2023. As a part of project, the Bank committed to planting one tree for each order of TamEco card.

3. Green internal processing

- The Bank was successful in the reduction of total GHG emissions and electricity usage per employee approximately 5% and 10,6% respectively from 2022 to 2023 (Figure 7).

Figure 7



Source: ABB Sustainability Report (2023)

III. PASHA Bank

PASHA Bank is a leading corporate bank in Azerbaijan with its strong capital base. The Bank achieved total regulatory capital adequacy ratio of 20.41% in 2024 IV quarter. One of its strategic goals is to finance projects that promote environmental protection and energy efficiency. PASHA Bank implements an integrative sustainability strategy that consists of its economic, social and environmental activities.

1. Green corporate responsibility

- The Bank joined the tree planting campaign organized by IDEA Public Union in collaboration with the Ministry of Ecology and Natural Resources.

- The Bank offers digital loan products and SME customers can apply completely online, without submission of physical documents or visiting branches. This is a convenient and fast way for doing business that enhances flexibility and effectiveness.

2. Green product development

- The State Oil Company of the Republic of Azerbaijan (SOCAR) successfully placed $200 million in “green” bonds with the support of PASHA Capital Investment Company. These bonds targeted developing renewable energy sources and supporting new "green" energy projects.
- PASHA Bank also made investments in environmentally friendly modes of transport. Within a joint project with “Xaliq Faiqoğlu” Company, the Bank financed the import of 50 compressed natural gas (CNG) buses and 5 electric buses. Moreover, the Bank supported financing of many other green projects.

3. Green internal processing

- PASHA Bank effectively manages total electricity and water consumption by using an advanced technology infrastructure throughout its branch network and at headquarters.
- The Bank formed its own recycling infrastructure. Initiatives include recycling vehicle batteries, in addition to collecting waste papers and disposing of electronic equipment.
- The Bank organizes special training for its staff members to increase environmental awareness among the workforce and other stakeholders.
- PASHA Bank has joined the Mastercard Sustainable Cards Program to reduce plastic waste and restore environmental protection. The aim of program is to eliminate gradually the usage of polyvinyl chloride (PVC) in the production of payment cards and replace with recycled and bio-based materials for all newly issued cards for by 2028.

IV. Xalq Bank

Xalq Bank, founded in 2004, is one of the largest private banks in Azerbaijan in terms of total assets (ABA, 2023).

1. Green corporate social responsibility

- A tree planting campaign was held in the Mushfigabad settlement of Baku organized by Xalq Bank and supported by the Ministry of Ecology and Natural Resources.
- Support of online banking services via XalqOnline app, implementation of Digital Card for free that allows the management and tracking of banking operations. The customers can also use Cash In ATMs to top up the card.

2. . Green product development

- On April 06, 2023 Xalq Bank took part in sustainability-linked syndicated loan project with total amount $1.3 billion to be used according to ESG criteria originated for Ziraat Bank. Loans extended within the Earthquake Support Packages to mitigate the effects of the earthquake in February.

- On May 13, 2024, Xalq Bank participated in the syndicated loan facility for Türk Eximbank (Türkiye Ihracat Kredi Bankası A.Ş.) with total amount $728m equiv. This loan also will be used in accordance with ESG standards, which refer to the principles of environmental, corporate governance and social responsibility. The bank highlights the significant role of participation in this syndicated loan project for enhancement of interbank relations with the banks of the Republic of Türkiye.

V. Bank Respublika

Bank Respublika, being one of the largest commercial banks in the country, attempted to promote sustainability through various initiatives.

1. Green corporate social responsibility

- Bank Respublika proactively supports provision of basic financial operations with help of mobile banking. It makes possible to activate virtual Digital Card via application.
- The bank's employees planted about 100 trees around Bank Respublika Arena with the players of "Sabah" FK, one of the leading clubs in the national football championship.

2. Green product development

- The bank introduced "Green Loan" as new financial instrument for entrepreneurs, offered under the EU4Business-EBRD Credit Line, which represents a combined effort of the EU and the European Bank for Reconstruction and Development and aims to support environmentally sustainable projects and improve the energy efficiency of micro, small and medium-sized enterprises (MSMEs). This product proposes numerous benefits to entrepreneurs such as up to 15% cashback to reduce the financial burden on entrepreneurs, a decline in operational costs, quick processing and the usage of cleaner technologies for environmental protection.

3. Green internal processing

- The bank conducted several events for the "Year of Solidarity for a Green World". There was held two-day seminar on green financing for employees with the Dutch Entrepreneurial Development Bank (FMO). Specialists from FMO shared their experience in field of green financial projects and discussed possibility for development of such initiatives in the banking sector.

VI. AccessBank

AccessBank established since 2002 and serves Azerbaijan MSME and retail market with total assets of 1.5 bn AZN. 66 % of loan portfolio is devoted to micro loans (AccessBank, 2023). One of the strategic goals of AccessBank is to ensure sustainable development and financial profitability for investors.

1. Green corporate social responsibility

- The bank participates in tree plantation campaigns. In 2024, for the sake of "Year of Solidarity for a Green World", a tree planting campaign was held with the support of AccessBank with the participation of members of the Baku Port and the Institute of Internal Auditors (IIA Azerbaijan Chapter). During the campaign, 170 olive and pine trees were planted in the territory of the Baku Port.
- The Bank puts to use its digital platform myAccess for all customer segments. In 2023, AccessBank successfully moved to the Azericard processing center. This migration helps to expand payment tools by integrating its digital services with Google Pay and Apple Pay.
- Since 2022 after joining "Collect Batteries, Protect Nature" project, AccessBank has collected used batteries at its headquarters and branches in other regions, then handled them over to a specialized waste management company for safe disposal.

2. Green product development

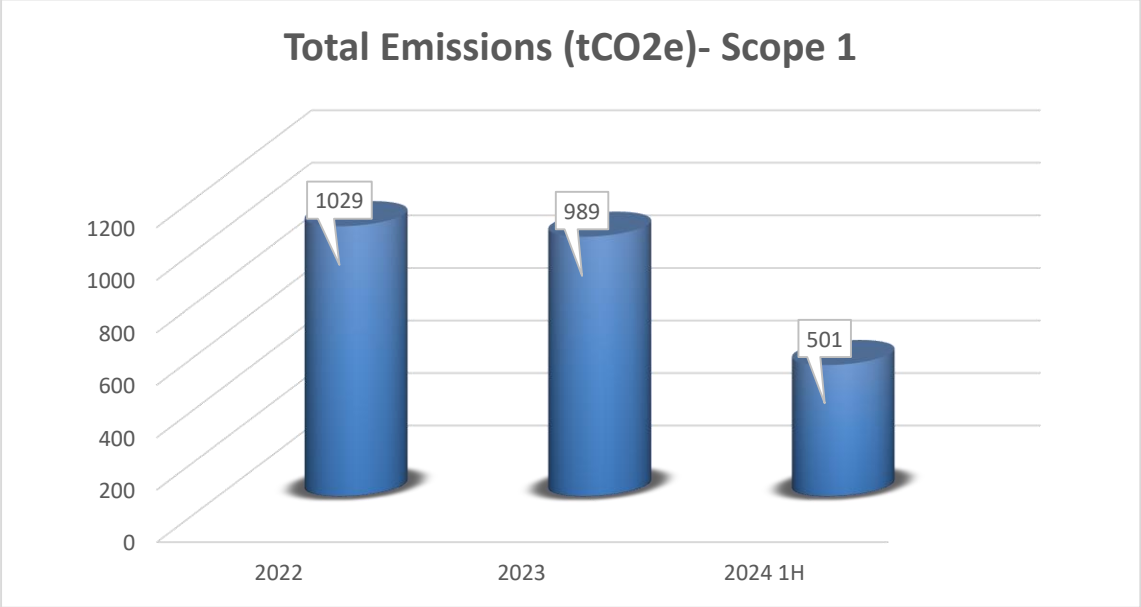
- In 2023, AccessBank signed a senior unsecured loan agreement with the Global Climate Partnership Fund S.A. (GCPF) with first committed tranche of AZN 8.5 million. The proceeds from loan will support initiatives for energy efficiency and renewable energy projects undertaken by MSMEs in Azerbaijan.

3. Green internal processing

- AccessBank carries out activities directed to minimize its carbon footprint. This target implies optimizing operations and investing in energy-efficient technologies. In 2023,the bank started tracking emissions with the goal to continuously reduce them. According to statistics, total emissions (tCO2e) based on Scope 1 reduced significantly from 2022 to first half of 2024 (Figure 8).

Figure 8

AccessBank- Total Emissions based on Scope 1



Source: AccessBank Sustainability Report

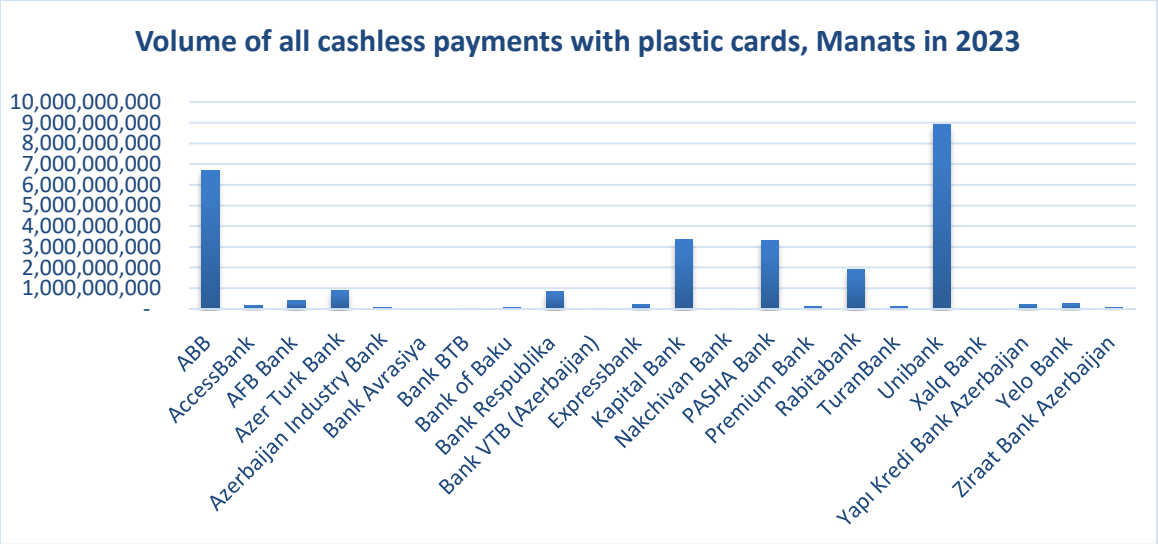
VII. Unibank

Unibank represents one of the largest private banks founded in Azerbaijan in July 1992 under the name of MBank.

1. Green corporate social responsibility
   - The bank planted 500 trees in the Mushfigabad area. Bank employees planted Eldar pine and olive seedlings on an area of about 1 hectare. The tree planting campaign was supported by the Eco Hub Public Union for Support of Ecological Initiatives.

2. Green product development
   - Unibank issued securities that can be classified as green bonds in compliance with international green finance standards in October 2024. The nominal value of the bonds is set at 100 AZN, with an annual interest rate of 11.5%.
   - Unibank entered into a strategic partnership with one of the leading taxi companies Yango Azerbaijan. The aim of partnership is to provide financial support for increasing the number of eco-friendly hybrid cars in Baku. As part of this partnership, the delivery of 500 new hybrid cars to four partner taxi fleets of Yango Azerbaijan was expected. The cars were offered under very favorable, preferential conditions.
3. Green internal processing
   - The bank has launched its first digital branch, which offers access to services and products in a completely digital format. Noticeably, Unibank was ahead in the volume of cashless payments made with active plastic cards in 2023 (Figure 9).

Figure 9



Source: ABA (2023)

Results of Regression Analysis

Table 3: Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
ROA	6	2.12	1.29	.03	3.94
Watercons	6	10.86	.31	10.53	11.28
Size	6	16.11	.30	15.71	16.45
Energycons	6	16.06	.06	15.97	16.14
Waste	6	7.56	.92	6.56	8.51
Carbon	6	8.87	.05	8.79	8.92

Source: Authors' calculations

Table 3 above demonstrates the descriptive statistics of the data generated using STATA software. The table summarizes the mean, maximum and minimum values, and standard deviation for the variables. In the following analysis, we examined the role of environmental impact on bank characteristics by using a set of resource-based environmental factors. The profitability of the banks was measured by Return on Assets (ROA), which is derived as the total net income divided by the book value of assets. Consequently, higher levels of ROA indicate better performance for the bank.

According to the obtained results, both banks in the sample showed positive performance in terms of profitability, with a positive mean of 2.12% for ROA. Typically, a desirable level of ROA is above 1%.

The low standard deviation observed for all independent variables and the control variable suggests small variability and homogeneity in the data. When it comes to environmental indicators, it is evident that the banks in the sample are primarily exposed to water and energy consumption.

Table 4 : Regression Output

Variable	***Coefficient***	***Std.Error***	***P-value***
Waste	*-.31*	*- 0.06*	*0.96*
Energycons	*-10.12*	*27.73*	*0.77*
Size	*6.76*	*10.66*	*0.64*
Watercons	*6.40*	*10.06*	*0.63*
Carbon	*-1.31*	*39.28*	*0.97*

Source: Authors' calculations

Table 4 illustrates regression output generated from regression analysis of equation (1). The results show that the coefficient of the waste, energy consumption and GHG emissions on ROA is negative. However, we find a positive coefficient for water consumption among the environmental variables. Notably, profitability is more severely affected by energy consumption and greenhouse gas emissions. Conversely, the higher of water consumption is associated with increased profitability. As regards the control variable, we notice that profitability positively influenced with an increase of bank size as it was expected. These findings align with previous studies, including Emmanuel et al. (2024). To sum up, all regressors are statistically insignificant as p-values are higher than 0.05.

4. CONCLUSIONS

This research discusses how the financial system contributes to the development of green banking. A large body of academic literature acknowledges that the enforcement of green regulatory policies is a key factor in promoting green investments in financial institutions. Roadmap for Sustainable Finance for 2023-2026, introduced by the Central Bank of Azerbaijan, supports the incorporation of ESG factors into risk management policies.

The present study analysed green banking initiatives implemented in Azerbaijan, categorizing them according to the three categories used in the study by Sharma and Choubey (2022) for Indian banks. The results indicate that the top-performing seven banks in Azerbaijan have been quite successful in recent years in establishing and implementing green banking practices. Notably, all the banks under review demonstrated a strong commitment to participating in activities linked to green corporate social responsibility. These banks have consistently engaged in important campaigns organized for environmental protection purposes. Furthermore, all of them have adopted internet and mobile banking for a wide range of banking operations. The banks in the country also showed positive trends in the green product development dimension presented in the classification. Despite being relatively new, several green financing products, such as green loans, green deposits, and green bonds, have been successfully introduced to the market.

In terms of internal process improvements, it is clear that all the banks under consideration have made considerable efforts to ensure effective waste management and reduce their carbon footprint. Trainings for employees, as well as initiatives aimed at saving water, paper, and electricity, are being intensively implemented. The introduction of fully digital branches is another initiative that has been successfully executed.

However, there is still room for improvement. It is expected that the scope of these initiatives will continue to expand across various dimensions. In general, it is likely that large-scale implementation of certified green buildings, the use of renewable energy through solar-powered ATMs, or the generation of wind power for branches will be pursued in the future.

As a growing body of academic literature recognizes, we can infer that environmental management which became an important part of business regulation, facilitates efficiency and profitability of banks in Azerbaijan. Particularly, two major banks of the country showed consistency in terms of environmental performance. Both banks proactively target to reduce their carbon footprint by implementing effective environmental management strategies. We observe a negative but not significant relationship between disclosures of environmental performance regarding energy consumption, carbon emissions, and waste, and financial

performance, even in the short term. Our findings coincide with the study by Dragomir et al. (2022). However, it is crucial to consider that other unobserved factors or additional variables that are not reflected in our model can also influence ROA. In this case, further investigation might be necessary to attain a more complete model for the determinants of ROA.

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HYDROGEN'S ROLE IN GREEN ECONOMY: OPPORTUNITIES AND CHALLENGES IN SELECTED EUROPEAN COUNTRIES

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Abstract: *Hydrogen is an important element in the transition to a green economy, with its potential to play a key role in the decarbonization of industry and transport within the European Union. The aim of this article is to analyse the differences in hydrogen production and consumption between selected European countries in the context of their economic maturity. Based on data from 2020 to 2023, a quantitative analysis was conducted including variables such as hydrogen production and consumption capacity and GDP per capita. Using non-parametric tests (Kruskal-Wallis, Dwass-Steel-Critchlow-Fligner), statistically significant differences were identified between groups of countries with high and low levels of hydrogen infrastructure development. The results confirm that higher economic performance of countries is closely related to a more developed hydrogen economy. The discussion highlights the importance of investments, regulatory frameworks and technological innovations in the implementation of hydrogen solutions. The article also identifies the challenges faced by less developed countries and recommends an approach based on support and cooperation within the EU.*

Keywords: *European Union, Green Economy, Green Logistics, Hydrogen, Non-parametric tests, Sustainability.*

1 INTRODUCTION

The transition to a green economy is one of the key challenges of the 21st century, with the decarbonisation of industry and transport among its main priorities. Hydrogen, as a flexible energy carrier, is gaining increasing attention for its potential to contribute to reducing greenhouse gas emissions, diversifying energy sources and supporting innovation in the field of sustainable mobility. In this context, the European Union has set ambitious targets for the production and use of hydrogen, which, however, encounter differences in the economic and technological readiness of individual Member States.

The aim of this study is to analyse the relationship between the economic performance of countries and the level of development of hydrogen infrastructure, specifically in the area of hydrogen production and consumption capacity and the number of registered hydrogen vehicles. Special emphasis is placed on identifying differences between countries with a high and low level of economic development, while the approach chosen in the work allows identifying potential disparities and formulating recommendations for EU policy in the area of supporting the development of hydrogen technologies.

1.1 Literature review

Hydrogen has been at the forefront of discussions on Europe's energy transition in recent years as a key element in the fight against climate change. Although plans are ambitious and investments are increasing, this energy carrier remains at the beginning of its journey towards mass use (Abbasov, 2024). The European Union has set ambitious goals to achieve 10 million tonnes of domestic production of green hydrogen and a further 10 million tonnes from imports by the end of this decade, but current production of clean hydrogen remains well below these values. Studies show that for hydrogen technologies to be successfully implemented, obstacles must be overcome technological, economic and regulatory barriers. The so-called hydrogen valleys and national initiatives in selected European countries must play a key role in this (Sadik- Zada, 2021).

1.1.1 Concrete steps under the European hydrogen strategy

The European Commission plans to present an EU hydrogen strategy together with a strategy for the integration of European energy systems with the aim of connecting the various energy sectors. The primary steps the EU is considering include scaling up the development of hydrogen technology, increasing the production of clean hydrogen to one million tonnes per year and doubling the funding for the hydrogen initiative within the EU budget to €1.3 billion (Kovač, Paranos & Marciuš, 2021). Other measures include allocating €2-4 billion over the next two years to launch projects financed by the sale of emission allowances and supporting investments in renewable energy and hydrogen infrastructure. According to the published documents, the overall EU economic package should include a plan for 2021-2027 and a "recovery instrument" of at least half a trillion euros (Vivanco-Martín & Iranzo, 2023).

One of the most promising concepts for the development of a hydrogen economy in Europe are the so-called hydrogen valleys. These are regional ecosystems within which hydrogen is produced, transported and used within an integrated system. Such areas could serve as a springboard for the creation of a larger European hydrogen economy (Sadik- Zada, 2021). Currently, there are only three hydrogen valleys in the EU - one in Denmark and two in Germany. These countries can be considered pioneers in this area. On the positive side, however, another 17 projects are actively developing, indicating a gradual expansion of hydrogen solutions across the European continent (Kumar & Lim, 2022).

1.1.2 European ambitions for hydrogen valleys

The European Commission has set itself an ambitious target of doubling the number of operational hydrogen valleys by 2025. The Commissioner for Innovation, Research, Culture, Science and Youth has highlighted their importance. According to her, hydrogen valleys are key to creating a European hydrogen research and innovation area. Hydrogen valleys allow new technologies to be integrated directly into a hydrogen ecosystem tailored to local requirements. This approach provides space for testing and optimizing different solutions before their wider deployment, which is extremely important for new and emerging technologies (Lagioia, Spinelli & Amicarelli, 2023).

1.1.3 Main challenges in the development of hydrogen technologies

The three main obstacles can be considered regulation, permitting processes and access to the energy grid. Countries need clear regulation and clear permitting processes, but access to the energy grid is the most problematic (Zainal et al., 2024). This is essential to ensure sufficient renewable electricity to produce green hydrogen. Without solving this problem, it will be difficult to achieve the set goals for the production and use of hydrogen on the required scale. These challenges reflect the complexity of the transition to a hydrogen economy (Kakoulaki et al., 2021).

While the European Union coordinates a common approach to the hydrogen economy, individual Member States are implementing their own initiatives that reflect their specific conditions, priorities and possibilities (Mneimneh et al., 2023). Germany and Denmark have emerged as European leaders in hydrogen technologies, as evidenced by the fact that these countries are home to three currently operational hydrogen valleys (Hashimova, 2023). Germany, Europe's largest economy, is investing massive resources in the development of the hydrogen sector, while Denmark is building on its experience with wind energy, which it plans to use to produce green hydrogen (van der Spek et al., 2022). In 2024, the European Commission, together with Spain, Lithuania and Austria, announced new financial support for the development of hydrogen from renewable sources through an innovation fund. These three Member States have joined the "Auctions as a Service" scheme in the second auction of the European Hydrogen Bank. In addition to the €1.2 billion in EU funding, the three countries have allocated over €700 million from national resources to support renewable hydrogen projects on their territory. The total funds mobilised through the renewable hydrogen auction reached around two billion euros (Falcone, Hiete & Sapio, 2021).

1.1.4 Technological and infrastructure constraints

Another major challenge is the need to develop and optimise technologies for the production, storage, transport and use of hydrogen. Electrolysers, the essential equipment to produce green hydrogen, are still relatively expensive and their production on an industrial scale is limited. The infrastructure for the distribution of hydrogen is also problematic (Squadrito, Maggio & Nicita, 2023). Although some European countries, such as the Netherlands, Germany and Portugal, have the potential to use existing natural gas infrastructure to transport hydrogen, this requires significant investment and technical adaptations. These countries are well placed to expand the use of hydrogen thanks to their natural gas infrastructure that can be adapted to transport hydrogen (Trattner, Klell & Radner, 2022; Azadnia et al., 2023). The economic viability of hydrogen projects remains one of the biggest obstacles to their wider deployment. The production of green hydrogen is currently more expensive compared to conventional methods of producing hydrogen from natural gas or the direct use of fossil fuels in industry (Capurso et al., 2022). Hydrogen currently accounts for less than 1 percent of European energy consumption and is mainly used as a feedstock in the chemical industry (Ismayilova & Hajiyeva, 2024). This situation highlights a significant gap between current reality and strategic objectives, underlining the need to accelerate the development of the sector and increase investment in relevant technologies and infrastructure (Seck et al., 2022; Genovese et al., 2023).

While there is a growing number of studies addressing the potential of hydrogen as part of a green transition (e.g. in industry, transport or energy), most research focuses on the technical, technological or environmental aspects of hydrogen use. However, only a limited number of works analyse regional differences in the development of hydrogen infrastructure in relation to the economic performance of countries. In particular, there is a lack of comparative analysis linking economic indicators such as GDP per capita with practical indicators of progress in hydrogen mobility and production. This study therefore seeks to fill this gap by examining whether and how a country's economic strength influences its ability to develop a hydrogen economy. Based on the identified research gap, we formulated the following research question: "What is the relationship between the economic maturity of countries (measured by GDP per capita) and the rate of development of hydrogen infrastructure, including the number of hydrogen vehicles and production capacities in EU-27 countries?".

2 DATA AND METHODOLOGY

This study examines the relationship between hydrogen infrastructure capacities and economic development in EU-27 countries. The dataset used includes national indicators obtained from publicly available sources such as Eurostat, the European Hydrogen Observatory and national statistical offices.

Three main variables were selected for the analysis:

- Hydrogen production capacity (MW/MWel),
- Hydrogen consumption capacity (in tonnes/year),
- GDP per capita (in euros).

Countries were divided into two groups – high and low levels of hydrogen infrastructure development – based on aggregated indicators of hydrogen production and consumption in 2025.

Due to the small sample size and the lack of examination of normal distribution, non-parametric tests were used to verify statistical differences between these groups:

- The Kruskal-Wallis test was used to assess differences between groups,
- The effect size (ε^2) was calculated to estimate the significance of the differences,
- Subsequently, Dwass-Steel-Critchlow-Fligner pairwise comparisons were applied to identify specific differences between groups.

The chosen methodological approach allowed comparing the readiness for the implementation of hydrogen solutions in different economic contexts, while taking into account the limitations of the available data and their distribution.

Based on the research question, we formulated the following hypotheses:

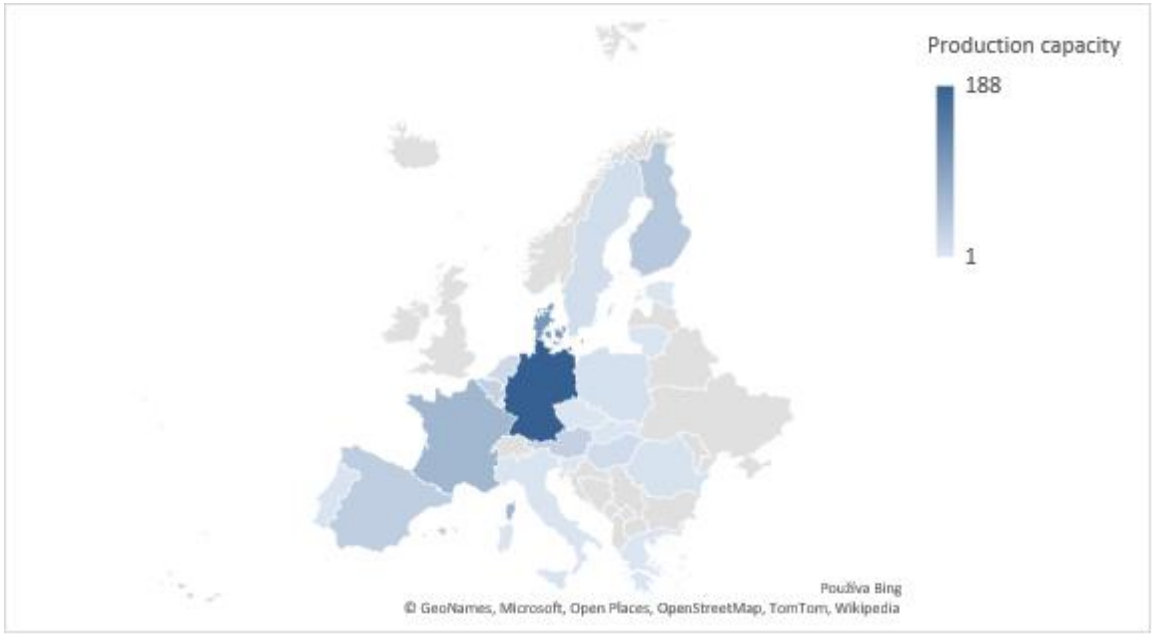
H1: *There is a statistically significantly higher hydrogen production and consumption capacity among countries with higher GDP per capita compared to countries with lower GDP per capita*.

H2: *Countries with higher GDP per capita have a higher number of registered hydrogen cars compared to countries with lower GDP per capita*.

3 RESULTS AND DISCUSSION

Figure 1 shows the differences in hydrogen production capacities between EU-27 countries. The results show higher production capacity in economically stronger countries, which corresponds to their investment potential and technological maturity (Germany, France, Denmark, Finland).

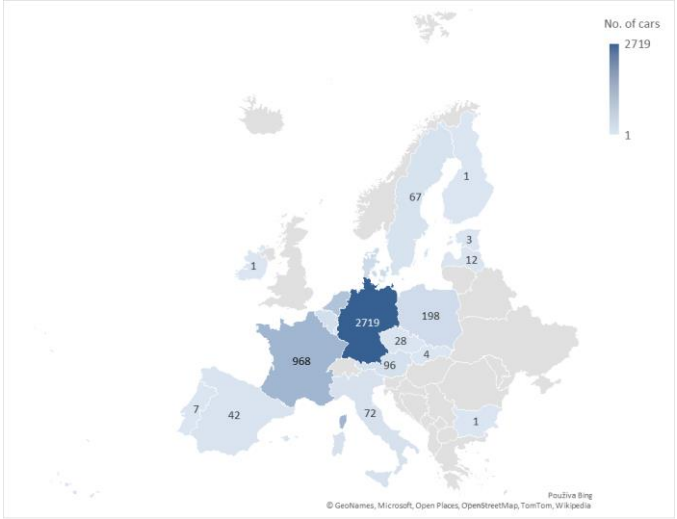
Figure 1. *Production capacity in the European union (2025)*



Source: European Hydrogen Observatory (2025)

Figure 2 illustrates the current number of registered hydrogen-powered passenger vehicles in individual European Union member states. Countries such as Germany and France have the highest number of registrations, indicating their more active approach to supporting alternative transport fuels and developing hydrogen infrastructure.

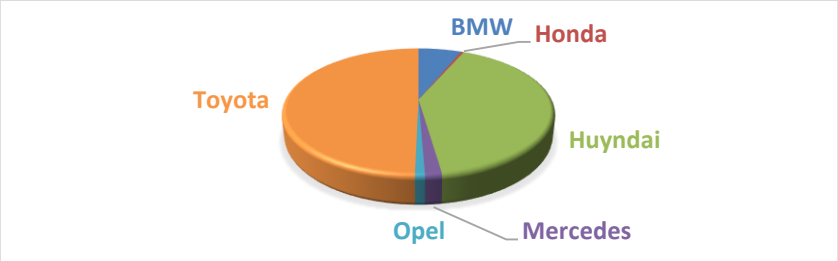
Figure 2. *Number of registered hydrogen cars in the European union*



Source: European Hydrogen Observatory (2025)

Figure 3 shows the market share of different car brands offering hydrogen-powered vehicles in individual European Union member states. The dominance of brands such as Toyota and Hyundai highlights the technological leadership of Asian manufacturers in the field of hydrogen propulsion and their penetration into the European market.

Figure 3. *Brand share of registered hydrogen cars in the European union*



Source: European Hydrogen Observatory (2025)

The results of the analysis show that there are statistically significant differences in the three variables under study between groups of countries with high and low levels of hydrogen infrastructure development: hydrogen production capacity, hydrogen consumption capacity and GDP per capita.

Table 1: *One-way ANOVA results*

	χ^2	df	p	ε^2
Production_capacity	6.1372	1	0.0132	0.3230
Consumption_capacity	5.7130	1	0.0168	0.3007
GDP_per_capita	10.5657	1	0.0012	0.5561

Dwass-Steel-Critchlow-Fligner pairwise comparisons

Pairwise comparisons - Production_capacity

		W	p
High	Low	-3.5035	0.0133

Pairwise comparisons - Consumption_capacity

		W	p
High	Low	-3.3802	0.0169

Pairwise comparisons - GDP_per_capita

		W	p
High	Low	-4.5969	0.0012

These results confirm that countries with higher GDP per capita also have significantly more developed hydrogen infrastructure – both higher production and consumption capacity. This trend is consistent with findings from previous studies that suggest that economically stronger countries are better positioned to invest in new technologies, including hydrogen (Capurso et al., 2022).

These differences suggest that the development of a hydrogen economy is closely linked to a country's economic performance. Rich countries such as Germany, Austria, and Denmark invest in the so-called "hydrogen valleys" – integrated regional ecosystems where hydrogen is produced, distributed and consumed locally (Lagioia et al., 2023).

On the contrary, in countries with lower GDP and weaker infrastructure, the development of these technologies faces a number of obstacles. The main ones include regulatory barriers, complex permitting processes and limited access to energy networks (Zainal et al., 2024).

An important finding is also the fact that high GDP does not automatically guarantee increasing hydrogen consumption – for example, Germany shows a decreasing trend in the volume of biofuel consumption, which may be related to the diversification of renewable sources and the streamlining of production processes (van der Spek et al., 2022).

The obtained results confirm that the development of hydrogen infrastructure is significantly influenced by the economic strength of the country. To achieve the EU's green economy goals, it will therefore be crucial to create support tools for less developed countries so that they can effectively participate in Europe's energy transformation (Falcone et al., 2021).

The results of the analysis clearly support both hypotheses and indicate that the economic maturity of countries is a significant determinant of the development of hydrogen infrastructure. Countries with higher GDP per capita achieve higher hydrogen production and consumption capacity, as well as a larger number of registered hydrogen vehicles. This trend is consistent with the findings of previous studies (Capurso et al., 2022; Lagioia et al., 2023) and points to the need for specific support instruments for less developed EU Member States. At the same time, it was identified that economic maturity alone may not be a sufficient prerequisite for the intensive use of hydrogen, as consumption can also be influenced by the diversification of the energy mix and the structure of industry in the countries concerned.

Table 1 clearly confirm the statistical significance of the differences between groups of countries. A p value of < 0.05 for all three variables (production capacity, consumption and GDP per capita) together with an effect size of ε^2 above 0.3 indicates a moderate to strong effect. These results are consistent with the assumption that economically stronger countries have a higher level of technological readiness as well as better access to investment resources.

4 CONCLUSIONS

This paper highlights significant differences in the development of hydrogen infrastructure between European countries and confirms that economically stronger countries (with higher GDP per capita) achieve higher hydrogen production and consumption capacity. The strength of the research

is the use of non-parametric statistical methods, which are also suitable for smaller samples and non-ideal data distribution, which allows for robust comparisons between groups of countries.

On the other hand, the study is limited by the relatively small number of countries analysed and the focus on selected quantitative indicators only. Therefore, the results cannot be generalized without reservations to the entire EU. In addition to economic maturity, other factors can also influence the development of hydrogen infrastructure – for example, the availability of natural resources, energy policy, public perception of hydrogen technologies or the level of technological readiness (compare with van der Spek et al., 2022; Capurso et al., 2022).

The practical implications of the research are clear – if the hydrogen economy is to be a tool for a fair and environmentally sustainable transformation of Europe, it is essential to specifically support the development of infrastructure, including in economically weaker countries. Policies should focus on: widening access to investment through European funds; simplifying permitting processes; supporting research and development of local solutions (Zainal et al., 2024); strengthening education and raising awareness about hydrogen in society.

In the future, research should follow longer-term developments and expand the spectrum of variables, including environmental benefits and socio-economic effects of the introduction of hydrogen technologies. It is also important to analyse in more depth successful examples, such as the so-called "hydrogen valleys" in Germany and Denmark, which could serve as a model for other countries (Lagioia et al., 2023).

The paper summarizes the knowledge on the development of hydrogen infrastructure in EU Member States and confirms the importance of economic maturity as a key factor in this development. The results point to the need for a differentiated approach to the creation of public policies that would take into account regional specificities and support the implementation of hydrogen solutions also in less developed areas. Specifically, countries with a GDP per capita above EUR 35,000 showed on average twice the hydrogen production capacity compared to countries whose GDP did not exceed EUR 20,000. In the future, it is appropriate to expand the research to include qualitative aspects, as well as environmental and socio-economic consequences of the introduction of hydrogen technologies.

In conclusion, it can be stated that the support of the hydrogen economy must be systemic, inclusive and strategically coordinated at the EU and individual national levels in order to fulfill its transformative potential in the context of a green economy.

The practical implications of the study lie in identifying specific economic obstacles that limit the development of hydrogen infrastructure in less developed countries. The results provide an argumentative basis for creating targeted financial and technical support from the EU, for example through cohesion policy, the European Hydrogen Bank or programs focused on regional innovation. At the same time, the contribution points to the need to simplify permitting processes and strengthen interstate cooperation in building hydrogen ecosystems. Taking these factors into account can contribute to a more balanced and effective implementation of the goals of the European Green Deal.

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SCENARIO FORECASTING REVENUE MANAGEMENT STRATEGY FOR UKRAINIAN HOTELS

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Abstract: *An organizational mechanism for revenue management implementing is proposed: monitoring and analytics of metrics for efficient adaptation; dynamic pricing and market segmentation; partnerships and staff motivation. Pessimistic, realistic, and optimistic scenarios have been developed to ensure the long-term effectiveness of revenue management. The pessimistic scenario as a preventive indicator of a crisis situation is proposed to prevent cost dissipation in the face of rate changes, ensuring the preservation of resource potential and maintaining consumer interest in the hotel product. The realistic scenario which reflects situationally possible deviations in revenue dynamics and likely fluctuations in demand focuses on strategizing preventive marketing measures to influence demand depending on external conditions and resource potential. The optimistic scenario, representing a favorable forecast involves the use of a portfolio of strategies, the variability of which provides conditions for maximizing income and helps to determine the priority areas of investment in the revenue management subsystems.*

Keywords: *Revenue management, scenario, strategy, hotels, dynamic pricing, digitalization.*

INTRODUCTION

The significant impact of a turbulent external environment and fluctuating market conditions has led to a decrease in the potential for implementing revenue management by hotel companies, especially small and independent facilities, due to limited economic and investment opportunities, deteriorating competitiveness and revenue shortfalls. The adaptation of Ukrainian hotels to the challenges associated with the war has demonstrated the importance of flexibility and the ability of businesses to respond quickly to external challenges, including those related to improving revenue management (Mazaraki et al, 2024). Therefore, attention should be paid to research related to the generalization of the evolutionary prerequisites and features of the implementation of the revenue management of various types of hotel enterprises and the identification of proposals on this basis for the formation of their strategic priorities in the context of the transformation of challenges and threats.

Therefore, the modern model of revenue management of hotel industry enterprises should be aimed at forming a balanced strategy with appropriate constraints and development vectors. Accordingly, this strategy involves not only the most efficient use of the available resource potential and ensuring sustainable growth of performance metrics that characterize the synchronization of growth opportunities, but also the establishment of partnerships to prevent cost dissipation. In other words, sustainable development and a collaborative model of the economy should be important principles in the new paradigm.

Strategic priorities for the implementation of the revenue management of hotel enterprises are aimed at achieving a balance of tactical and strategic goals, which will allow to reasonably allocate resource potential, determine descriptors of increasing revenues and adapting business processes to unfavorable external conditions (Kulyk et al, 2024).

In the context of setting strategic priorities, the following should be considered. The difference in the use of revenue management (RM) tools between hotels of different categories determines the choice of performance indicators and becomes a key element in the choice of a strategic priority, which serves as the basis for choosing a strategy. Given the diversity of tools used in hotels for revenue management, let's consider all possible variations.

1. Big Data, risk analysis, controlling. Big Data tests large amounts of analytics used to justify decisions, analyze consumer behavior and adapt pricing strategies, which ensures the flexibility of operational business processes and optimization of the value chain, leading to revenue maximization using a decision-making algorithmization model that structures the stages of management decision-making and automates business processes using integrated digital platforms, Google Analytics tools and global data analysis platforms. This toolkit covers the following performance indicators: key performance indicators (KPIs), Occupancy Rate, average daily rate (ADR), revenue per available room (RevPAR), average length of stay (ALOS), cost revenue per available room (CPAR).

2. Benchmarking. The process of analyzing the performance of competing hotel companies in order to improve business efficiency, optimize the current state of affairs and implement the positive experience of competitors. Benchmarking is an effective method of strategic and crisis management, which is a mechanism for comparative analysis of performance indicators and technologies of companies to identify and implement best practices. This toolkit covers the following performance indicators: revenue generation index (RGI), average rate index (ARI), market penetration index (MPI), net promoter score (NPS), life time value (LTV).

3. Business modeling. Some businesses use demand forecasting models and technologies based on historical booking data, which allows hotels to adjust their strategies using a technology platform that improves operational efficiency and customer service through real-time booking and management systems. This toolkit covers the following performance indicators: ADR, RevPAR, CPAR.

Thus, the definition of strategic priorities is based on the tools used and is the quintessence of the performance indicators monitored by the hotel. The basis for the formation of the external core of the effectiveness of the revenue management is the strategic guidelines that determine the meaningful idea and serve as a theoretical basis for determining the directions that ensure the effectiveness of the choice of strategies for practical application,

revenue management focuses on optimizing revenues through the implementation of environmental principles, which allows attracting investors focused on sustainable development. Implementation of digital tools in RM is a determinant of long-term efficiency of RM.

Theoretical Background

The multivariable characteristics of factors influencing the choice of strategic priorities of revenue management of a hotel enterprise, in particular in a turbulent environment, creates the basis for determining how to achieve a balance of tactical goals of the internal core of the revenue management efficiency as a key goal. The choice of strategic priorities and the combination of interests of stakeholders is determined by determining the cause-and-effect relationships between threats and opportunities and expected results in the system of evaluating tactics and further strategizing of the revenue management.

Scenario forecasting of the revenue management strategy as an alternative to single-variant forecasts is aimed at considering many factors. Modeling of possible scenarios depending on changes in internal and external factors is the result of scenario forecasting, which involves the analysis of possible development alternatives under the same initial conditions and allows to formulate optimal revenue management strategies adapted to market conditions (Chiang et al, 2007; Möller et al, 2004; Petropoulos et al, 2022).

In the context of choosing revenue management strategies, scenarios are forecasting of hypothetical development options based on the method of multiple regression using an artificial intelligence system, based on fuzzy sets and methods of fuzzy logical inference, presented in the form of an action plan.

The main advantage of scenario forecasting is the identification of factors that influence risk-based decision-making and determine priorities in the use of development opportunities (Homem-de-Mello & Bayraksan, 2014; Rahimian & Mehrotra, 2022; Strauss et al, 2018).

The heterogeneity of initial conditions in terms of seasonal fluctuations, the level of income of hotel enterprises and market factors of individual destinations causes a contradiction in determining the role and accuracy of the forecasted indicators in the revenue management. Explaining the essence of this thesis, especially in times of crisis, it is appropriate to note that the fundamental content of scenario forecasting is budget planning and strategic management, but is associated with significant challenges from the market business environment, and at the level of the hotel industry enterprise - the availability of resource potential and the balance of subsystems of revenue management as functionalities of its organizational mechanism.

However, it is worth noting that the accuracy and relevance of forecasts depends on large amounts of data, as well as analytical skills and the ability to analyze the results obtained, which necessitates the use of machine learning and artificial intelligence technologies, which, in turn, leads to the expansion of data collection and accumulation capabilities, the introduction of new methods in the process of their analysis and processing.

The problem lies in the fact that the resource capabilities of hotel enterprises for the implementation of revenue management are different in relation to the available potential, even if the enterprises belong to the same category, are located in the same climatic conditions, and are focused on a similar target consumer segment. The variability of the initial conditions of

hotel enterprises determines not only heterogeneous requirements for the development of strategies, but also affects the possibility of their implementation, which depends on the correlation of factors influencing the effectiveness of revenue management.

By the combination of external and internal environment factors in determining the potential of a hotel enterprise in terms of the effectiveness of revenue management, we understand the technology for assessing the level of occupancy rate (demand for hotel services) and the level of revenue per available room (RevPar). The methodology of scenario forecasting includes the analysis of historical data, identification of key drivers of influence, construction of alternative scenarios and assessment of their probability.

The mechanisms of scenario forecasting are described in detail by determining the correlation dependence of various parameters, among which the most common are indicators that characterize the relationship between two random variables (paired indicators): correlation moment, correlation coefficient.

In addition, other statistical indicators can be mentioned: mathematical expectation value, variance, and mean-square estimate. Thus, pairwise regression analysis involves the consideration of one independent variable and allows us to define a pairwise linear regression as a causal model of a statistical linear relationship between two quantitative variables (Klein et al, 2020)

The scenario of variability of substrategies of revenue management in the hotel business may include several key aspects that help to adapt to changing market conditions and increase the effectiveness of revenue management. It is the multivariate development of events and the turbulence of the external environment that determines the use of the scenario method in order to predict possible strategic priorities and select the optimal substrategies of revenue management. This method is used to evaluate and analyze alternative development options for hotel enterprises operating in the same market conditions. In the context of choosing revenue management substrategies depending on the trends in demand fluctuations and revenue growth rates, the scenarios are predictive development alternatives presented in the form of tactical goals and objectives. The main elements of the scenario method are the analysis of market conditions, in particular market data, including competitors, demand for services, seasonality and economic conditions and trend identification, which is to identify current and future trends in consumer behavior, such as changes in preferences for the type of accommodation or services. Having identified the areas of scenario forecasting, the management of the hotel management company has established the main directions of development and the consequences of the planned changes: flexibility in pricing using algorithms to automatically adjust prices depending on supply and demand; development of promotions and discounts for different customer segments, such as families, business travelers or groups; market segmentation based on demographic, psychographic and behavioral characteristics of consumers; development of personalized service offers.

METHOD

I.1. Sample and population

The survey was conducted from April to July 2023 and focused on the period from February 24 to the end of 2022 in hotels in Poland and Ukraine using the CAWI method

(computer-assisted web interview). Hotel managers from Ukraine and Poland (top managers and/or heads of structural units - sales, marketing, and reservation departments) were invited to participate in the survey.

I.2. Data Collection Process and Methods

The final mailing list included 306 hotels in Poland and 312 hotels in Ukraine, of which 100 hotels in Poland and 98 hotels in Ukraine responded to the survey. It should be noted that some of the hotels participating in the survey were reluctant to provide information, so some responses were found to be missing, incomplete, which reduced the number of questionnaires from Poland by six (N1 = 94) and from Ukraine by five (N2 = 93). In accordance with the entire population of certified hotels in Ukraine and Poland, the sample can be considered representative of the hotel market in Ukraine and Poland. Hotels from every voivodeship in Poland and every region of Ukraine, except for the temporarily occupied ones, took part in the survey. Most often, the survey involved two- and three-star hotels with an average capacity of 45 rooms in Poland and 49 in Ukraine. The quantitative empirical study was conducted in late 2022 and early 2023, i.e., during the period of martial law in Ukraine. The questionnaire was developed in accordance with the specifics of hotel operations under martial law, considering the peculiarities of different categories of hotels and the use of the revenue management system to improve performance.

I.3. Methodology

For the mathematical identification of scenarios of variability of revenue management (Si) substrategies, three strategic structural components (areas of choice) are defined: S1 - analysis of historical data; S2 - identification of key drivers of influence; S3 - assessment of the probability of the scenario's realization.

The methodology for identifying scenarios of variability of substrategies can be represented in the form of a matrix:

$$Si = (S1; S2; S3). \quad (1)$$

Strategic priorities are identified by C, such as: C1 - anti-crisis; C2 - supporting; C3 - cluster. The types of actions aimed at continuous transformation of the scenario selection processes are presented in the form of a column matrix:

$$Cj = \begin{pmatrix} C_1 \\ C_2 \\ C_3 \end{pmatrix} \quad (2)$$

Multiplying the selected matrices results in a rectangular matrix:

$$P_{ij} = S_i C_j, \quad (3)$$

where the elements of the matrix Pij are goals that determine the qualitative improvement of scenarios of variability of revenue management substrategies, i.e. strategic goals. The resulting matrices can reflect the scenario, Pij:

$$P_{ij} = \begin{pmatrix} S_1C_1 & S_2C_1 & S_3C_1 \\ S_1C_2 & S_2C_2 & S_3C_2 \\ S_1C_3 & S_2C_3 & S_3C_3 \end{pmatrix} = \begin{pmatrix} P_{11} & P_{12} & P_{13} \\ P_{21} & P_{22} & P_{23} \\ P_{31} & P_{32} & P_{33} \end{pmatrix} \quad (4)$$

The obtained forecasts have a high degree of approximation accuracy and can be used in the system of tactics evaluation and further revenue management strategy (Kimes, 2003; Lentz et al, 2021; Lin & Huang, 2015; Matsuoka, 2022).

RESULTS

Considering the directions of development and the consequences of the planned changes, we have developed scenarios for the variability of revenue management substrategies in the hotel business, which provide for constant market monitoring, flexibility in pricing, personalization of services and the use of modern technologies.

In practice, the use of scenario forecasting of the revenue management strategy makes it possible to make an informed choice among the relevant fluctuations in the market conditions of the substrategy/s to achieve the tactical and strategic goals of the revenue management.

In the crisis and post-crisis (post-war) period, for example, investing in the hotel business can be a profitable source for business diversification and as the main source of income (Bosovska et al, 2023).

Given the impact of certain environmental factors (level of demand), strategic priorities, and revenue potential (internal environment), we propose specific scenarios for the development of strategic behavioral models and the creation of competitive advantages for hotel enterprises. Such modeling of scenarios will allow to identify potential opportunities for the development of hotel enterprises (Table 1).

Table 1: ***Matrix for implementing revenue management substrategies***

	Scenario of variability of substrategies (V)		
	anti-crisis (C_1)	*supporting (C2)*	*cluster (C3)*
Analysis of historical data (S1)	adaptability	related diversification	cooperation
Identification of key drivers of influence (S2)	Product diversification	Development of new products and markets	Product modification
Assessment of the probability of scenario realization(S3)	Simulation strategy	Traditional strategy	Innovative strategy

Source: (Bakker et al, 2020; Gibbs et al, 2018; Pereira & Cerqueira, 2022; Xiao et al, 2024).

The matrix of implementation of the revenue management substrategies shown in the table contains a horizontal combination of elements that determine the competitiveness and efficiency of choosing the directions of modeling revenue management scenarios. It should be noted that the optimistic scenario provides a starting point for the level of efficiency of the revenue management for the hotel industry enterprise, with a high coefficient of synchronization in statics and dynamics. In turn, the baseline scenarios involve the use of a limited range of strategies that require investment. The pessimistic scenario assumes the use of

limited functionality of the revenue management, when only the dynamic pricing strategy can be used. The proposed scenarios are focused on the choice of revenue management substrategies, when it is important to determine the determinants of revenue management efficiency, risks, features of resource potential, as well as costs of the hotel enterprise (Dana, 2008; Demirciftci et al, 2020; Sundaram et al, 2020; Talluri & Van Ryzin, 2004; Webb, 2016; Yang et al, 2014).

Based on the modeling results, scenarios have been identified that make it possible to choose the revenue management substrategy(s) depending on the trends in demand fluctuations and revenue growth rates. The pessimistic scenario is a preventive indicator of a crisis situation in an unfavorable market environment. To stabilize revenue, the article proposes a dynamic pricing substrategy that prevents cost dissipation in the situation of tariff changes, ensuring the preservation of resource potential and maintaining consumer interest in the hotel product.

The optimistic scenario, representing a favorable forecast of market conditions, involves the use of a portfolio of substrategies, the variability of which provides conditions for maximizing revenues and efficient use of resource potential, and helps to determine the priority areas of investment in the subsystems of the revenue management.

DISCUSSIONS/CONCLUSIONS

In practice, the use of scenario forecasting of the revenue management strategy makes it possible to make an informed choice among the relevant fluctuations in the market situation of the substrategy/s to achieve the tactical and strategic goals of the management.

In times of crisis, it is important to use a scenario approach, since, taking into account the factors of internal and external influence, it is the miscalculation of possible scenarios that is an indicator of trends in the hotel services market. In times of market turbulence, an important process is to monitor the financial, resource, human resources, marketing, environmental and digital capabilities of a hotel company for timely adaptation to new consumer needs. The proposed scenarios take into account the level of efficiency of the management of hotel industry enterprises, which is determined by the synchronization coefficient. In order to ensure the reliability of data analysis, the following areas of scenario selection have been identified: analysis of historical data; identification of key drivers of influence; assessment of the probability of scenario implementation. A systematic approach was used to evaluate the strategic priority of the hotel industry enterprise, which allows to effectively analyze the factors of influence for making management decisions.

The strategic priorities for revenue management implementing are aimed at achieving a balance of tactical and strategic goals in the frame of the external core of revenue management efficiency. The use of the instrumentarium proposed in the article allowed to allocate three basic strategic priorities for the implementation of revenue management: anti-crisis (outsourcing strategy), supporting (segmental), cluster (consolidated), the choice of which depends on the assessment of the performance indicators of operating activities (Chiang et al, 2007).

The economic effect is calculated and the risks of implementing strategies within the framework of strategic priorities are identified. Implementation of the outsourcing strategy for delegation of non-core and supplementary business functions of the operating activities

reduced the burden on internal resources and influenced the annual revenue growth in the range of 0.5--2.7%. The segment strategy focused on differentiating distribution channels to increase consumer demand, maintaining loyalty, and promptly adjusting the tariff policy has helped to identify sources of profitability that lead to an annual increase in operating income of 3 to 5% (Mazaraki et al, 2024). It has been proved that the strategic priority in the format of the consolidated strategy is aimed at ensuring long-term revenue growth with an annual increase of (up to 10%).

Scenario forecasting of the variability of the revenue management strategies is aimed at achieving a balance of tactical goals of the internal core of revenue management efficiency. A correlation analysis was carried out to assess how changes in demand can affect the level of income. Based on the results obtained, two types of correlations were identified: positive and negative (Petropoulos et al, 2022).

. These results made it possible to accurately determine the relationship between demand and income, which is the basis for creating adaptive scenarios for choosing revenue management strategies. In particular, they helped to develop substrategies to optimize pricing policy, distribution channels, and to introduce new technologies and tools for revenue management.

Based on the results of the scenario forecasting, four scenarios were modeled to determine the likely strategy of revenue management. For the pessimistic scenario, as a preventive indicator of a crisis situation, the dynamic pricing substrategy is likely to be used; for the basic ones, the distribution, differentiation of the hotel product, and personalization substrategies are defined; for the optimistic scenario, a portfolio of substrategies is proposed, the variability of which ensures the conditions for maximizing revenues. It is proved that the choice of a probable revenue management strategy allows to respond proactively to potential external threats and to substantiate adaptive measures depending on future changes in the external environment.

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RISING DANGER OF AIR CONDITIONERS: A NECESSITY OR A LUXURY?

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Abstract: *Air conditioners have become an indispensable part of modern life, providing a comfortable indoor climate, especially during the hot summer months. However, their use comes with environmental consequences. The increased electricity consumption required to power air conditioners significantly contributes to greenhouse gas emissions and further exacerbates climate change. This research focuses on the use of air conditioners and addresses the question of whether they are used rationally. Methods for reducing air conditioner usage and promoting their proper use are presented. The study analyzes the relationship between air conditioner electricity consumption, GDP, and temperature, highlighting the significant correlation between air conditioner usage and economic prosperity rather than climate conditions. A discussion on policy measures, energy efficiency improvements, and behavioral adaptations is also included.*

Keywords: *Air conditioner; Greenhouse gases; GDP; Electricity consumption; Cooling, international standard*

1. Introduction

The mass use of air conditioners began in the 20th century, when technologies began to improve and reduce costs (Basile, 2016). The first commercial air conditioner was developed in 1902 in the United States. However, these devices were very expensive and could only be used by the rich. In the 1920s, new technologies began to be developed, which made it possible to produce cheaper and more efficient air conditioners. This led to an increase in demand for air conditioners, which began to be used even in commercial premises. In the 1950s, air conditioners began to be massively used in households. This was due to several factors, including:

- Growing population: A greater number of people lived in urban areas where summers can be very hot and humid.
- Rising standard of living: People began to appreciate comfort more and were willing to pay more for air conditioners.

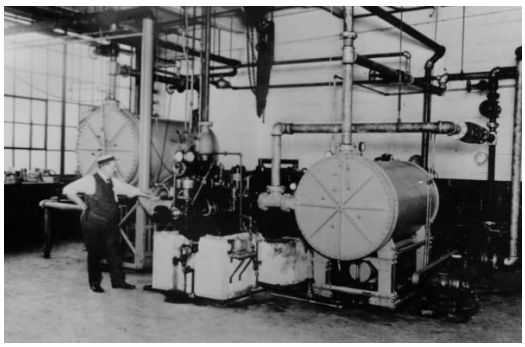
In recent decades, the use of air conditioners has continued to increase. This is due to several factors, including:

- Upcoming climate crises (Lynas, 2008) (Polya, 2020): Climate change is making summers warmer and more humid in many parts of the world. This increases the demand for air conditioners that provide a comfortable indoor temperature.
- Reducing the cost of air conditioners: Air conditioners have become cheaper in recent years. This made them more accessible and contributed to an increase in demand.

- Development of new technologies: The development of new technologies (Silberstein et al., 2024), such as inverter air conditioners, has increased the energy efficiency of air conditioners. This contributed to reducing their negative impact on the environment.

Today, air conditioners are used in all parts of the world. In some parts of the world, such as the United States, household air conditioners are almost indispensable.

Figure 1. *Centrifugal cooling machine from 1922*



Source: (Magazine, 2019)

2. Methodology

This study analyzed data from 17 countries that account for more than 70% of the world's air conditioner electricity consumption. The analysis included data from organizations such as the International Energy Agency (IEA, 2022), the World Meteorological Organization (WMO, 2023), and the World Bank (2023). The study evaluated variables such as national electricity consumption, GDP per capita, and the average summer temperature at 12 PM in the capitals of each country. Macroeconomic variables such as GDP are frequently used in empirical energy studies to explain cross-country differences in consumption patterns (Boduri & Pjetri, 2024). The statistical correlation was analyzed using the Pearson correlation coefficient.

2.1 Research questions

1. What is the global electricity consumption of air conditioners?
2. How does electricity consumption of air conditioners relate to GDP in each country?
3. How does electricity consumption of air conditioners relate to the average summer temperature in each country?

2.2 Research Objectives

The aim of this research is to determine how electricity consumption of air conditioners, GDP, and average summer temperature relate to each other. The results of the research may be useful for designing policies that will help reduce electricity consumption and greenhouse gas emissions from air conditioners.

3. Electricity consumption and greenhouse gas production

All electricity consumers are responsible for greenhouse gas production, specifically CO_2 (MacKay, 2013). The amount of CO_2 produced depends on how the electricity is produced. The average CO_2 emission per 1 kWh per country depends on the structure of electricity production in that country.

Countries that produce most of their electricity from renewable sources have lower CO_2 emissions than countries that produce most of their electricity from fossil fuels. The average global CO_2 emission per 1 kWh is 0.55 kg/kWh. This emission varies depending on the energy source used to produce electricity (Eldesouki et al., 2023). Renewable energy sources such as solar, wind and hydropower have the lowest emissions (Lave & Hendricks, 2013). These energy sources do not produce any CO_2 emissions, but it should be borne in mind that a lot of energy is needed to produce the technology that captures renewable sources and that these sources are very volatile. High emissions are produced by fossil fuels such as coal, oil and natural gas (IPCC, 2013). The production of electricity from these sources releases large amounts of CO_2.

Air conditioners accounted for 1.6% of global greenhouse gas emissions in 2020 (IEA, 2022), equivalent to 4.8 billion tonnes of CO2. Emissions from air conditioners have been increasing in recent years as demand for them has increased. Demand is driven by global warming, which is causing rising temperatures during the summer months. By comparison, lighting accounted for about 2.4% of global greenhouse gas emissions. That's about 7.2 billion tons of CO_2. Emissions from lighting are decreasing as more and more efficient lighting such as LED bulbs are used. So far, only refrigeration appliances contribute more greenhouse gases to households. They accounted for 2.2% of global greenhouse gas emissions in 2020. That's 6.6 billion tonnes of CO_2. In line with the expected thermal heating and the consequent increasing use of air conditioners, in a few years air conditioners can be expected to become the largest consumer of electricity and consequently, the main cause of greenhouse gases in households. If the trend of electricity consumption continues, this could cause significant problems for global electric energy. Air conditioners are important consumers of electricity and their consumption contributes to an increase in greenhouse gas emissions.

3.1 Measurement of electricity consumption for air conditioning operation

To conduct research on the use of air conditioners, a lot of data was obtained. For accurate data, measurements should be carried out on each air conditioner. Since such measurements are not carried out, certain values are given approximately, which were obtained with the help of previously conducted public research.

The amount of electricity consumed by a particular air conditioner is determined by (Wang, 2001):

- Outdoor temperature
- Set temperature in the room
- Insulation of air-conditioned space
- Proper use of air conditioning
- Installation location of an external device
- Air conditioning device maintenance
- Energy class
- The method of using the air conditioner, etc.

The consumption of electricity at the national level is determined by the number of installed devices. Here also, the values are given from various surveys, since the exact number of working devices is unknown. Air conditioners are mainly used for cooling living quarters.

Therefore, the key to use of air conditioners is outdoor temperature. The study used data on the average temperature during the 2 warmest months of the year at 12 p.m. in the country's capital (WMO, 2023). The reason for choosing the capital, and not the average temperature to countries, lies in the reliability of the data. The reason for using the average temperature data at 12 o'clock is because there can be large differences between day and night temperatures, but air conditioners should only be used for outdoor temperatures higher than 26°C.

4. The use of air conditioners in the world

The number of built-in air conditioners is rapidly increasing. In 2022, around 3.6 billion air conditioners were operating worldwide, 50% more than in 2010 (IEA, 2022). The number of air conditioners is expected to increase to 9.2 billion by 2050. According to the world's population – 8 billion, 0.45 air conditioners are installed per capita.

Figure 2 shows the increasing electricity consumption for air conditioners globally. In 2022, it amounted to 2,700 TWh, representing 8% of global electricity consumption. In Europe, this figure is 7%, in the United States it is 15%. Electricity consumption of air conditioners increases as average temperatures on Earth rise, as does air conditioning availability. According to projections (IEA, 2022), this share will increase to 18% and 3,000 TWh respectively by 2050.

Figure 2. *Trend of rising CO_2 and electricity consumption due to air conditioners*

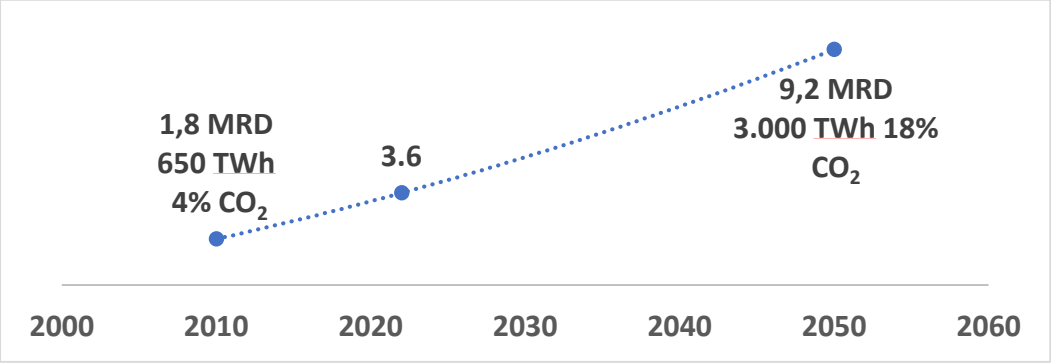
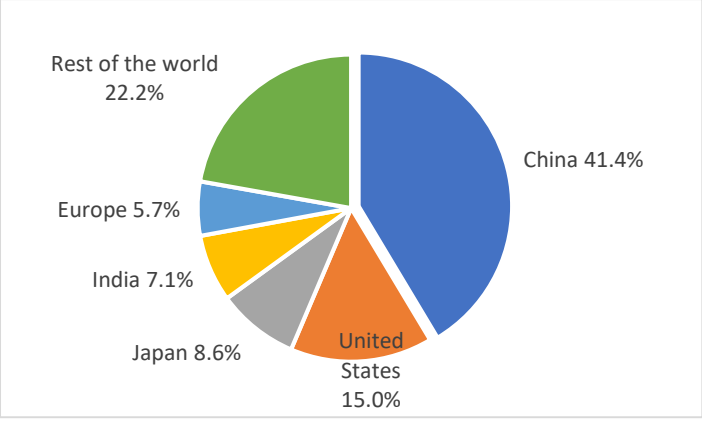


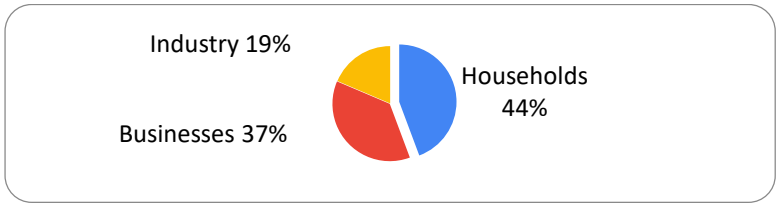
Figure 3 shows that more than 40% of all air conditioners are used in China, which is somewhat expected as China is the largest in terms of number of people and has also the largest production capacity.

Figure 3. *Distribution of electricity consumption due to the use of air conditioners*



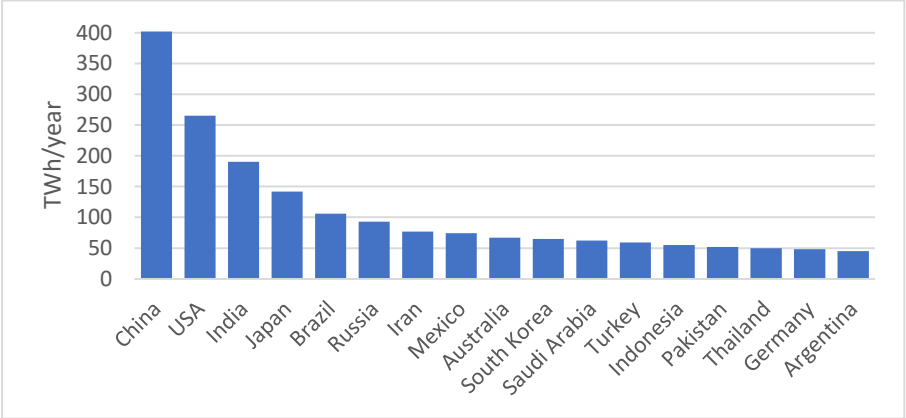
Most air conditioners are installed in households. With the current share of installed air conditioners, it can be expected that the number of installed appliances will increase most significantly precisely in household use, since a significant part of the developing world does not yet use mass air conditioners compared to the developed world. Furthermore, more and more people, in general, work from home.

Figure 4. *Distribution of installed air conditioners by sector*



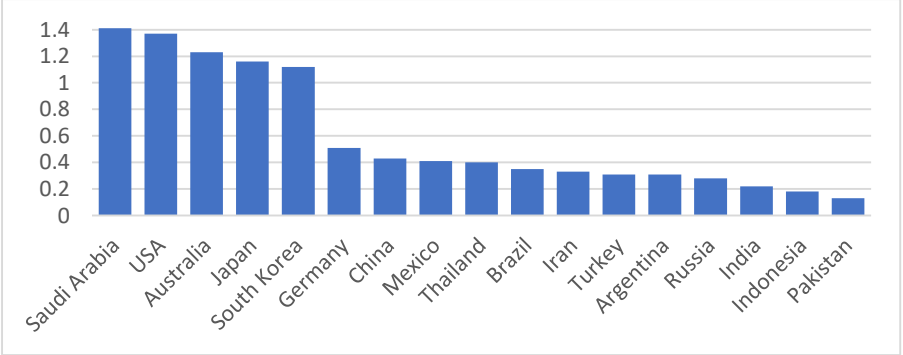
For further detailed analysis, 17 countries that consume more than 70% of the world's electricity - consumed by air conditioners - have been selected. Figure 5 shows that the largest consumer is China. As we will see in later analyses, high consumption is due to the population of a particular country and not due to the excessive use of air conditioners.

Figure 5: *Countries with the highest electricity consumption for air conditioners*



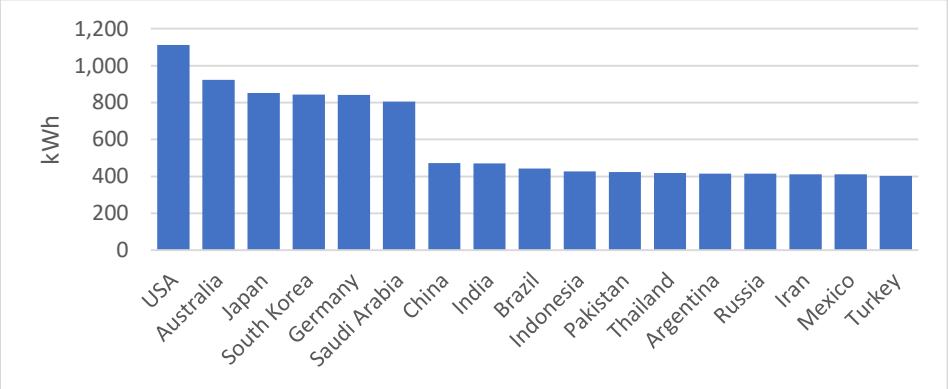
A better indicator of the overall use of air conditioners in each country is the number of installed appliances per capita. Figure 6 shows that Saudi Arabia uses the most devices per capita - 1.4 devices per capita, followed by the USA, Australia and Japan. The global average is 0.45 climates per capita.

Figure 6: *Number of installed air conditioners per capita*



In addition to the average number of air conditioners per individual, it is also important how much the appliance is used. The following Figure 7 shows how much kWh of electricity is accounted for by the average air conditioning user. It is clear that the use of air conditioners is the highest in the United States, followed by Australia and Japan.

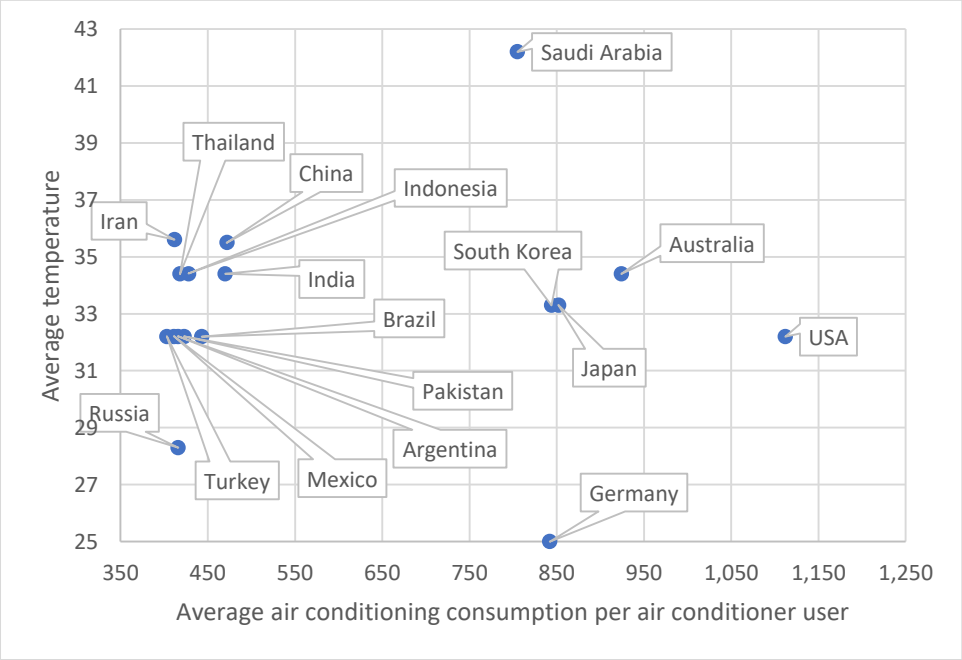
Figure 7: *Average air conditioning consumption per air conditioner user*



Logically, we would expect that consumption would depend on external temperatures - the warmer the location of a particular country, the greater the use of air conditioners (Nguyen et al., 2017). However, Figure 8 shows a large consumption gap between countries with comparable outdoor temperatures. In terms of consumption, the United States stand out strongly, while Germany stands out for its low average temperature.

When establishing the statistical correlation between outdoor temperature and electricity consumption per air conditioner the Peason correlation coefficient was applied (Blalock, 1972). Since the coefficient is only 0.019, we can conclude that the use of air conditioners is not related to outdoor temperature.

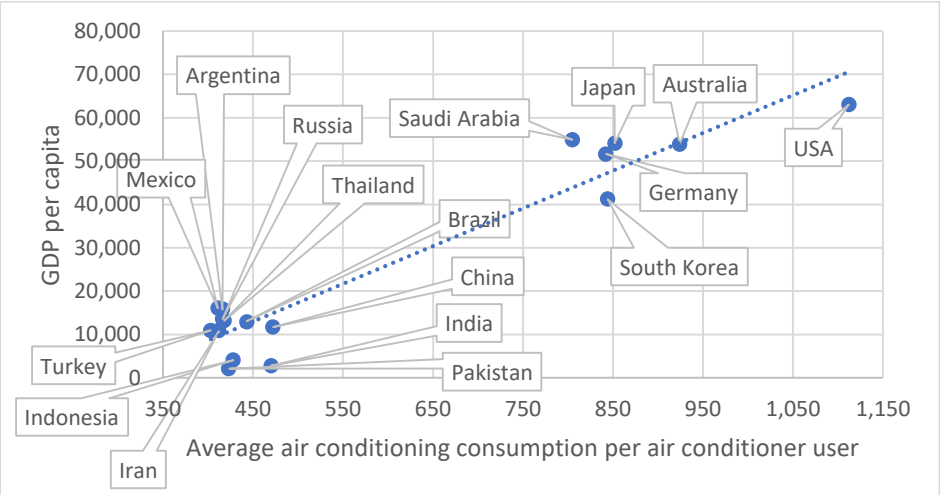
Figure 8. *Consumption depending on outdoor temperature*



The survey then examined whether the use of air conditioners is related to the GDP of each country (World Bank, 2023). Figure 9 shows that countries are divided into two groups. The first group contains countries that have low GDP and also have low electricity consumption for air conditioners. The second group consists of rich countries – the United States, Australia, Japan, Saudi Arabia, Germany and South Korea, which also consume the most energy.

The link between consumption and GDP is also statistically provable, with the Pearson correlation coefficient of 0.956, which translates into a very high correlation. The trend line shown in the graph also proves the correlation. From the data obtained, we can conclude that the use of air conditioners does not depend on temperature conditions, but primarily on the level of the standard of living. We can conclude that, especially in more affluent countries, air conditioners are being over-utilized.

Figure 9. *Spending as a function of government GDP*



4.1 Rational use of air conditioners

The purpose of air conditioners is to create a temperature zone of comfort. In order for a person to feel well, however, several factors need to be taken into account. Air conditioning can only affect temperature and humidity.

The comfort zone depends on (Nicol et al., 2022):

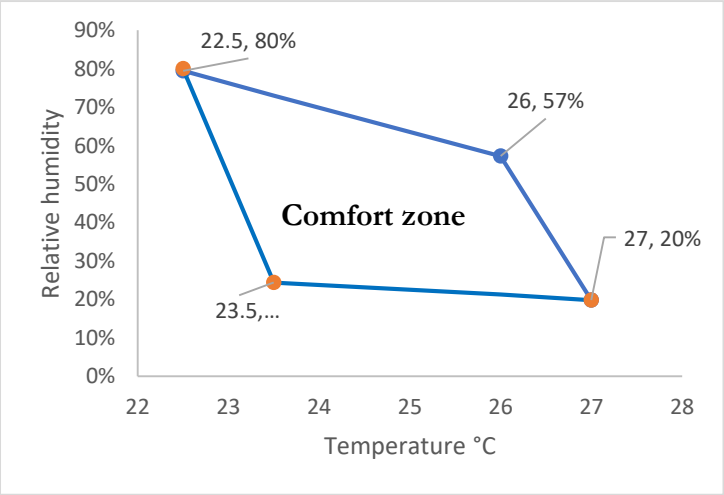
- Human activities. The activities of a person are usually conditioned by his work which is impossible to control.
- Wall temperatures. The temperature of the walls is highly dependent on the insulation used. With proper insulation, we can significantly influence energy consumption both in winter and summer (Zhang et al., 2022). With good insulation and built-in ventilation system, a favourable temperature can be maintained in most cases without the use of air conditioners.
- Relative humidity. The humidity in the room is mostly influenced by the climate in which we are located or the air in the vicinity of the building. The humidity of the air can be largely regulated by the ventilation of the premises.
- Air temperatures. The air temperature depends on the outdoor temperature, the number of devices that heat the air and the number of people in the room. We can greatly

influence the temperature in the room by properly shading and preventing direct sunlight during the summer months.

- The speed of air movement. The speed of air movement depends on the mode of ventilation and air conditioners, which, with unprofessional installation, can greatly affect the comfort zone.
- Clothing. The right temperature can be greatly influenced by choosing suitable clothing. We use light and airy clothing during the hot months.

All of the above influences whether we will feel comfortable at a lower or higher temperature.

Figure 10. *Comfort zone where temperature and relative humidity are taken into account*



Most people set the temperature of the air conditioner to their feel. Such adjustment leads to an incorrectly defined temperature. Setting the thermostat too low not only wastes energy but also increases the risk of respiratory illnesses. International standards ANSI ASHRAE55 (ASHRAE, 2021) (Fig. 10) and ISO7730 can help to set up air conditioners correctly (Loveday et al., 2002). The standards define the comfort zone, where the temperature and relative humidity in the room for work in the office and in the locals in general are taken into account. A favourable temperature is determined between 22.5°C and 27°C. By lowering the desired temperature, we influence a higher consumption of electricity (Pita, 2008) (Kato et al., 2018). With each degree, electricity consumption increases by 6-8% (Wang et al., 2013). The difference between the set maximum (27°C) and the minimum temperature (22.5°C) can be more than 30% in electricity consumption (El Berry, 2019). Many air conditioners are set below the recommended minimum temperature and electricity consumption is even higher. The optimal use of air conditioners would be automatic adjustment of their operation according to the relative humidity and temperature in the room.

5. Discussions and Conclusions

This study has presented important insights into the rising global use of air conditioners and its relationship with economic development and climate. One of the key findings is that electricity consumption for air conditioning is much more closely related to a country's GDP than to its average outdoor temperature. This suggests that comfort and lifestyle, driven by economic capability, are stronger motivators than actual climatic needs.

The strength of this study lies in its use of cross-national data and its statistical approach, including Pearson correlation, which offers strong evidence for the conclusions drawn. However, one limitation is the reliance on average national data, which may overlook regional variations within countries. Additionally, some of the data, such as the number of functioning air conditioning units, had to be estimated due to lack of direct measurements.

The results are generally consistent with previous research (Nguyen et al., 2017; AIJES, 2024), reinforcing the concern that increased access to cooling, if unmanaged, can escalate energy demand and CO2 emissions significantly. While smart and energy-efficient technologies can mitigate this trend, behavioral adaptations and policy regulation remain critical.

Although this study does not employ primary data collection, its analytical approach allows for generalisation across many countries, especially those in similar stages of economic development. Future research could include deeper case studies or household-level surveys to validate the observed macro trends.

In practical terms, the study underlines the need for:

- Policy incentives for energy-efficient cooling;
- Greater enforcement of international temperature standards;
- Improved insulation regulations in building codes;
- Public campaigns that promote sustainable cooling habits.

These findings provide valuable input for decision-makers and urban planners aiming to reduce the environmental burden of rising cooling demand. More interdisciplinary research will be necessary to further integrate engineering, behavioral science, and public policy approaches in this field.

Findings indicate that air conditioner electricity consumption is strongly correlated with GDP rather than outdoor temperature. Countries with higher GDPs exhibit higher electricity consumption from air conditioners, suggesting overuse rather than necessity. This aligns with previous studies, such as Nguyen et al. (2017), which found that energy consumption patterns depend more on economic prosperity than climatic conditions.

A comparative analysis with prior literature, including studies published in AIJES (2024), supports the idea that improvements in insulation, energy efficiency, and smart cooling technologies can significantly reduce electricity consumption and mitigate environmental impacts. AIJES research highlights the importance of integrating adaptive cooling systems and enforcing energy policies that address the increasing demand for cooling in both developed and developing regions.

Policy recommendations include:

- Implementing international temperature-setting standards (ASHRAE, 2021) to prevent unnecessary overcooling.
- Promoting energy-efficient air conditioners (El Berry, 2019) to optimize energy use.
- Enhancing building insulation (Zhang et al., 2022) to reduce dependency on artificial cooling.
- Public awareness campaigns to encourage responsible air conditioner use and sustainable practices.

If the current global trend in air conditioner consumption continues, it could pose severe challenges for electricity infrastructure and climate policies. Addressing this issue requires a collaborative effort involving policymakers, manufacturers, and consumers to implement energy-efficient solutions effectively.

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THE IMPACT OF PRIVATE INVESTMENT IN THE CIRCULAR ECONOMY ON EU GDP

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Abstract: *The main purpose of this research is to analyze the Impact of Private Investments in the Circular Economy on EU GDP for the period 2010-2020. This research has a sample of 28 EU Member States and analyzes a 10-year period. The scientific methodology applied in this study is the quantitative method. The data used in this research are secondary and are generated from official data published by Eurostat and the World Bank. Based on the results of this research, we may conclude that there is a negative relationship between private investments in the Circular Economy and the GDP of the European Union countries for the period 2010-2020. During the period 2010-2020, some EU countries experienced problems in attracting private investments due to difficult economic and political conditions, they had influenced private investments to have a negative effect on GDP.*

Keywords: *Circular Economy, GDP, Private Investments.*

1. INTRODUCTION

This research will discuss the impact of private investments in the circular economy on the GDP of the European Union countries for the period 2010-2020. The main variables of this research are: Gross Domestic Product (GDP), Private Investments and Gross Value Added of the Circular Economy (IPEC), Persons Employed in the Circular Economy Sectors (PPEC), Final Consumption Expenditure (SHKF), and Inflation (INFL).

The inclusion of all EU Member Countries will make the research even more qualitative because it will present a real overview of the impact of these circular economy indicators on the GDP of all EU countries. The indicator of private and gross added values in the circular economy is an indicator that is used to monitor the progress of the economy in the field of competition and innovation. Through these indicators, the circular economy contributes significantly to economic expansion and the creation of new jobs.

The circular economy may make a significant contribution to the creation of new places of jobs and economic growth. Eurostat, on an annual basis, gathers information on the number of employees in the circular economy. This indicator determines if the shift from the traditional economy to the circular economy is producing the desired results by examining the growth of other sectors and the creation of new jobs.

On the other hand, the improvements in the productivity of the material as well as the efficiency of the use of the material, are otherwise known as the productivity of the resources.

According to Eurostat, productivity growth in recent years has been significantly slower than that of labor and energy productivity.

The key conclusions indicate that while investment plays a crucial role in enhancing resource efficiency, the combination of innovation and investment significantly contributes to the reduction of environmental degradation (Lehmann, Cruz-Jesus, Oliveira, & Damásio, 2022). The purpose of this article is to understand the significance of the impact of private investment in the circular economy on the GDP of EU countries, considering the importance of the transition from a linear economy to a circular one, where resources are not discarded but reused. This research also aims to provide recommendations for policymakers in order to create a more favorable environment for private investment in the circular economy.

2. LITERATURE REVIEW

The research conducted by Hondroyiannis et al. (2024) analyzes the relationship between a macro-level Turnover Rate and various macroeconomic variables in a sample of 28 European countries using panel data. The findings suggest a strong positive relationship between real GDP and the turnover rate in the long run, while higher environmental taxes are associated with an increase in the turnover rate.

According to Hysa et al. (2020), developed economies are innovating to spur growth and are providing government support to manufacturers in order to transition from linear to circular economies. As a result, waste materials in industrial systems are being recycled or reused, improving the efficiency of resource use through a zero-waste approach. The results of both econometric models showed a strong and positive correlation between the circular economy and economic growth, emphasizing the crucial role of sustainability and innovation.

According to Kaivo-Oja, Vehmas, and Luukkanen (2022), a well-functioning circular economy brings benefits to businesses, people, and the environment. It is described as a systems-based solutions framework designed to tackle global challenges such as climate change, biodiversity loss, waste, and pollution. A key finding of their research is that, within the European Union, the levels of synergy between economic indicators, such as GDP and GNI, and core variables of the circular economy do not consistently align and may differ significantly from one another.

According to Brussels et al. (2022), the impact assessment was conducted using a computable general equilibrium (CGE) model, as this approach allows for the quantification of both direct and indirect economic and environmental impacts of the simulated shocks. The results indicate that different types of fiscal policies can guide an economy toward a more circular model.

Research carried out by Robaina, Villar, and Pereira (2020) contrasts the circular economy with the traditional linear economy, emphasizing its potential as a sustainable model for producing goods and services and fostering economic development. With this aim, a series of determinants for a circular economy in Europe were analyzed for the period between 2000 and 2016. A cluster analysis was implemented and complemented by three econometric evaluation methods: panel unit root tests, panel co-integration, and a vector autoregression model. The main findings allowed European countries to be grouped into three distinct clusters based on the growth rate of their resource productivity and the explanatory factors selected.

According to Hysa et al (2020), industrialized economies are leveraging innovation to stimulate economic growth while also providing governmental support to manufacturers transitioning from linear to circular economic models. As a result, waste products within industrial systems are increasingly being recycled or repurposed, enhancing the efficiency of zero-waste strategies and the sustainable use of limited resources. The results of both econometric models used in their study demonstrated a strong and positive relationship between circular economy practices and economic growth, highlighting the essential role of sustainability, innovation, and investment in zero-waste programs in promoting overall prosperity.

The study carried out by Lehmann et al. (2022) used data from Eurostat and the United Nations, spanning 28 European nations from 2011 to 2017, to determine the two primary aspects of the circular economy, which are resource efficiency and environmental degradation. Additionally, using dynamic panel models, an analysis is conducted to compare the effects of investment, human capital, innovation, and past turnover levels on each identified feature of the circular economy. The results demonstrated that, as the investment by itself has a substantial role in enhancing resource efficiency, innovation, and investment together greatly minimize environmental degradation, whereas only the investment is also important in the promotion of resource efficiency.

The research carried out by Nedelea et al. (2018) conducted an empirical study between 2008 and 2015 using cross-sectional analysis applied to the interrelationships between data concerning the EU-28 member countries. The study's focus is on the effect of the bio-economy on economic growth. In the framework of the bio-economy, three econometric models based on ordinary least squares regression are created to emphasize the connections between economic growth, the circular economy, and intellectual capital. The circular economy's added value is positively correlated with the export of recyclable raw materials, employment within the sector, and the rate at which municipal garbage is recycled.

On the other hand, the research carried out by Bianchi and Cordella (2023) suggests that, while encouraging a shift toward more circular economic systems can contribute to reducing the extraction of primary resources, the overall effect of such initiatives remains relatively limited. Their estimates show that the amount of primary resources extracted annually due to economic growth is approximately four times greater than the amount saved through circular economy (CE) initiatives.

3. METHODOLOGY

The primary goal of this research is to examine how private investments and the circular economy's gross added value affect the GDP of EU member states between 2010 and 2020. Thus, this study demonstrates the effects of private investments and the circular economy's gross added value on the GDP of the 28 EU member states. Inclusion of all EU member states, the research will be even more qualitative as it will give a true picture of how these circular economy metrics affect each nation's GDP.

The main variables of this research are: Gross Domestic Product (GDP), Private Investments and Gross Value Added of the Circular Economy (IPEC), Persons Employed in

the Circular Economy Sectors (PPEC), Final Consumption Expenditure (SHKF), and Inflation (INFL).

The scientific methodology that has been applied in this study is the quantitative method, applying the deductive approach, which uses the existing theory to prove the hypotheses and draw conclusions. The data that will be used in the research are secondary data and will be generated from official data published by Eurostat and the World Bank. These data are mainly annual data presented also in the form of time series expressed in percentages. 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 private investments and gross added values of the circular economy affect the growth of the GDP of the European Union countries for the period 2010-2020?
2. How does the change in the number of employees in the circular economy affect the GDP of the European Union countries for the period 2010-2020?
3. What is the relationship between inflation, final consumption expenditure, resource productivity, and GDP for the countries of the European Union for the period 2010-2020?

The timeframe 2010-2020 was chosen for this study because it encompasses a complete decade and provides for a thorough examination of patterns and implications of private investments in the circular economy across European Union countries. This timeline encompasses the post-global financial crisis recovery phase, an increased policy emphasis on sustainable development, and significant progress in circular economy projects. Data availability and trustworthiness are also important factors in this decision, as official statistics and economic indicators for this time are comprehensive and consistent across countries. Although extending the period to 2025 would provide more recent insights, data for years after 2020 are sometimes tentative or unavailable at the time of the study, thereby affecting the robustness and comparability of conclusions. As a result, focusing on 2010-2020 assures that the research has a solid empirical foundation and that the policy implications are based on finished and validated facts.

The main hypothesis of this research is:

H_1 - Private investments and gross added values in the Circular Economy affect the GDP of the European Union countries.

Table 1: *Description of variables included in econometric models*

Variables	Variable review	Date of source
Dependent Variable (Y)	Gross Domestic Product (GDP)	Annual reports of the World Bank, time series (2010-2020) (https://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG, 2024)
Independent Variable (X1)	Private Investments and Gross Value Added in the Circular Economy (IPEC)	Eurostat annual reports on circular economy indicators, time series (2010-2020) (https://ec.europa.eu/eurostat/web/circular-economy/database, 2024)
Independent Variable (X2)	Persons employed in the	Eurostat annual reports on circular economy indicators, time series (2010-2020)

	Circular Economy sectors (PPEC)	(https://ec.europa.eu/eurostat/web/circular-economy/database, 2024)
Independent Variable (X3)	Final Consumption Expenditure (FCF)	Annual reports of the World Bank, time series (2010-2020) (https://data.worldbank.org/indicator/NE.CON.TOTL.KD.ZG, 2024)
Independent Variable (X4)	Inflation (INFL)	Annual reports of the World Bank, time series (2010-2020) (https://data.worldbank.org/indicator/FP.CPI.TOTL.ZG , 2024)
Independent Variable (X5)	Productivity of resources in the circular economy	Eurostat annual reports on circular economy indicators, time series (2010-2020) (https://ec.europa.eu/eurostat/web/circular-economy/database, 2024)

Source: Data processing by authors (2024)

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:

$$GDP = \beta_0 + \beta_1 IPEC + \beta_2 PPECit + \beta_3 INFLit + \beta_4 SKF + \beta_5 Prod.Resit + \gamma it$$

Where:

GDP - Gross Domestic Product

IPEC - Private Investments and Gross Value Added in the Circular Economy

PPEC - Persons employed in the Circular Economy sectors

INFL - Inflation

SHKF - Final Consumption Expenditures

Prod, Res - Resource Productivity

Stochastic variables (other factors not considered in the model), I-code, and t–time period

4. RESULTS OF THE ECONOMETRIC MODEL

In this section, the results of descriptive analysis, correlation analysis, 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 are obtained from the World Bank and Eurostat databases. The time period along which this study extends is the period 2010-2020. 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, and GEE model.

Table 2: *Descriptive statistics for the variables included in the study*

Variable	Obs	Mean	Std. Dev.	Min	Max
IPEC	307	.670684	.3352697	.1	1.7
PPEC	307	1.787296	.5853898	.4	3.6

INFL	308	1.415045	1.416978	2.09	6.09
SKF	308	1.063534	2.828701	-12	10.1
Prod. Res	307	1.792713	1.162285	0.29	4.5
MNE	306	1.513337	3.546917	11.16	24.4

Source: Author's own calculations using STATA (2024)

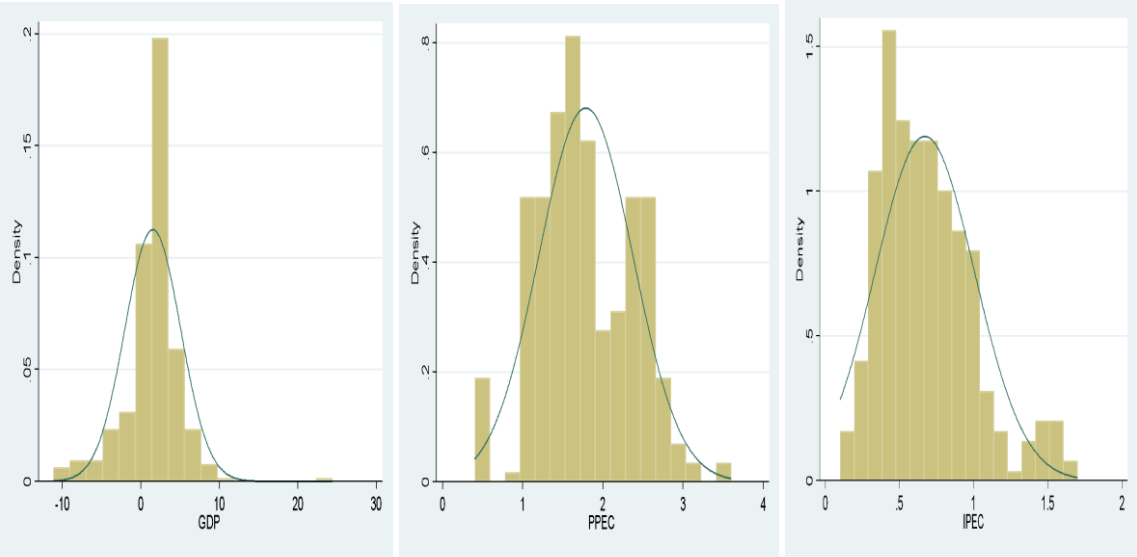
From the descriptive statistics, we can see that the research has 307 observations. The IPEC variable has a mean of 0.67, a minimum value of 0.1, and a maximum value of 1.7.

The PPEC variable has an average of 1.78, a minimum value of 0.4, and a maximum value of 3.6. Whereas INFL has an average of 1.41, a minimum value of -2.09, and a maximum value of 6.09.

The SHKF variable has 308 observations; an average of 1.06, a minimum value of -12, and a maximum value of 10.1, so the standard deviation is quite high. Prod. Res has an average value of 1.79, a minimum value of 0.29, and a maximum value of 4.5.

The GDP variable has 306 observations, an average of 1.51, a minimum value of -11.16, and a maximum value of 24.4.

Figure 1. *A graphic representation of GDP, PPEC, and IPEC*



Source: Author's own calculations using STATA (2024)

From the graphical presentation of the histogram, we can see that between GDP as a dependent variable and private investments and gross added values of the Circular Economy, as well as persons employed in the Circular Economy as independent variables, a normal distribution exists.

5. EMPIRICAL SUMMARY OF ECONOMETRIC MODEL RESULTS

The following section presents and interprets the summarized results of the econometric model.

Table 3. *Summary of empirical results from the econometric model*

Variables	Linear Regression	Random Effects Generalized Least Squares (GLS) Regression	Fixed Effects Regression	Haussmann Taylor Regression	GEE Model	GMM Model
MNE	-	-	-	-	-	-
IPEC	-1.112109 (0.009) ***	-1.2 (0.02) **	-1.604146 (0.063) *	-1.839911 (0.019) **	-1.280126 (0.021) **	-.5413688 (0.638)
PPEC	-.1421379 (0.546)	-.0843017 (0.805)	.0202363 (0.979)	.3863939 (0.588)	-.0828484 (0.808)	1.876413 (0.100) *
INFL	.1694437 (0.06) *	.2166044 (0.015) **	.2625833 (0.005) **	0.2421285 (0.007) ***	.2171025 (0.014) **	.2650805 (0.012) **
SKF	.9977681 (0.000) **	.985045 (0.000) ***	.9792111 (0.000) **	0.9876457 (0.000) ***	.9849271 (0.000)***	1.034553 (0.000) ***
Prod. Res	.2939534 (0.02) **	.3481249 (0.06) *	1.134713 (0.01) *	0.5240353 (0.038) **	.3495123 (0.060) *	.4058518 (0.685)
R Square	0.5989					
Adj. R 2	0.5922					

Source: Author's own calculations using STATA (2024)

*significance level 10%

** significance level 5%

*** 1% significance level

Based on the results of the standard multiple regression analysis and the equation of regression, we understand that all the variables of this study are significant at a reliability level of 10%, except for the variable of Persons Employed in the Circular Economy, which exceeds the allowed significance. The coefficient of correlation between dependent and independent variables is 59.89%. So there is an average correlation or connection between the variables of this study. The coefficient of determination between the independent and dependent variables is on average high in value, 59.22%, so for 59.22%, the independent variables explain the dependent variable. These results prove that this model is statistically sustainable.

β_0 - whether all factors ARE constant, then the value of GDP is 0.68.

β_1IPEC - If Private Investments in the Circular Economy increase by one unit while keeping other factors constant, then GDP will decrease by 1.11 units. This finding is real because the level of significance IS $0.009 < 0.05$.

β_2PPEC - if the number of Employed Persons in the Circular Economy per unit increases, keeping the other factors constant, then the GDP will decrease by 0.14 units. This statement is not true because the significance level exceeds the 10% significance level, i.e., $0.54 > 0.05$

β_3INFL - if inflation increases by one unit, keeping it constant with other factors, then the GDP will increase by 0.16 units. This statement is true at a significance level of 10%, thus $0.06 < 0.10$.

β_4SHKF - If final Consumption Expenditure increases by one unit while keeping other factors constant, then GDP will grow by 0.9 units. This finding is real because the level of significance is 0.000 < 0.05.

β_5Prod.Res - if the Productivity of resources increases by one unit while keeping other factors constant, then GDP will grow by about 0.29 units. This finding is because the level of significance is 0.02 < 0.05.

Therefore, it can be concluded that all independent variables are significant and statistically significant and prove the validity of the hypotheses of this study, with the exception of the variable of employed Persons in the Circular Economy, which is not significant at the 10% confidence level.

Based on the generated results, we can conclude that there is a positive relationship between Inflation, final consumption expenditures, and GDP.

The main hypotheses of this research are:

H_1 - Private investments and gross added values in the Circular Economy affect the GDP of European Union countries.

Based on the results, we can conclude that private investments and gross added values of the Circular Economy affect the GDP of the European Union countries for the period 2010-2020.

6. DISCUSSIONS/CONCLUSIONS

The literature research shows that the shift to a circular economy can have a brief negative impact on economic growth and GDP, particularly during the transition phase. However, all studies underline that this can have long-term benefits for economic growth and sustainable development if implemented carefully and with the assistance of suitable regulations.

In the study conducted by Kirchherr et al. (2018), the barriers of the circular economy in the EU were examined with 208 respondents and 47 expert interviews. The study finds that cultural barriers, especially a lack of consumer interest and awareness, as well as a reluctant company culture, are considered the main barriers to the circular economy by businesses and policymakers. These are driven by market barriers, which, in turn, are caused by the lack of synergistic government interventions to accelerate the transition to a circular economy. The study highlights that while the circular economy can bring long-term benefits, implementation can cause economic growth to slow down in the initial stages.

Despite the circular economy focusing on redesigning processes and recycling materials, providing opportunities for more sustainable business models, this article has also identified several tensions and limitations. These include the lack of the social dimension of sustainable development, which limits ethical impacts, as well as unforeseen consequences. The study concluded that the circular economy can contribute to economic growth, but this requires a period of transition and adaptation to achieve positive results (Murray, A., Skene, K., & Haynes, K., 2017).

Another study examines the macroeconomic consequences of moving to a circular economy. This research suggests that the impact on GDP may vary in the short and long term and highlights the need for supportive policies to aid this transition, supporting our conclusions

on the negative impact of private investment in the circular economy on GDP, especially during the transition period (McCarthy, A., Dellink, R., & Bibas, R., 2018).

Based on the statistical data obtained by Stata calculations and the fixed effect, we can conclude that changes in private investments and gross added values of the circular economy hurt the GDP of European Union countries between 2010 and 2020. In the period 2010-2020, some EU countries experienced problems in attracting private investments due to difficult economic and political conditions, which influenced private investments to have a negative effect on GDP. In countries that fail to create a favorable environment for private investment, GDP growth may be halted or limited. In cases where private investment is limited or negatively affects investor confidence due to factors such as political instability, lack of legal certainty, or insufficient market conditions, it can have a negative impact on economic growth.

One of the most important practical implications of this study is the need to improve the private investment climate in the circular economy and comprehend the necessity to migrate to a circular economy.

To ensure that private investment has a positive impact on European Union countries, the EU needs to improve the investment climate to make private investment more attractive. This can be achieved by improving fiscal and financial policies, providing lower-interest loans to investors, adjusting taxes and fees reasonably, as well as creating a more conducive environment for doing business. Furthermore, free and fair competition should be promoted, and more investment should be made in infrastructure and energy to support sustainable development.

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THE IMPACT OF SOCIO-ECONOMIC FACTORS ON THE EFFECTIVENESS OF PUBLIC ACCOUNTABILITY FRAMEWORKS IN THE EU

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Abstract: *This study explores how socio-economic factors affect the effectiveness of public accountability frameworks in EU member states, with Romania as a case study. Using data from the World Bank, Eurobarometer, and cross-country comparisons, it identifies five key determinants: income inequality, education, healthcare access, political participation, and economic stability. Grounded in institutional theory, the research shows that inclusive institutions and lower disparities lead to stronger accountability, while weaker frameworks often reinforce inequality and corruption. For Romania, the study recommends boosting transparency, enforcing anti-corruption measures, improving rural-urban equity, and enhancing civic education to strengthen the link between citizens and institutions.*

Keywords: *public accountability, socio-economic factors, European Union, governance, institutional theory, Romania, income inequality, transparency*

INTRODUCTION

Democratic governance relies fundamentally on effective public accountability—mechanisms that ensure governments remain transparent, responsive, and answerable to their citizens. Within the European Union's complex, multi-level governance structure, the relationship between socio-economic development and the functionality of accountability frameworks has become increasingly important for understanding variations in governance quality among member states.

Despite the EU's formal commitment to transparency, good governance, and democratic accountability, significant disparities persist in how effectively these principles are implemented across member countries. While states such as those in the Nordic region consistently demonstrate high levels of institutional trust and citizen engagement, several Eastern European countries, including Romania, continue to face structural challenges such as corruption, weak institutional capacity, and low public confidence in governance.

These differences suggest that institutional design alone does not account for variations in accountability effectiveness. Rather, underlying socio-economic factors—such as income inequality, education levels, economic stability, and social cohesion—play a critical role in shaping how accountability mechanisms are perceived, accessed, and enforced. In contexts

marked by high inequality or weak public services, even well-designed frameworks may fail to function effectively.

This study investigates how socio-economic conditions influence the effectiveness of public accountability mechanisms across EU member states, with a particular focus on Romania as a post-transition case. Grounded in institutional theory, the research explores how socio-economic contexts affect the legitimacy and performance of governance structures.

The study addresses the following research questions:

- What socio-economic factors explain cross-national variations in accountability effectiveness within the EU?
- How do income inequality, education, economic conditions, and social cohesion interact to shape governance outcomes?

By combining comparative analysis with a focused case study, this research contributes to the broader understanding of democratic accountability in the EU. It aims to inform both scholarly debates on governance and practical efforts to strengthen institutional performance, especially in countries where socio-economic disparities undermine accountability. Romania's experience offers valuable insights into the challenges and opportunities of building more effective accountability frameworks in post-transition settings.

Governance structures are deeply influenced by historical choices, with institutions playing a pivotal role in shaping outcomes. Countries with inclusive institutions tend to channel socio-economic development into equitable and sustainable governance, promoting transparency and fairness. In contrast, nations with emerging institutions often reinforce cycles of inequality and corruption, undermining public trust and hindering long-term progress. Recognizing the importance of institutional inclusivity is critical for understanding governance challenges and opportunities in diverse socio-economic contexts.

The effectiveness of governance frameworks hinges on the strength and adaptability of institutions. Robust checks and balances, such as independent judicial systems, transparent public financial management, and active civil society organizations, are essential for translating socio-economic resources into effective governance practices. Institutions that fail to evolve in response to socio-economic changes, such as globalization, technological advancements, or demographic shifts, risk becoming rigid and unresponsive, fuelling public discontent. Institutional adaptability is therefore not only a mechanism for resilience, but also a prerequisite for legitimacy and public trust.

Addressing socio-economic inequalities is equally vital for fostering better governance. Programs that reduce income disparities and improve access to education create an environment where governance frameworks can thrive. By empowering marginalized groups and enhancing public awareness, these efforts contribute to more equitable and inclusive systems of governance. Moreover, empowering civil society strengthens accountability, ensuring that governance reflects the diverse needs and expectations of the population.

Building institutions that are transparent, inclusive, and adaptive remains fundamental to effective governance. Transparency mitigates corruption, inclusivity fosters equitable representation, and adaptability ensures institutions remain relevant amid changing socio-economic dynamics. By incorporating these principles into policy, the European Union and its member states can address the complex interplay between socio-economic development and governance, fostering more effective and equitable public accountability frameworks.

Exploring the Link between Socio-Economic Development and Governance

Socio-economic development and governance are intricately connected, with the effectiveness of governance frameworks often shaped by the socio-economic environment in which they operate. Understanding this relationship requires a deep dive into theoretical foundations, particularly institutional theory, which provide valuable insights into how socio-economic factors influence governance. Institutional theory places institutions—understood as shared beliefs, norms, rules, and symbols—at the core of organizational analysis. It examines how organizations adopt practices and designs to gain legitimacy, align with societal norms, and ensure survival in their environments. This theory emphasizes that organizations are not isolated entities but are deeply influenced by external cultural, legal, and normative forces. Institutional theory focuses on how institutions mediate the relationship between socio-economic factors and governance.

Institutional theory has significantly contributed to understanding why organizations adopt specific practices. However, one may consider it obsolete for its perceived determinism and oversimplification of human agency. Despite these challenges, the theory remains a powerful framework for analysing organizational behaviour, particularly in contexts where legitimacy and cultural alignment are critical for survival. Public accountability is a cornerstone of effective governance, ensuring that governments and public institutions remain answerable to their citizens. Within the European Union (EU), the complexity of multi-level governance structures presents unique challenges and opportunities for fostering accountability. A significant body of research has explored the socio-economic determinants that influence public accountability in the EU, offering valuable insights into how these factors shape governance outcomes.

Numerous studies have identified key socio-economic factors that play a critical role in shaping public accountability frameworks within the EU. These factors include economic development, income inequality, education levels, and cultural diversity. Below, we review some of the most relevant findings. Research consistently highlights a positive correlation between economic development and public accountability. Economically prosperous member states tend to have stronger institutional frameworks, greater transparency, and higher levels of civic participation. For instance, a study by Charron et al. (2017) found that wealthier EU countries exhibit lower levels of corruption and higher public trust in institutions. Studies such as those by Rothstein and Uslaner (2005) argue that high levels of income inequality erode social trust and weaken public accountability. In the EU, countries with lower income inequality, such as Sweden and Denmark, tend to score higher on accountability metrics compared to more unequal states like Romania and Bulgaria.

Education is a critical driver of civic engagement and public accountability. According to a study by Deakin and Reed (2019), higher education levels are associated with greater demand for transparency and better oversight of public resources. This trend is particularly evident in Northern European countries, where investments in education have fostered a culture of accountability. Cultural and social norms significantly influence public accountability. Research by Hofstede et al. (2010) suggests that individualistic cultures, prevalent in Western Europe, are more likely to prioritize accountability compared to collectivist cultures. Additionally, cultural attitudes toward corruption and nepotism vary across the EU, affecting the effectiveness of accountability mechanisms.

The EU's diverse socio-economic landscape creates significant regional variations in public accountability. Studies have categorized member states into distinct clusters based on their accountability performance:

Countries such as Sweden, Germany, and the Netherlands consistently rank high in public accountability indices. These nations benefit from strong institutions, robust legal frameworks, and high levels of socio-economic development.

Southern European countries, including Italy, Greece, and Spain, face challenges related to corruption and bureaucratic inefficiency. However, recent reforms aimed at enhancing transparency and reducing inequality have shown promising results.

Eastern European states, including Romania, Bulgaria, and Hungary, often struggle with weak institutions and low public trust. Research by Mungiu-Pippidi (2015) highlights the role of historical legacies and socio-economic disparities in shaping these outcomes.

The Role of Transparency, Integrity, and Accountability in Governance

Transparency, integrity, and accountability are foundational to effective governance in the European Union (EU). These principles are enshrined in EU treaties, emphasizing open decision-making processes, citizen participation, and the accessibility of information. Such frameworks are critical for building trust in public institutions and ensuring that socio-economic policies serve the common good. For example, mechanisms like the EU's Transparency Register and parliamentary oversight help scrutinize interactions between policymakers and lobbyists, ensuring that policies align with citizens' interests rather than private agendas.

There is an uneven implementation of transparency and accountability measures across EU institutions and member states, shaped by socio-economic disparities. In wealthier countries with robust economies, these frameworks function more effectively, supported by stronger institutions and greater public trust. Conversely, in countries with weaker economies or higher levels of corruption, such as Romania or Bulgaria, public accountability mechanisms often face greater challenges. Socio-economic inequality exacerbates these issues, making it harder to ensure fair representation and equitable policy implementation.

Despite significant progress, the EU faces challenges in ensuring consistent application of accountability frameworks. Institutions such as the European Parliament and Commission have adopted codes of conduct, mandatory transparency requirements, and measures to regulate lobbying. However, gaps remain in areas like enforcement, particularly for the Council of the EU, which lags in transparency compared to other institutions. Recent reforms aim to address these gaps, including the introduction of stricter codes of conduct for European Commissioners and measures to mitigate conflicts of interest.

A recurring theme in the report is the role of citizen engagement in strengthening public accountability. EU treaties mandate that institutions act “as closely as possible to the citizen,” reflecting the need for participatory governance. This principle aligns with the broader socio-economic goal of reducing disparities by involving marginalized communities in the decision-making process. Such participation fosters trust and ensures that governance frameworks address diverse needs effectively.

In the European Union (EU), policymaking has shifted away from traditional, hierarchical structures toward more complex, decentralized processes. These include networks

of political, public, and private actors, forming informal and formal groups that collaborate on policy formulation and implementation. These interactions take place across multiple levels of governance, and often involve a diverse range of actors, from bureaucracies to interest groups and private companies. However, this networked form of governance raises critical concerns about accountability.

One of the central issues in multi-level governance is the accountability of the various actors involved. These actors, such as bureaucrats, interest groups, non-governmental organizations (NGOs), and experts, may not have a democratic mandate, which complicates the accountability process. While they are accountable to different entities, these relationships are often weak or ambiguous. For instance, bureaucrats, though subject to political oversight, may not face sufficient scrutiny due to the complex layers of governance. Similarly, interest groups often only answer to their members or donors, and NGOs may struggle with internal accountability and external representation of their constituencies.

Experts, who are seen as independent, are usually held accountable by their peers but do not face political accountability. The lack of direct political oversight in these networks leads to what some describe as "accountability gaps," where decision-making processes are obscure and hard to scrutinize by the public. This lack of visibility is particularly evident in formal networks, like European regulatory agencies, which deal with technical matters that don’t attract media attention. As a result, public scrutiny is limited, and accountability can become fragmented.

The complexity of multi-level networks also creates competing accountability demands. Actors within the network must navigate multiple forums, each with different expectations, which can lead to conflicting priorities and a lack of clarity about who is responsible for what. As accountability procedures become more intricate, they risk becoming ineffective or misunderstood. These networks, though a response to the complexity of modern governance, face challenges in ensuring that all actors are properly held to account, creating a paradox of "excess accountability" without adequate political oversight.

While EU governance networks offer flexibility and inclusivity, they also present significant challenges for political accountability. The lack of transparency and the fragmentation of responsibility can make it difficult for citizens and other stakeholders to hold decision-makers accountable, undermining trust in the EU’s policymaking processes.

The Impact of Socio-Economic Factors on the Effectiveness of Public Accountability Frameworks in the EU: A Focus on Romania

The effectiveness of public accountability frameworks across European Union (EU) member states varies significantly, with socio-economic factors playing a critical role in shaping institutional performance. Disparities in income distribution, education, healthcare access, political participation, and economic stability directly influence public trust, civic engagement, and the ability of governance systems to ensure transparency and responsiveness. This section explores these dynamics, with a particular focus on Romania as a representative post-transition state.

Income Inequality

Income inequality is a major barrier to effective accountability. Societies with pronounced economic disparities often exhibit lower levels of trust in public institutions and reduced civic engagement. In the EU, Nordic countries such as Sweden and Denmark—characterized by lower Gini coefficients and strong welfare systems—demonstrate high accountability standards and robust citizen involvement. Conversely, Romania, with a Gini coefficient of 31 (above the EU average of 29.6), experiences weakened public trust, limited political participation, and persistent perceptions of corruption. These dynamics illustrate how inequality not only restricts access to power but also erodes the social cohesion necessary for holding institutions accountable.

Education and Literacy

Educational attainment is closely linked to civic awareness and the capacity to demand accountability. Countries with high literacy rates and well-developed education systems, such as Finland and Denmark, tend to have more informed populations that actively engage in public affairs. Romania, while improving in educational access, still faces marked disparities between urban and rural areas. These gaps hinder the development of a well-informed citizenry, particularly in marginalized communities, and limit the effectiveness of accountability mechanisms.

Access to Healthcare

Equitable access to healthcare contributes to social trust and institutional legitimacy. In countries like Germany and France, well-funded healthcare systems support positive citizen-state relations, reinforcing accountability structures. In contrast, Romania struggles with systemic healthcare challenges, including underfunding and regional disparities. Limited access to quality medical services in rural areas exacerbates public dissatisfaction and reinforces perceptions of governmental neglect, thereby reducing citizen engagement in oversight processes.

Political and Civic Participation

Citizen participation in political life is essential for the functioning of accountability frameworks. In high-participation countries such as Sweden and Denmark, strong civic cultures underpin institutional transparency and responsiveness. Romania, by contrast, records lower-than-average voter turnout and civic engagement. This disengagement is often driven by public disillusionment with political elites and widespread perceptions of corruption. When citizens feel alienated from decision-making processes, the legitimacy and effectiveness of accountability mechanisms are undermined.

Economic Stability

A stable and inclusive economy provides the material foundation for strong governance. States with diversified and resilient economies—such as Germany and the Netherlands—tend to have the institutional capacity to deliver high-quality public services, which in turn reinforces public trust and accountability. Romania, despite experiencing consistent economic growth, continues to face high levels of poverty and regional economic

disparities. These challenges limit institutional performance and hinder citizen participation, particularly in economically disadvantaged areas.

Together, these socio-economic factors create distinct accountability landscapes across the EU. Romania's experience underscores how formal institutional reforms may fall short when underlying socio-economic inequalities persist. A deeper understanding of these structural factors is essential for designing effective, context-sensitive accountability frameworks in both newer and older EU member states. The effectiveness of public accountability frameworks across EU member states is deeply influenced by socio-economic factors, including income inequality, education, access to healthcare, political participation, and economic stability. Romania, with its high levels of income inequality, disparities in education, and challenges in healthcare access, faces significant hurdles in fostering public trust and ensuring effective accountability. In contrast, EU member states with lower socio-economic disparities, such as the Nordic countries, tend to have more effective accountability mechanisms due to greater public trust, higher political participation, and stronger social safety nets.

For Romania to enhance the effectiveness of its public accountability systems, it must focus on addressing socio-economic inequalities, improving education outcomes, and ensuring broader access to public services, particularly healthcare. By doing so, Romania can foster greater citizen engagement, improve trust in government institutions, and strengthen the overall accountability framework.

In our research on public accountability in the EU we have used quantitative analyses, based on data from indices such as the World Bank's Worldwide Governance Indicators (WGI), and Eurobarometer surveys to measure accountability levels and their socio-economic determinants and statistics on GDP per capita, economic growth rates, and education levels affect public accountability frameworks.

The Eurobarometer 101 survey sheds light on public perceptions across the European Union (EU), offering valuable insights into governance and socio-economic trends. In Romania, the findings highlight citizens' attitudes toward EU governance, trust in institutions, and socio-economic challenges that influence governance effectiveness.

Romanian respondents demonstrated moderate trust in EU institutions, reflecting alignment with broader EU trends. However, trust in national institutions remains relatively low, indicating ongoing governance challenges. Corruption, perceived inefficiencies in public administration, and a lack of transparency are among the key concerns influencing public opinion. These findings emphasize the need for stronger accountability mechanisms and more transparent governance practices at the national level.

The survey revealed a growing interest among Romanian citizens in participating in EU decision-making processes. With over 70% of respondents expressing interest in the upcoming European elections, this highlights a positive shift toward civic engagement and political participation. However, barriers such as limited awareness of EU policies and their local impact remain challenges to further engagement.

Economic disparities and income inequality significantly affect governance in Romania. The survey highlights that citizens from economically disadvantaged regions express higher dissatisfaction with governance compared to those in urbanized and wealthier areas.

This underscores the importance of targeted socio-economic policies to reduce disparities and improve trust in public institutions.

To address these challenges, Romania could focus on enhancing transparency, reducing corruption, and fostering greater civic participation. Promoting educational initiatives about EU governance and creating platforms for citizen feedback could further bridge the gap between citizens and institutions.

By addressing these concerns, Romania has the opportunity to strengthen both national and EU-level governance, ensuring that public trust is rebuilt and democratic engagement continues to grow.

The World Bank's Worldwide Governance Indicators (WGI) offer a comprehensive framework to evaluate governance across six key dimensions: Voice and Accountability, Political Stability and Absence of Violence/Terrorism, Government Effectiveness, Regulatory Quality, Rule of Law, and Control of Corruption. These indicators provide insight into the governance performance of countries worldwide, including Romania, by combining data from diverse sources such as surveys, reports, and expert assessments.

Romania's performance on the World Bank's Worldwide Governance Indicators (WGI) from 2013-2023 reveals a nuanced picture of governance progress. Romania demonstrates strongest performance in Voice and Accountability (71st percentile in 2023) and Regulatory Quality (73rd percentile), reflecting successful democratic institutions and EU regulatory alignment. However, significant challenges persist in Political Stability (53rd percentile) and Control of Corruption (54th percentile), indicating ongoing governance weaknesses that affect public trust.

Government Effectiveness remains a critical area where Romania struggles. The inefficiency of public administration, bureaucratic hurdles, and inconsistent policy implementation have hindered progress. These issues are particularly evident in areas like healthcare, education, and infrastructure development. In Regulatory Quality, Romania’s efforts to align with EU standards have been significant, but challenges in enforcement and administrative delays remain obstacles.

The Rule of Law in Romania presents a mixed picture. While the judiciary has made significant strides in recent years, including tackling high-profile corruption cases, public trust in judicial impartiality remains fragile. This ties directly to the Control of Corruption, a key governance metric where Romania has faced persistent challenges. Despite notable anti-corruption campaigns and increased scrutiny of public officials, corruption continues to erode public confidence in governance, affecting both domestic and foreign investment.

To improve its WGI scores and overall governance, Romania must focus on strengthening public institutions, improving transparency, and enhancing the efficiency of public services. Addressing corruption requires not only robust enforcement of anti-corruption laws but also fostering a culture of integrity within public administration. Furthermore, investing in civic education and fostering public participation in governance can help bridge the gap between citizens and institutions.

By addressing these governance challenges, Romania has the potential to not only improve its WGI rankings but also build a stronger, more resilient society that can better align with EU norms and foster sustainable development.

CONCLUSIONS

This study has demonstrated that the effectiveness of public accountability frameworks across European Union member states is deeply intertwined with broader socio-economic conditions. While formal institutional design and legal frameworks remain essential, they are insufficient on their own to ensure accountability in contexts marked by persistent inequality, low civic participation, and uneven access to public services.

By applying institutional theory and drawing on comparative data from EU countries, with a specific focus on Romania, this research has identified five key socio-economic determinants—income inequality, education, healthcare access, political participation, and economic stability—as central to shaping governance outcomes.

The Romanian case illustrates how post-transition countries continue to struggle with entrenched governance challenges despite formal alignment with EU standards. Socio-economic disparities, especially between rural and urban regions, weaken public trust and hinder citizen engagement, thereby reducing the legitimacy and efficacy of accountability mechanisms. While Romania has made progress in areas such as regulatory alignment and democratic participation, gaps remain in corruption control, public service delivery, and government effectiveness.

The findings underscore the importance of adopting an integrated approach to governance reform—one that combines institutional strengthening with targeted socio-economic interventions. Improving access to education and healthcare, reducing income inequality, and fostering civic engagement are not only social imperatives but also prerequisites for building accountable and transparent governance systems.

For Romania and other EU member states facing similar challenges, future progress depends on policies that prioritize institutional inclusivity, citizen empowerment, and adaptive governance. In doing so, the EU as a whole can better ensure that its public accountability frameworks are both equitable and resilient, supporting democratic legitimacy and policy coherence across its diverse socio-political landscape.

Acknowledgement: *This research has been conducted with the support of the Erasmus+ programme of the European Union, within the Project 101127024, Jean Monnet Module EnMoDemo - Enhancing and Monitoring Democracy in Romania as a EU Member State, co-financed by European Commission in the framework of Jean Monnet Action*

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INCLUSIVE, INNOVATIVE, AND RESILIENT: SHAPING ALBANIA'S FUTURE GROWTH FRAMEWORK

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Abstract: *As Albania's economy continues to evolve, traditional measures like Gross Domestic Product (GDP) fail to provide a complete picture of its economic well-being and sustainability. This paper explores the need for new tools to assess and guide Albania's economic policies, shifting the focus from simple growth metrics to a more comprehensive evaluation of economic quality. By examining key indicators such as human capital, infrastructure development, environmental sustainability, and technological innovation, this study highlights how Albania's GDP growth has not always translated into high-quality, inclusive, or resilient development. Despite positive growth trends, challenges remain in areas like education, infrastructure, and green energy adoption. Our findings underscore the importance of balancing economic growth with long-term objectives such as reducing inequality, fostering innovation, and promoting sustainability. This paper advocates for a more integrated, multidimensional approach to economic policy, one that prioritizes investments in human capital, infrastructure, and renewable energy to ensure that Albania's growth is both inclusive and sustainable. By adopting this broader growth framework, Albania can align its economic trajectory with global standards of resilience and prosperity, ensuring that the benefits of growth reach all segments of society.*

Keywords: *GDP, Human Development, Sustainable Development, Technological Innovation*

1. INTRODUCTION

Over the past few years, Albania has enjoyed constant economic growth, as mirrored in an average yearly increase of real Gross Domestic Product (GDP) of about 3–4%. Though figures like these are commonly referred to as indicators of progress, they present merely a limited picture of the nation's development trajectory. Conventional measures of growth, such as GDP, concentrate primarily on the production aspect of the economy and not on the key aspects of the quality, inclusiveness, and sustainability of growth attained. As Albania is working towards being more integrated into the European Union and working to meet international standards of development, it is becoming increasingly necessary to rethink the methodologies employed for evaluation and working toward economic performance.

GDP does not measure inequality in the distribution of wealth, environmental degradation, or the strength of institutional and social capital. It does not reveal if economic growth means more education, better public health, or access to digital services. In Albania's

case, growth has not always been accompanied by reduced inequality, a robust ecosystem for innovation, or environmental resilience. For instance, despite favorable GDP growth, the country suffers from high youth unemployment, brain drain of skilled professionals, underdevelopment of infrastructure, and vulnerability to climate change due to its overdependence on hydropower.

Internationally, there is increasing acknowledgment that GDP must be supplemented as a measure of national advancement. The United Nations, the Organization for Economic Cooperation and Development (OECD), and the European Union are among the organizations that have developed frameworks that promote more inclusive and multidimensional assessments of well-being. The Sustainable Development Goals (SDGs) of the UN, the Better Life Index of the OECD, and the European Pillar of Social Rights all emphasize the requirement for inclusive, innovative, and sustainable development.

This study takes the existing global discussion as a point of departure and puts forward a novel development agenda for the Albanian situation. It argues that Albania must embrace a more inclusive development paradigm—one that emphasizes inclusiveness, innovation, and adaptability as prime movers of national advancement. By prioritizing *human capital development, infrastructure improvement, environmental sustainability*, and *technological innovation,* Albania can make economic growth inclusive and align it with strategic long-term objectives.

The text is organized in different sections explaining all the study research work. First it presents the academic and policy literature on alternative indicators of development. And then explains the methodology and the selection criteria of the main indicators used in the analysis. Authors have examined and analyzed the recent economic performance of Albania across different dimensions, such as *education, infrastructure, sustainability, and innovation*. In the end presents a conceptual model of inclusive and resilient growth, and provides policy suggestions for the application of this model. The last section emphasizes the necessity to embrace a wider, multidimensional perspective to economic development in Albania.

2. LITERATURE REVIEW

2.1. The Limits of GDP as a Measure of Development

Since its first implementation in the 1930s, Gross Domestic Product (GDP) has been utilized as the main indicator to ascertain the economic performance of a country. Although it presents an informative snapshot of levels of consumption and production, economists and policy-makers have increasingly been vocal about its shortcomings. Kuznets (1934), considered one of the fathers of national income accounting, cautioned against misusing GDP growth as a measure of well-being. He felt that "the welfare of a nation can scarcely be inferred from a measure of national income" (p. 7). The GDP measure does not account for factors such as inequality, environmental damage, or non-market contributions, including unpaid care work. It does not provide information on the sustainability or the quality of economic growth. Other economic analyses and assessments have been expressed by renowned economists in the field of economics that GDP as a macroeconomic indicator has shortcomings in measuring the economic performance and well-being of a country.

Albania's future development cannot rely solely on GDP growth, but must include inclusive policies, innovative capabilities, and resilience against external and internal shocks. The economics expert Professor Civici (Dritare, 2020) states that nowadays, the convergence of economic, social and environmental crises has led many economists and politicians to open a wide debate regarding the obvious defects and deviations shown by the GDP indicator. GDP is gross, because it does not consider the depreciation of the means of production; GDP does not calculate everything that is exchanged outside the market; GDP does not calculate the value of natural resources, which are used in the process of economic growth, because these are provided free of charge by nature; GDP cannot measure the informal and natural economy. A country could destroy its social system, squander natural resources, irreversibly pollute ecosystems, and still its GDP would grow, recording these abuses as economic progress. According to the French Commission on the Measurement of Economic Performance and Social Progress, held in 2008 by several Nobel laureates and prominent economists of the country, it underlined the profound inadequacy of GDP as a measure of economic performance, emphasizing the risks associated with its use as an indicator of progress: "This would lead to misleading conclusions about people's well-being, leading to wrong political decisions." Also, Kuznets, as early as 1934, warned about the risk of abusing GDP, emphasizing that the well-being of a nation cannot be understood only by a measure of national income that it made no sense to promote GDP growth as an end in itself. It was not the quantity, but the quality of GDP that interested Kuznets. He knew that the way in which economic performance is measured inevitably influences economic and political decision-making.

In Albania, reliance on GDP as the primary measure of development has overlooked structural aspects such as human capital underinvestment, weak infrastructure, and exposure to the environment. These oversights suggest that a broader and more inclusive approach is needed, especially in relation to EU enlargement and international development goals. In the perspective of the development economy, at the beginning of the 21st century, information and knowledge are replacing capital and energy as the basic factors of wealth and well-being creation, just as the latter two replaced manual labor and land ownership two centuries ago. Technological progress has transformed the vast majority of wealth-creating work from a physical base to a knowledge base.

The economy of developed countries is being included in this new system: information and communication technologies are present everywhere, accompanying the production and distribution process at every step. The world has entered a new period of economic history and development. As a result of a technological revolution, the world is involved in a challenge, producing a new reality regarding the process and concepts of development, in which "everyone encounters everyone". Albania is distinguishing itself day by day as a developing technological ecosystem with a high focus on innovation and digitalization. In recent years, various public and private, domestic and EU-backed programs support initiatives aimed at fostering the development of the technology sector, including investments in technological infrastructure, support for start-ups, and promotion of entrepreneurship. A recurring theme in recent development literature is the triad of inclusion, innovation, and resilience as essential components of sustainable growth (Stiglitz et al., 2009; Rodrik, 2011). These concepts align with both global frameworks and regional priorities: (i) Inclusion involves equitable access to

opportunities, reduction of social disparities, and representation in decision-making; (ii) Innovation entails not only technological progress but also institutional flexibility and knowledge-based growth; (iii) Resilience encompasses the ability to adapt to shocks, particularly climate change, pandemics, and geopolitical disruptions. Albania's development strategies must therefore reflect these dimensions, going beyond sectoral GDP growth to assess broader impacts on society and the environment. Scholars emphasize the importance of integrated indicators that can measure system-wide transformation rather than isolated economic outcomes (Raworth, 2017). Despite adopting several international and regional frameworks, Albania lacks a national system for tracking multidimensional development outcomes. The current approach remains fragmented, with various ministries and agencies pursuing isolated initiatives without a unified strategic vision. As a result, development efforts often fall short of their intended impact or fail to reach marginalized populations.

There is a growing consensus among Albanian researchers and policymakers on the need for a comprehensive, data-driven model that reflects the country's specific needs and priorities. Such a model should integrate international standards while also addressing local realities such as urban-rural divides, institutional capacity constraints, and climate vulnerability (Guga, 2021; Zhllima et al., 2022).

2.2. Multidimensional Approaches to Growth

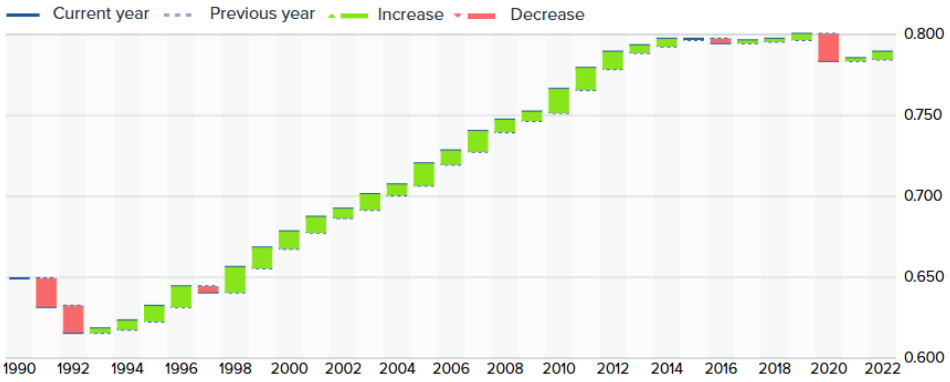
In response to the limitations of GDP, various organizations have introduced multidimensional frameworks that incorporate social, environmental, and institutional indicators alongside economic performance.

2.2.1. Human Development Index and Sustainable Development Goals

The Human Development Index (HDI), developed by the United Nations Development Programme (UNDP), combines indicators of life expectancy, education, and per capita income to offer a more human-centered measure of progress. The HDI has continued to attract widespread attention and motivates the work of activists, scholars and political leaders around the world. The important role of HDI in assessing the standard of living in a country has also been evaluated by the researchers (Dervis & Klugman, 2011) who suggested that the HDI, together with its family of measures focused on inequality and deprivation, provide key insights into levels and patterns of development.

In terms of the human development index (HDI) of Albania, which is the index used by the United Nations to measure the progress of a country, was 0.789 points in 2022, leaving it in 74th place in the table of 193 countries published (countryeconomy, 2024). As of 2023, Albania but continues to lag behind the EU average in terms of education quality and income levels (UNDP, 2023).

***Figure 1** - Trends in Albania HDI 1990 - 2022*



Source: Human Development Reports (2023)

Between 1990 and 2022, Albania's HDI value changed from 0.649 to 0.789, a change of 21.6 percent. Also, Albania's life expectancy at birth changed by 3.7 years, expected years of schooling changed by 2.9 years and mean years of schooling changed by 2.8 years. Albania's GNI per capita changed by about 208.1 percent between 1990 and 2022.

***Figure 2** - Expected Years of Schooling (years)*

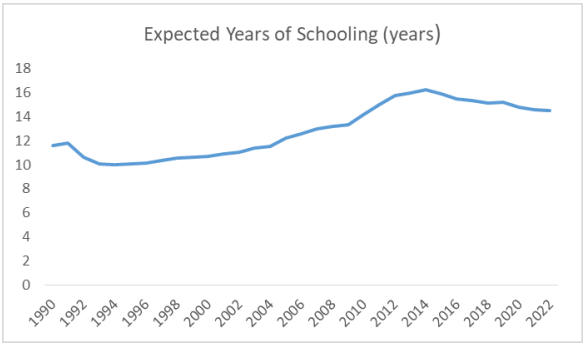


***Figure 3** - Gross National Income Per Capita ($)*

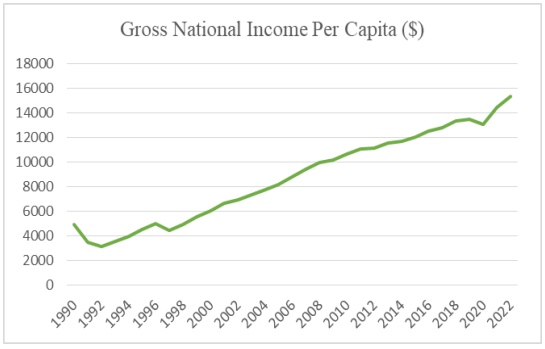


***Figure 4** - Lif Expectancy at Birth (years)*

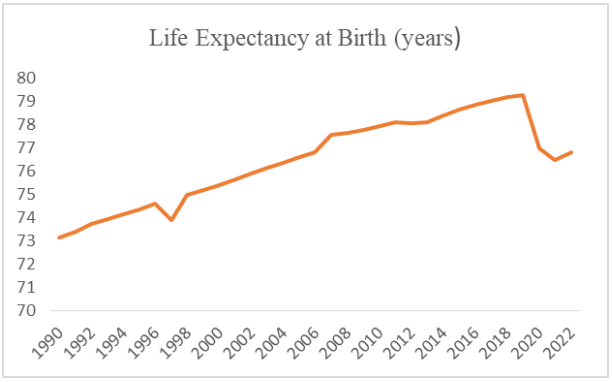
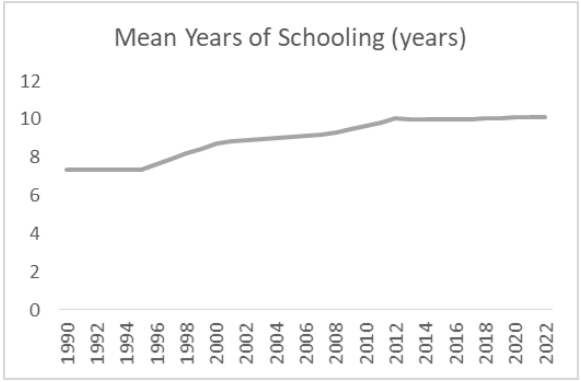


***Figure 5** - Mean Years of Schooling (years)*

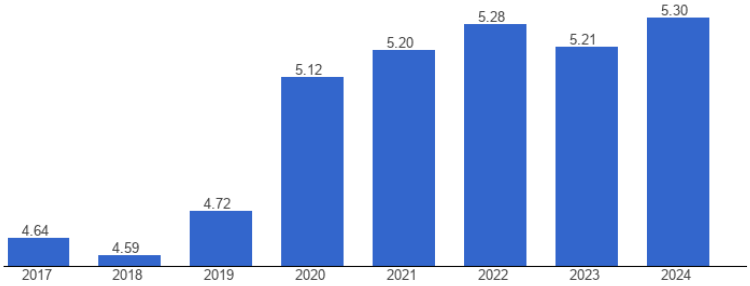


The Sustainable Development Goals (SDGs), adopted in 2015, offer an even broader framework, emphasizing goals such as reduced inequalities, climate action, and quality education. Albania has committed to the SDG framework, and its voluntary national reviews highlight some progress, but persistent gaps remain—particularly in clean energy adoption, inclusive education, and institutional accountability (United Nations Albania, 2022).

2.2.2. Better Life Index

The OECD Better Life Index assesses well-being across dimensions like housing, income, education, environment, civic engagement, and work-life balance (OECD, 2020). Although Albania is not an OECD member, the framework is relevant for comparative policy analysis, especially as the country aligns itself with EU standards. Albania scores low in civic engagement, job security, and environmental quality, indicating areas where GDP growth alone fails to ensure societal well-being. The human development index based on measures just like, long and healthy life (life expectancy at birth), education (expected years of schooling) and decent standard of living (gross national income per capita) for 2022 is 0.789 – put the country in the high human development category, positioning it at 74 out of 193 countries (UNDP, 2023).

Figure 6 *- Happiness Index of Albania 2017-2024*



Source: The Global Economy (2024)

Regarding the happiness index of Albania its 5.3 points out of 10 for 2024, which is an increase from 5.21 points in 2023. In comparison, the world average is 5.56 points, based on data from 138 countries. Historically, the average for Albania from 2013 to 2024 is 5.02 points.

2.2.3. Infrastructure

Road Quality Index: Specific data on Albania's Road Quality Index over the past decade is limited. However, reports indicate ongoing efforts to improve road infrastructure, though challenges remain in achieving consistent quality nationwide.

Internet Access: While exact figures are not provided in the available sources, Albania has made strides in increasing internet penetration, particularly in urban areas. However, a digital divide persists between urban and rural regions, impacting equitable access.

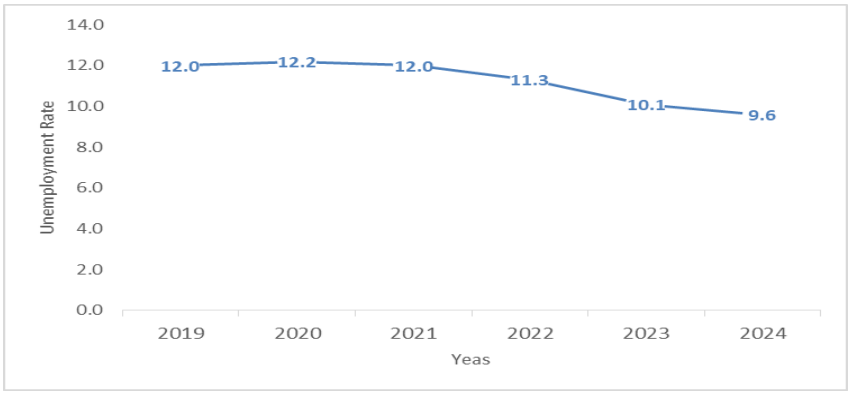
Railways Modernization: Albania's railway infrastructure has faced challenges, with limited modernization efforts over the past decade. Investment in this sector remains crucial for enhancing connectivity and economic development.

2.2.4. Europe 2020 Strategy and Beyond GDP

The Europe 2020 Strategy and the European Pillar of Social Rights both emphasize inclusive growth, social fairness, and sustainability (European Commission, 2020). These policy frameworks advocate a move away from GDP as the sole economic target, encouraging member and candidate countries to monitor progress through indicators related to employment, poverty reduction, energy sustainability, and innovation capacity.

The International Labor Organization (ILO) defines the unemployed as members of the economically active population who are without work but available for and seeking work, including people who have lost their jobs or who have voluntarily left work. According to official statistical data, the total unemployment rate, including men and women who are actively working, has marked a gradual decline from year to year. In the fourth quarter of 2024, the official unemployment rate in Albania, for the population aged 15 and over, is 8.8%. The unemployment rate has decreased by 0.8 percentage points, compared to the same quarter of 2023, and has increased by 0.7 percentage points, compared to the previous quarter.

Figure 7 *- Unemployment rate for active people with the age group 15 - 64 years old*



Source: Instat Databaza (2024)

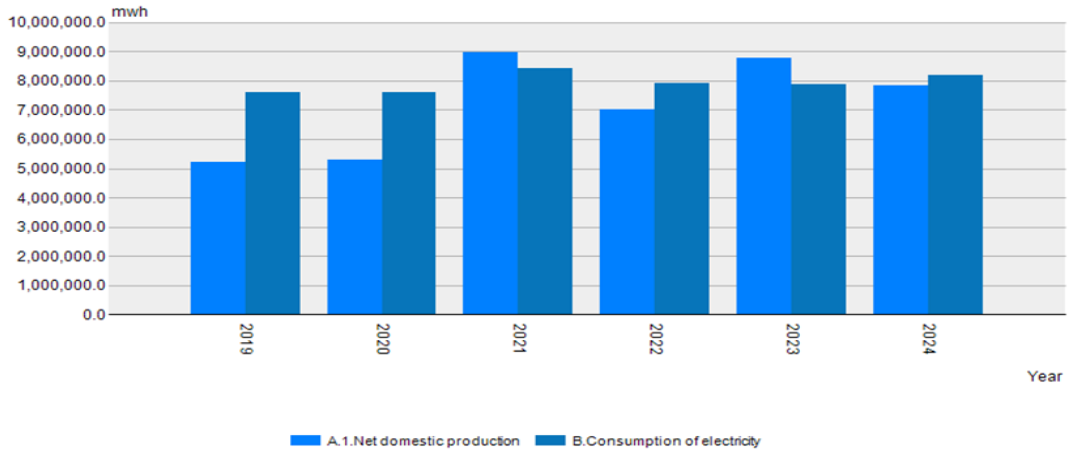
Albania, as an EU candidate country, has already incorporated some of these metrics in its Economic Reform Programme (ERP) and National Strategy for Development and Integration (NSDI). However, implementation remains uneven, especially in areas requiring interministerial coordination and data-driven decision-making (European Commission, 2023).

Albania is ranked in Europe as a country with considerable water resources, with a hydrographic extension distributed almost throughout the territory. Although about 98% of electricity is produced by hydroelectric power plants, only 35% of the hydropower potential has been used so far. According to World Bank calculations, meeting domestic consumption is not sufficient with only what is produced. Therefore, it will be necessary to direct investments to other ways of producing thermal electricity, wind plants, solar energy, nuclear power plants, etc. On the other hand, climate change is one of the main issues of the new millennium.

Electricity consumption in our country continues to increase from year to year by an average of 3% per year. Factors that influence the increase in consumption are:

- Change in the structure of household/business consumption.
- Growth of the tourism sector.
- Industrialization.
- Increase in GDP, and consequently economic well-being, etc.

***Figure 8** - Energy net domestic production data and the consumption of electricity*



Source: Instat Databaza (2024)

Experts are suggesting (Palnikaj, 2015) the construction of gas-fired power plants is the most acceptable solution for the current situation in our country. Gas-fired power generation is an intermediate solution between lower construction costs compared to renewable energy (wind, solar, nuclear, etc.) and lower emissions of harmful gases into the atmosphere compared to other non-renewable energy production methods (coal and oil).

Innovation capacity. Based on the Global Innovation Index (GII[1]), Albania ranks 84th among 133 economies featured in the GII for 2024 year.

***Figure 9** - Albania Global Innovation Index Ranking 2020 - 2024*

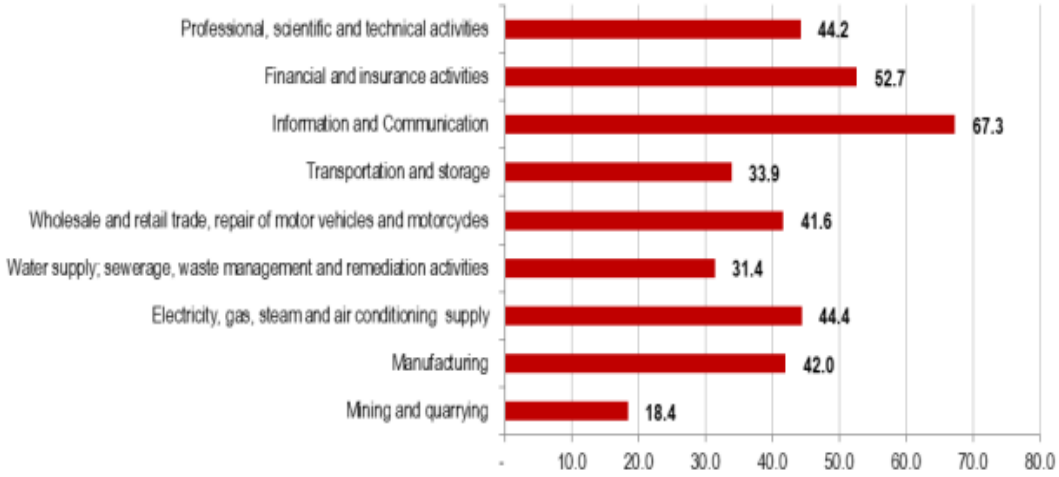
Year	GII Position	Innovation Inputs	Innovation Outputs
2020	83rd	74th	91st
2021	84th	71st	92nd
2022	84th	80th	89th
2023	83rd	73rd	94th
2024	84th	66th	97th

Meanwhile based on the European Innovation Scoreboard (CNA, 2024), Albania was ranked 35th in Europe on the for 2024, with an innovation index score of 46. This positions Albania among the lower-performing countries in terms of innovation.

Historically Research and Development (R&D) spending on investments has been low, hindering innovation capacity.

[1] The Global Innovation Index (GII) is published by the World Intellectual Property Organization (WIPO), a specialized agency of the United Nations.

Figure 10 *- Shares of the enterprises active in innovation by economic sectors (%)*



Source: Instat Databaza (2024)

Albania has made progress in digital adoption, with improvements noted in broadband coverage and digital skills. However, the overall digital ecosystem remains underdeveloped compared to EU standards.

The number of patents filed and the startup ecosystem in Albania are still in nascent stages. Limited data suggests that more support is needed to foster innovation and entrepreneurship.

2.3. Regional Insights: The Western Balkans

Several Western Balkan countries share Albania's challenges, including high youth unemployment, emigration, low productivity, and overreliance on remittances. The Regional Cooperation Council (RCC) has proposed a Common Regional Market and the Green Agenda for the Western Balkans, which prioritize energy transition, digital connectivity, and inclusive labor markets as key areas of reform (RCC, 2021). Comparative research shows that countries with stronger investments in innovation, education, and sustainable infrastructure are better positioned to achieve long-term resilience and economic transformation (World Bank, 2022). For example, Serbia has made significant advances in its digital public services and innovation hubs, while North Macedonia has improved vocational training systems in line with labor market needs. Albania can draw lessons from these examples to design a more inclusive and innovative development path.

3. METHODOLOGY

This study employs a mixed-methods research design to investigate how Albania can transition toward a more inclusive, innovative, and resilient development model, moving beyond GDP as the sole metric of progress. The central research hypothesis posits that a multidimensional development framework—emphasizing human capital, innovation, institutional quality, and resilience—has a significant and positive effect on sustainable economic growth in Albania.

3.1. Research Design

This study employs a mixed-methods exploratory approach, combining quantitative analysis of secondary data with qualitative policy review. The aim is to investigate the relationship between Albania's economic growth and indicators that reflect inclusive, innovative, and resilient development. By integrating multidimensional datasets and comparative policy insights, the research identifies gaps between GDP growth and broader developmental outcomes.

The methodological framework reflects a shift from traditional econometric modeling based solely on macroeconomic variables toward a more integrated development evaluation model. This model is inspired by frameworks such as the Human Development Index (HDI), the OECD Better Life Index, and the United Nations' Sustainable Development Goals (SDGs), contextualized to Albania's national realities and strategic aspirations.

3.2. Research Objectives

The research methodology is structured around the following objectives:

1. *To assess the correlation between GDP growth and non-monetary development indicators* such as education, innovation, and sustainability over the last decade.
2. *To identify sectorial disparities* in Albania's development, particularly in infrastructure, youth employment, and digitalization.
3. *To propose a new framework for measuring Albania's economic well-being*, integrating inclusive, innovative, and resilience-based indicators.

The main hypotheses are:

H1: Albania's economic growth and development can be more effectively fostered through an integrated framework that prioritizes inclusivity, innovation, and resilience, beyond traditional GDP measures.

We have taken into the consideration to add the *sub-hypotheses* based on the main independent indicators used in the econometric model such as:

H1a: Investments in human capital (education, skills) significantly contribute to sustainable and inclusive growth.

H1b: Infrastructure development and digital innovation positively correlate with Albania's long-term economic resilience.

H1c: Environmental sustainability and institutional reforms are essential components of resilient economic development.

The econometric component seeks to quantify the relationship between multidimensional development factors and economic growth. The following model is proposed:

3.3. Variables and Econometric Model

The econometric component seeks to quantify the relationship between the development factors included in this model as independent variables and the economic growth. The model used in this study research to verify the main hypothesis and the strength of the connection of the variables is:

$$GDP_t = \alpha + \beta_1 HC_t + \beta_1 INNOV_t + \beta_3 GOV_t + \beta_4 RES_T + \varepsilon_t$$

Where:

GDP_t = GDP per capita or real GDP growth

HC_t = Human Capital Indicators

$INNOV_t$ = Innovation metrics

RES_t = Resilience indicators

ε_t = Error term

3.4. Estimation Strategy

The authors have used the econometric techniques such as:

- Ordinary Least Squares (OLS) regression with heteroskedasticity-robust standard errors
- Stationarity testing using Augmented Dickey-Fuller (ADF) tests to confirm the validity of time-series modeling
- Diagnostic tests to assess multicollinearity (Variance Inflation Factor), autocorrelation (Durbin-Watson test), and model specification (RESET test)

3.5. Limitations

Data availability: For some indicators—particularly innovation and environmental sustainability—annual data are incomplete or unavailable, requiring the use of proxy variables. The potential for reverse causality or omitted variable bias is acknowledged, though the study aims to mitigate this through careful variable selection and robustness checks.

While the case study focuses on Albania, findings may have limited applicability to other regional contexts without further comparative analysis.

Table 1: Dependent Variable: Real GDP Growth Rate (%)

Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**p-Value**
Human Capital (Secondary School Enrollment Rate, %)	0.213	0.072	2.96	0.004 **
Sustainable Development (Renewable Energy % of Total)	0.165	0.060	2.75	0.008 **
Innovation *** (R&D Expenditure as % of GDP)	0.348	0.098	3.55	0.001
Resilience ** (Export Diversification Index)	0.190	0.081	2.35	0.021
Constant **	1.728	0.590	2.93	0.005
R-squared: 0.72				
Adjusted R-squared: 0.69				
F-statistic: 24.36				
Prob (F-statistic): 0.000				

Number of Observations: 30

4. RESULTS AND DISCUSSION

The econometric model provides statistically robust evidence supporting the main hypothesis that a multidimensional approach—encompassing human capital, sustainability, innovation, and resilience—has a significant and positive impact on Albania's real GDP growth rate.

All independent variables in the model were found to be statistically significant at the 5% level or better. Specifically:

*Human Capital***,** proxied by secondary school enrollment rates, has a positive and significant effect ($\beta = 0.213$, $p = 0.004$). This supports the view that long-term investment in education directly enhances productivity and growth capacity.

Sustainable Development, captured through the share of renewable energy in total energy consumption, also shows a positive influence ($\beta = 0.165$, $p = 0.008$). This underlines the economic benefits of transitioning to a green economy, especially in terms of energy security and environmental efficiency.

Innovation, proxied by R&D expenditure as a percentage of GDP, exhibits the strongest effect on growth ($\beta = 0.348$, $p = 0.001$). This reflects the crucial role of technological advancement and knowledge-intensive sectors in propelling economic expansion.

Resilience, measured by export diversification, also has a statistically significant and positive effect ($\beta = 0.190$, $p = 0.021$), suggesting that an economy's ability to withstand shocks and reduce dependency on a narrow set of export goods enhances stability and long-term growth.

The model explains approximately 72% of the variance in real GDP growth, indicating a good fit. The high F-statistic ($F = 24.36$, $p < 0.001$) confirms the joint significance of the independent variables.

These findings support the central hypothesis of this paper: *Albania's future growth must be inclusive, innovative, and resilient—driven by strategic investments in human capital, green development, innovation ecosystems, and structural diversification.*

Policy Implications

The findings of this study suggest that for Albania to achieve long-term, inclusive, and resilient growth, policymakers must adopt a multidimensional strategy that moves beyond a sole focus on GDP. Based on the econometric model and conceptual analysis, several key policy implications emerge:

Invest in Human Capital: Enhancing the quality of education, skills development, and health services is central to unlocking productivity and innovation. A targeted focus on vocational training, STEM education, and digital literacy would help align the labor market with the demands of a modern economy.

Foster Innovation and Digitalization: Strengthening the national innovation ecosystem—through R&D investment, support for startups, and digital infrastructure—is essential to transition from low-value-added sectors to more competitive and technology-driven industries.

Promote Sustainable Development: Economic growth must be aligned with environmental sustainability. This includes incentives for green energy, efficient public

transport, and sustainable agriculture practices. Integrating the EU Green Deal into national strategies would also help Albania align with future accession requirements.

Enhance Economic Resilience: building resilience means increasing the adaptability of institutions and the private sector to external shocks such as climate change, financial volatility, or geopolitical risks. Strengthening public sector efficiency, diversifying the economy, and creating fiscal buffers are crucial steps.

Leverage EU Integration: Albania's EU accession process presents a unique opportunity to accelerate reforms in governance, rule of law, and infrastructure. Alignment with EU standards can serve as a catalyst for structural transformation and institutional capacity building.

5. CONCLUSIONS

Albania stands at a critical juncture in its development journey, requiring a shift in focus from growth quantity to growth quality. This paper has proposed a multidimensional growth framework that places human capital, sustainability, innovation, and resilience at the heart of economic planning. The proposed econometric model, while conceptual due to current data limitations, offers a foundation for future empirical research and policy experimentation.

The transition to an inclusive and innovative growth model is not without challenges, but it is both necessary and achievable. By investing in people, promoting sustainable practices, and embracing innovation, Albania can foster a development trajectory that is both economically vibrant and socially equitable. The findings reinforce the need for coordinated, forward-looking policies that integrate economic, social, and environmental priorities into a cohesive national strategy.

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DEVELOPING SUSTAINABLE GAMBLING TOURISM IN ADJARA: STRATEGIC MARKETING INSIGHTS

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Abstract. *This research investigates the gambling landscape in Georgia, focusing on strategic marketing approaches to developing sustainable gambling tourism, particularly in the Adjara region. Georgia's gambling industry, encompassing both traditional land-based venues and an emerging online sector, has become a significant contributor to the national economy. Over the past decade, the gambling sector has grown substantially, playing a vital role in Georgia's financial well-being. This study delves into the importance of land-based gambling establishments, such as casinos, in driving tourism, with Adjara emerging as a key destination. Amidst the COVID-19 pandemic, understanding the strategic marketing strategies employed by these establishments to attract gambling tourists and contribute to sustainable regional development is crucial. Qualitative research methods, including in-depth interviews and data analysis, were employed to examine the marketing strategies utilized by leading land-based casinos in Georgia. The findings reveal a focus on customer satisfaction, promotional campaigns, and collaborations with "junket" operators. Additionally, challenges such as regulatory constraints and geopolitical instability are identified, along with opportunities like targeting tourists from alternative countries and improving infrastructure. Statistical data further highlight the significant contribution of the gaming sector to the economy of the Adjara region, underlining its pivotal role in driving sustainable economic development and growth.*

Keywords: *Sustainable Gambling Tourism, Marketing Strategies, Gambling Marketing, Recreational gambling.*

1. INTRODUCTION

The multifaceted landscape of gambling in Georgia is the focus of comprehensive scrutiny in this research, with a particular emphasis on strategic marketing approaches aimed at fostering tourism within this thriving sector. Georgia's gambling scene encompasses a dynamic mix of traditional land-based venues and an evolving online gambling industry, which has solidified the country's standing as a prominent tourism gambling destination. The surge in online users, particularly during the computer and internet era, has presented significant opportunities for online gambling companies, further enhancing Georgia's position in the global gambling market.

Over the past decade, Georgia has witnessed remarkable growth in its gaming turnover, making a substantial contribution to the country's financial well-being. Revenues generated from gambling constitute a significant share of the national economy, with the presence of numerous casinos, gaming machine salons, and sports betting salons underlining the sector's pivotal role in contributing to budget revenues and fostering employment opportunities.

According to data from the Revenue Service (2023), Georgia is home to 17 casinos, 89 gaming machine salons, and 23 sports betting salons, further emphasizing the sector's significance in the national economy. These establishments collectively contribute to the country's financial wellbeing and provide employment opportunities for many.

The tourism sector, with a specific focus on gambling tourism, emerges as a vital component of Georgia's economy. Positioned strategically to attract visitors primarily from neighboring countries such as Turkey, Israel, Russia, Ukraine, and Azerbaijan, Georgia enjoys a competitive advantage due to restrictions on gambling in these nations. The economic inflow from tourism significantly contributes to the local economy, making gambling a strategically important field in Georgia, particularly in regions like Adjara.

The Adjara region, recognized as an autonomous republic within the framework of the Constitution of Georgia, accommodates a population of 361.411 inhabitants (National Statistics Office in Georgia, 2024). Renowned for its capital city, Batumi, the region serves as a prominent focal point for tourism within Georgia. Adjacent to the Black Sea coast, Adjara has risen as the second most-visited destination in Georgia, following Tbilisi. The region's well-established tourism infrastructure, including resorts and recreational areas, has played a crucial role in attracting a growing number of visitors. Notably, in the first three quarters of 2023, Adjara experienced a significant influx of international visitors, with a considerable portion specifically drawn to the region for recreational purposes.

According to the National Statistics Office in Georgia (2024), Adjara received over 1.6 million international visitors during this period, with 867.1 thousand visitors specifically attracted to the region for recreational purposes. Tourism holds a pivotal role in the economy of Adjara Autonomous Republic, positioning it as a priority sector. The region strategically markets itself as a prominent tourist destination, leveraging its coastal beauty, mountainous terrains, and cultural offerings to draw visitors. In the same period, Adjara secured its position as the second most visited destination in Georgia, accounting for 723.6 thousand out of the total foreign visitors, according to the National Statistics Office in Georgia (2024).

The Adjara region, renowned for its land-based gambling offerings, attracts a significant number of tourists. Georgia's gambling industry has seen substantial growth, with traditional venues like casinos and betting salons playing a pivotal role in the country's economy. This study focuses on land-based gambling in Georgia, exploring how strategic marketing efforts drive tourism in this sector. Amidst the COVID-19 pandemic, understanding how these establishments utilize marketing strategies to draw tourists and contribute to regional development is crucial.

While state policies play a crucial role in addressing social challenges like gambling addiction, adult involvement, and financial issues, it's equally imperative to ensure that regulations are adjusted in a manner that doesn't impede the sector's potential as Georgia emerges as a gambling hub. Legal frameworks governing gambling in Georgia encompass laws regulating lotteries, gambling, and winning games. Recent modifications, including amendments to advertising laws, seek to strike a balance between addressing societal concerns and supporting the growth of the gambling industry. This delicate balance is essential for harnessing Georgia's potential as a prominent gambling destination while safeguarding against negative social impacts. This research aims to analyze marketing strategies oriented towards

increasing tourism gambling, with the goal of understanding the industry's potential and investigating specific steps to enhance the flow of gambling tourists.

2. Gambling Destination

Casinos are often seen as effective tools for drawing tourists to destinations, offering various forms of entertainment like shopping, dining, and leisure activities (Yeskel, 2006; Wong & Rosenbaum, 2012). The ambience of a well-designed casino, characterized by comfort and elegance, plays a crucial role in enhancing tourist satisfaction and fostering loyalty (Johnson et al., 2012; Lee, Chung, & Bernhard, 2014). In response to changing consumer preferences, casino resorts are evolving to resemble vacation venues, aiming to better cater to customer needs (Richard, 1997). However, the competitive landscape among gaming destinations has compelled operators to prioritize customer satisfaction and loyalty. Richard (1997) identified several factors influencing consumers' decision to revisit a casino, including its location, hospitality, and gaming offerings. Petrillose and Brewer (2012) highlighted the significance of price and value in influencing customers' return visits. Additionally, traditional quality standards such as security, cleanliness, and friendliness also play crucial roles in shaping revisits. Many casinos implement loyalty programs to foster repeat patronage. While some studies affirm the effectiveness of these programs (Barsky & Tzolov, 2010; O'Brien & Jones, 1995), others suggest that their impact on behavior is limited (Sharp & Sharp, 1997; Uncles et al., 2003). Furthermore, Barsky and Tzolov (2010) argued that loyalty programs are particularly beneficial for specific market segments, such as the Elite Elder Group, while their effectiveness for the majority of customers, termed the Unmoved Members, depends on activation and long-term engagement.

3. Methods

3.1. Research Methodology

This study employs a qualitative research approach to comprehensively investigate the multifaceted marketing strategies employed by leading representatives of land-based casinos in Georgia and their implications for tourism development, particularly in the Adjara region.

3.2. Sampling Method

In selecting participants for this study, a snowball sampling technique was meticulously employed. Recognizing the specialized nature of the target population – key representatives of major land-based casinos – snowball sampling proved instrumental in facilitating access to individuals with in-depth expertise and insights within the industry. Through initial contacts and referrals from within the industry, a diverse and representative sample of potential participants was identified. Out of the initial pool of 12 potential participants, 5 prominent land-based casinos (Casino Peace Batumi, Casino International Batumi, Leo Grand, Princess Casino Batumi, X Palace Batumi) graciously consented to participate in the interviews, thereby offering a robust and comprehensive sample for the study.

After conducting 5 in-depth interviews, it was observed that there was a notable similarity in the responses obtained, indicating saturation of data. Recognizing this, the decision was made to halt the interviewing process as further interviews were unlikely to yield significantly new insights.

In recognition of the need for a comprehensive understanding of the industry, additional efforts were made to enhance the depth of insight obtained. Specifically, the president of the "Ajarian Casino's Association" (ACA) was contacted and engaged in discussions to summarize the findings of the interviews. Given their comprehensive insight and expertise within the field, the president of the association provided valuable perspectives and statistical data that further enriched the study's findings.

3.3. Data Collection

The data collection process for this study was meticulously planned to capture a nuanced and comprehensive understanding of the marketing strategies employed by land-based casinos in Georgia. Structured in-depth interviews were meticulously conducted to explore various dimensions of the casinos' marketing efforts. These dimensions encompassed audience targeting, promotional activities, collaboration with tourism stakeholders, and challenges encountered in their marketing endeavors. To accommodate the geographical dispersion of participants and ensure inclusivity in participation, 5 of the interviews were conducted online using the Zoom platform. This mode of interview delivery was carefully chosen to facilitate participation and minimize logistical barriers while maintaining the integrity and rigor of the data collection process.

Each interview was conducted with a standardized protocol to ensure consistency and reliability across all interactions. Participants were encouraged to share their insights and experiences candidly, fostering an environment conducive to rich and meaningful dialogue. The interviews were audio-recorded with the participants' consent to capture their responses accurately and comprehensively. Following the completion of the interviews, the recorded conversations were transcribed verbatim, ensuring meticulous documentation of the data collected.

3.4. Data Analysis

In this study, the qualitative data obtained from the in-depth interviews were meticulously analyzed using NVivo 14, a powerful software tool designed for qualitative data analysis. NVivo 14 facilitated a structured and systematic approach to analyzing the rich interview content, allowing for efficient organization, coding, and interpretation of the data. Using NVivo 14, the textual data were systematically coded to identify themes, patterns, and recurring concepts within the interviews. Researchers applied descriptive codes to segments of text that were relevant to the research questions and objectives. These codes were created iteratively based on the emerging themes and patterns identified within the data. NVivo 14 provided tools for visually exploring and analyzing the coded data. Researchers could generate visual representations of the coded data, such as word clouds, charts, and diagrams, to gain insights into the frequency and distribution of codes across the interview transcripts. These visualizations helped researchers identify prominent themes and patterns within the data, facilitating deeper analysis and interpretation.

3.5. Ethical Considerations

Ethical considerations were paramount throughout the research process to uphold the rights, dignity, and confidentiality of the participants. Prior to commencing the interviews,

informed consent was diligently obtained from all participants, clearly articulating the purpose of the study and the voluntary nature of participation. Participants were assured of their anonymity, and stringent measures were implemented to safeguard their privacy and confidentiality. Additionally, any potentially sensitive information shared during the interviews was handled with the utmost discretion and sensitivity, reinforcing the ethical integrity of the research endeavor.

In summary, the research methodology employed in this study is meticulously designed to provide a robust and comprehensive examination of the marketing strategies employed by land-based casinos in Georgia and their implications for tourism development. By adopting a qualitative approach and adhering to rigorous ethical standards, this study endeavors to generate valuable insights that contribute significantly to our understanding of the complex interplay between the gambling industry and tourism in the region.

4. Results

This data interpretation stems from an investigation into the marketing strategies employed by gambling companies in Georgia, specifically focusing on attracting tourists to gamble and contribute to the development of the Adjara region. The analysis delves into various challenges, collaboration opportunities, marketing strategies, and potential avenues for growth identified through thematic coding of qualitative interview data.

The data interpretation underscores the substantial impact of the gaming business sector on Batumi's tourist season. Over time, there has been a notable extension in the duration and significance of this sector, transitioning from a brief period of one and a half to two months to a year-round operation. This evolution highlights the pivotal role played by the gaming industry, particularly during the extended low season lasting approximately 8-9 months in the Ajara region. Such findings underscore the enduring significance of the gaming sector in driving tourism activity and economic sustainability throughout the year, especially during periods of reduced tourist visitation. During this period, the task of attracting tourists to the region primarily falls upon businesses within the gaming sector. This factor holds significant importance as it not only sustains the gaming industry but also influences other sectors such as local hotels, food establishments, and transportation. The interdependence among these sectors is crucial for ensuring their continued operation with a positive financial balance, particularly during the low season.

Hence, the gaming business sector plays a pivotal role in the economy of the Adjara region, especially during the tourist season, where its significance is paramount for the financial sustainability of local operators. The in-depth interviews with the field experts provide the following insights about sector.

4.1. Marketing Strategies

In light of the data collected, it is evident that the gaming business sector in the Adjara region significantly impacts various aspects, including customer experience, decision-making, and loyalty programs. The sector demonstrates a commitment to providing exceptional customer experiences tailored to the preferences and needs of gambling tourists. This customization extends from specialized services such as separate restaurants with bespoke menus and accommodations for specific dietary requirements to amenities like spa procedures,

guided tours, and personal manager services focused on client needs. Furthermore, the sector's swift decision-making process facilitates timely responses to guest inquiries and requests, contributing to a seamless guest experience. Despite the absence of a dedicated marketing department, the sector effectively utilizes word-of-mouth marketing strategies to disseminate information and attract visitors to the region. Additionally, the integration of specialized loyalty programs across all casinos underscores the sector's dedication to fostering customer loyalty and satisfaction. These findings underscore the multifaceted role of the gaming sector in shaping tourism dynamics and highlight the importance of customer-centric approaches for sustainable growth and development.

4.2. Promotional Campaigns and Events

Contests, PR Events, Shows: Innovative promotional campaigns and events such as contests, PR events, and shows offer avenues for increasing visibility and attracting tourists to Adjara. Engaging and immersive experiences, such as interactive contests and high-profile entertainment events create buzz and excitement around gambling tourism in the region, driving interest and participation among potential tourists. Such type of information is speeded by special apps, contact persons and direct call. ROI: Respondents mentioned that measuring the return on investment (ROI) of promotional campaigns is essential for evaluating effectiveness and optimizing resource allocation.

4.3. Online and Digital Marketing

None of the enrolled casinos currently operate online gambling platforms. The prevailing sentiment among these establishments is that digital platforms are perceived as ineffective due to the absence of mass-produced products and lack of prior experience in promoting their casinos through international media channels. Instead, their marketing efforts primarily revolved around outdoor advertising through banners, a strategy that was employed until it was prohibited.

4.4. Collaboration and Partnership

Junkets, typically individuals or agencies with access to databases of potential clients, primarily comprise former gambling industry personnel or casino managers who retain connections with a network of gamblers. They offer diverse tour packages, including family-style recreation, across different countries. Collaborating with junkets presents an opportunity to augment the visibility and allure of gambling offerings in Adjara. By leveraging established networks, casinos can attract high-value customers. Partnering with junket operators facilitates access to affluent clientele, enabling casinos to provide exclusive perks and privileges, thereby enhancing revenue streams and solidifying the region's status as a premier gambling destination.

Previously, casinos in the Adjara region had engaged with traditional tour agencies/operators in an attempt to attract and retain customers. However, this approach was found to be ineffective in achieving desired outcomes. Despite efforts to leverage the services of these entities, the casinos experienced challenges in effectively attracting and retaining customers. As a result, the reliance on traditional tour agencies/operators as partners in customer acquisition and retention proved to be suboptimal.

4.5. Segmentation

Following the pandemic period, changes in the economic and political landscape have led to a shift in the segment of tourist gamblers visiting the Adjara region. Currently, the majority of gamblers originate from Israel, followed closely by tourists from Turkey, with others comprising a smaller proportion. Demographic characteristics vary significantly between these two primary segments.

Tourists from Israel primarily consist of elderly individuals with higher disposable incomes. They perceive Georgia as a desirable gambling destination and opt for leisurely holidays with their families. This segment prioritizes spending quality time and indulging in pleasurable experiences during their stay in the region.

In contrast, the segment comprising tourists from Turkey tends to be younger, typically ranging from 25 to 50 years old, and generally possess lower levels of disposable income compared to their Israeli counterparts. These individuals are attracted to the gambling offerings in Adjara but may have budgetary constraints that influence their spending habits and preferences during their visit. The remaining portion of the tourist gambling segment is characterized by a mix of various demographics and preferences, contributing to the diverse visitor profile observed in the region.

4.6. Opportunities

*Direct Flights and Airport Infrastructur*e: Increased availability of direct flights presents an opportunity to enhance accessibility and attract tourists from a wider geographic area. Improving air connectivity to Adjara can facilitate easier travel arrangements for potential tourists, reducing travel time and logistical barriers, and expanding the reach of gambling tourism marketing efforts to new markets.

Alternative Countries: Targeting tourists from Gulf countries represents an untapped opportunity, leveraging their high disposable income and interest in luxury tourism experiences. Gulf countries, known for their affluent population and penchant for luxury travel, present a lucrative market segment for gambling tourism in Adjara, offering the potential for significant revenue generation and market growth.

Business Consideration: An opportunity for the advancement of gambling tourism in Adjara lies in the consideration of policy development and stakeholder engagement. In this context, stakeholders within the gambling sector possess the capacity to articulate their perspectives, express positions, and substantiate arguments during decision-making processes. This participatory approach fosters transparency and inclusivity, enabling the sector to contribute constructively to policy formulation and implementation.

Furthermore, ensuring that decisions affecting the sector are communicated in advance is paramount. By providing timely information regarding preparation and implementation plans, particularly those with financial implications, stakeholders can adequately prepare and adapt to forthcoming changes. This proactive approach not only facilitates effective sectoral response but also cultivates an environment conducive to sustainable growth and development within the gambling tourism industry in Adjara.

Regulations: A less frequent escalation of taxes within the gambling tourism sector has the potential to cultivate a more stable investment environment. This stability engenders

predictability and reduces perceived risk, thereby fostering investor confidence and facilitating long-term planning. Moreover, by providing operators with greater financial predictability, infrequent tax adjustments enable more efficient resource allocation and promote business expansion. The resultant perception of government commitment to sectoral growth further enhances the sector's attractiveness to potential investors, potentially stimulating increased investment and sectoral expansion in Georgia.

4.7. Challenges

Airport Infrastructure: The adequacy and efficiency of airport infrastructure emerged as a significant challenge, potentially hindering the influx of tourists interested in gambling tourism in Adjara. Limited capacity and outdated facilities may impede the seamless arrival and departure of visitors, impacting the overall travel experience and deterring potential tourists.

Competitors in Cyprus: The presence of competitors in nearby destinations like Cyprus poses a competitive challenge, requiring strategic differentiation and positioning to attract tourists to Adjara. Cyprus, with its established gambling industry and robust tourism infrastructure, presents a formidable competitor for Adjara, necessitating innovative marketing strategies to carve out a distinct market niche.

Direct Flights: Limited availability of direct flights to Adjara presents a barrier to accessibility for potential tourists, impacting the ease of travel to the region. The absence of direct air routes may deter travelers seeking convenience and efficiency in their journey, leading them to opt for alternative destinations with better flight connectivity.

Regulations: Regulatory constraints and frequent changes in tax policies create a turbulent environment for gambling companies, necessitating adaptability and compliance. Uncertainty surrounding regulatory frameworks and taxation policies can impede investment and expansion efforts, posing challenges for sustainable growth and development in the industry.

In the past, there have been instances where the government unexpectedly raised or imposed taxes on the gaming sector without prior notice or consultation with industry stakeholders. Two recent cases serve as examples of such occurrences.

- On December 30, 2022, the Batumi City Council passed a resolution to increase local feesimposed on businesses, including the gaming sector, by approximately 40%. This decision, which came into effect just two days later on January 1, 2023, was communicated to the public through mass media channels. The sudden and disproportionate nature of this fee hike has placed significant pressure on the gaming sector, leading to a range of challenges and difficulties that stakeholders are still grappling with.
- Tax changes were adopted on December 13, 2023, through amendments to the Tax Code, which came into effect on January 1, 2024. These changes introduced several new taxes affecting the business sector, including the gaming industry. However, stakeholders in the gaming sector were not adequately informed about the proposed changes, as they learned about the existence of the bill only during the parliamentary hearing stage. This lack of prior notification prevented stakeholders from presenting their opinions and defending their interests effectively during the legislative process. As a result, the gaming sector, represented by Casinos, found itself in a particularly challenging position following the

implementation of the new tax regime. In response to the increased tax pressure, businesses in the gaming sector have been forced to take measures such as reducing employee numbers and cutting costs. Despite these efforts, navigating the new tax landscape remains a significant challenge for stakeholders in the gaming industry.

War in Neighbor Countries: Political instability and conflicts in neighboring countries pose geopolitical challenges, potentially affecting tourist arrivals to the region. Turbulence and unrest in neighboring nations may disrupt regional travel patterns and deter tourists from visiting Adjara, impacting the overall demand for gambling tourism in the region.

Weather: Weather conditions influence tourist preferences and travel patterns, impacting the appeal of Adjara as a gambling tourism destination. Unfavorable weather, such as inclement conditions or seasonal variations, may deter tourists from engaging in outdoor activities and exploring the region, limiting the overall tourist influx and revenue generation potential.

The assertion outlined above is unequivocally supported by statistical evidence obtained from a comprehensive dataset comprising information from ten casinos in the Adjara region, as provided by the Adjara Casino's Association. Analysis of the collected data for the years 2022- 2023 reveals the following trends:

- By the land-based casinos operating in the Adjara region during the year 2022, revenue generated from services such as hotels, transportation companies, and local food and beverage service establishments amounted to approximately 82,300,000 (eighty-two million three hundred thousand) GEL.
- According to the data from the first three quarters of 2023, expenditures made by landbased casinos in the Adjara region on services provided by hotels, transportation companies, and local food and beverage establishments amounted to approximately 69,100,000 (sixty-nine million one hundred thousand) GEL.
- Furthermore, concerning the tourism sector in the Adjara region, the influx of foreign visitors is notable. Specifically, in the year 2022, the total number of foreign visitors amounted to 1,126,086 individuals, with 88.3% originating from foreign countries.
- According to data from the third quarter of 2023, the number of visitors to the Adjara region amounted to 1,047,988 individuals. Notably, 91.1% of these visitors were foreign citizens.

The gaming business sector also represents a significant source of local employment within the Adjara region. It is imperative to acknowledge that the salaries offered within this sector are among the highest compared to other industries operating within the country.

- In 2022, the gaming business sector in the Adjara region disbursed approximately 80,800,000 (eighty million eight hundred thousand) GEL as the salary fund for its employees. By the third quarter of 2023, this figure increased to approximately 105,600,000 (one hundred five million six hundred thousand GEL). Additionally, the average salary of employees within this sector experienced growth over the specified period. For instance, the average salary of a secretary amounted to 2,392 GEL in 2022, and by the third quarter of 2023, it increased to 2,520 GEL.
- The gaming business sector also holds a significant position as one of the largest contributors to the tax revenue across the country. The total tax paid or generated by the gaming sector, referred to as land-based Casino, is directly correlated to the budget of the

Adjara region. Specifically, in 2022, the taxes paid directly by the gaming sector amounted to 57,500 (fourty seven million five hundred thousand) GEL, constituting 14.9% of the region's budget for that year.

- Indirectly generated as a consequence of the operations of the gaming sector in 2022, the total tax revenue amounted to 36,200,000 (thirty-six million two hundred thousand) GEL. This figure represents approximately 9.3% of the region's budget for the same year. Consequently, the combined direct and indirect tax contributions from the gaming sector in 2022 amounted to 25.2% of the region's budget.
- In 2023, the direct taxes paid by the gaming sector amounted to 91,860,000 (ninety-one million eight hundred sixty thousand) GEL. This figure represents 19.2% of the region's budget for the year 2023.
- In 2023, the indirect tax revenue generated as a consequence of the operations of the gaming sector amounted to 55,700,000 (fifty-five million seven hundred thousand) GEL. This figure represents approximately 11.4% of the region's budget for the same year. Consequently, when combined with the direct tax contributions, the total tax revenue generated by the gaming sector in 2023 amounted to 30.2% of the region's budget.

The figures presented above unequivocally underscore the significant contribution of the gaming sector, represented by Casino, to the economy of the Adjara region. They highlight the pivotal role played by both the gaming and tourism sectors in driving economic development and growth across the region.

5. CONCLUSIONS

In conclusion, this study sheds light on the multifaceted landscape of the gaming industry in the Adjara region of Georgia, emphasizing its significant contribution to the local economy and tourism sector. Through in-depth interviews and data analysis, we have uncovered valuable insights into the marketing strategies, challenges, and opportunities faced by land-based casinos in attracting tourists and sustaining growth in the region. The findings highlight the pivotal role of the gaming sector in driving tourism dynamics, employment, and tax revenue generation in Adjara. Despite facing challenges such as regulatory constraints, infrastructure limitations, and sudden tax changes, the gaming industry remains resilient and adaptable, leveraging collaborations, customer-centric approaches, and strategic partnerships to enhance its competitiveness. Furthermore, the study underscores the importance of stakeholder engagement, transparency in policymaking, and proactive measures to address the needs and concerns of businesses operating in the gaming sector. Moving forward, policymakers, industry stakeholders, and regulatory authorities must work collaboratively to create a conducive environment for sustainable growth and development of the gaming industry, ensuring its continued contribution to the economic prosperity of the Adjara region. Overall, this research provides valuable insights and recommendations for policymakers, industry stakeholders, and academics seeking to understand and enhance the role of the gaming sector in regional development and tourism promotion. By addressing the challenges and capitalizing on the opportunities identified in this study, the gaming industry in Adjara can continue to thrive and contribute to the overall prosperity of the region.

6. Limitations of the Research

Sample Size: The study relied on a limited sample size of interviews conducted with representatives from a select number of land-based casinos in the region. As a result, the findings may not fully capture the diversity of perspectives and experiences within the gaming industry.

Generalizability: Due to the specific focus on the Adjara region, the findings of this study may not be generalizable to other regions or countries with different socio-economic contexts and regulatory environments.

Self-reporting Bias: The data collected through interviews and surveys may be subject to self-reporting bias, where participants provide responses that are influenced by social desirability or their own perceptions of the topic.

Despite these limitations, this study provides valuable insights into the gaming industry in the Adjara region and serves as a foundation for further research in this area.

7. Recommendations

Based on the findings of this study, the following recommendations are proposed for stakeholders within the gaming industry, policymakers, and researchers:

1. Diversification of Marketing Strategies: Gaming establishments in the Adjara region should explore diversifying their marketing strategies beyond traditional methods like outdoor advertising. Investing in digital marketing channels, including online platforms and social media, can help reach a wider audience and adapt to changing consumer preferences.

2. Long-term Planning and Monitoring: Developing long-term strategic plans for the sustainable development of the gaming industry in Adjara is essential. This includes monitoring trends in tourist demographics, market demand, and regulatory changes to adapt strategies accordingly and ensure the continued growth and success of the industry. 3. Responsible Gambling Practices: Gaming establishments should prioritize responsible gambling practices to mitigate potential social and ethical concerns associated with the industry. Implementing measures such as age verification, self-exclusion programs, and promoting responsible gambling education can help foster a safer and more sustainable gambling environment.

4. Continued Research and Collaboration: Continued collaboration between academia, industry stakeholders, and policymakers is vital for advancing knowledge and addressing challenges within the gaming industry. Further research is needed to explore emerging trends, evaluate the impact of marketing strategies, and identify opportunities for innovation and growth.

5. Host Congresses and Events: Organize congresses, conferences, and trade shows focused on the gambling and tourism industries. These events provide platforms for networking, knowledge exchange, and business development opportunities. By hosting such gatherings in Georgia, the country can showcase its potential as a prominent gambling tourism destination and attract stakeholders from around the world. Invite Investors: Extend invitations to investors interested in the gambling sector to explore investment opportunities in Georgia. Highlight the country's favorable business climate, market potential, and opportunities for growth in the gambling industry. By

facilitating meetings and discussions with key stakeholders, Georgia can attract investment to develop new gambling facilities, infrastructure, and tourism offerings. Engage Representatives of Gambling Companies: Reach out to representatives of leading gambling companies to participate in industry forums, roundtable discussions, and site visits. Provide opportunities for them to learn about Georgia's market dynamics, competitive advantages, and investment potential.

By fostering direct engagement with industry leaders, Georgia can cultivate partnerships, collaborations, and investments that drive the development of its gambling tourism sector. Collaborate with Tourism Promotion Agencies: Partner with national and international tourism promotion agencies to coordinate marketing campaigns and promotional activities targeting investors and gambling companies. Leverage their expertise and networks to amplify Georgia's message as a desirable destination for gambling tourism investment and development.

By implementing these recommendations, stakeholders can work towards enhancing the competitiveness, sustainability, and positive impact of the gaming industry in the Adjara region, contributing to the overall economic development and prosperity of the region.

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RISK IN FINANCIAL DECISION-MAKING: A CONCEPTUAL FRAMEWORK FOR INVESTORS AND CORPORATE MANAGERS

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***Abstract**: This paper explores the multifaceted nature of risk in financial decision-making by integrating traditional finance models with insights from behavioural finance. It assesses the application of models such as the Capital Asset Pricing Model (CAPM), Weighted Average Cost of Capital (WACC), and Risk-Adjusted Discount Rates in real-world scenarios, examining how their effectiveness is influenced by psychological biases such as overconfidence, loss aversion, and herd behaviour. The study illustrates the impact of psychological and emotional factors on individual investor actions and corporate long-term capital investment decisions through a practical application example. The findings advocate for a comprehensive approach that combines computational tools with behaviorally informed human judgment, aiming to enhance risk analysis and improve financial returns for investors and managers.*

***Keywords:** Risk perception, behavioural finance, capital budgeting, CAPM, WACC, investment decision-making, risk-adjusted discount rate, overconfidence, loss aversion, cognitive biases, financial strategy, Warren Buffett, case study analysis.*

INTRODUCTION

Risk is a fundamental component of the financial decision-making process, affecting all levels of economic activity, from personal investment decisions to corporate decisions on capital allocation. Decision-makers, whether they are picking a basket of stocks or evaluating a multimillion-dollar project, have to come to terms with an uncertain future. In financial markets, risk is not an obstacle but a return generator, a value driver, and a strategic consideration. Insurers endure enormous risks, so the ability to assess, price, and manage risk is critical to sustained financial success.

There are many factors that contribute to financial risk, including market volatility and interest rate changes, as well as company-specific uncertainties, such as inefficiencies or a high debt load. Risk is generally divided into two categories for analytical purposes: systematic risk, which affects the entire market, and unsystematic risk, which is unique to an individual company or industry. The business risk – the risk arising from earnings fluctuations caused by operational conditions – and the economic risk – the risk added by using debt – also add to the uncertainty in the financial arrangements of the firms and the investors.

Risk perception and risk tolerance are also highly divergent. Behavioural finance has demonstrated that cognitive biases, such as risk aversion, overconfidence, and loss aversion, are key determinants of investment conduct and are likely to result in behaviour inconsistent

with a rational economic model. When developing a realistic financial decision model, it is essential to incorporate these behavioural complicating factors.

I advance a framework for integrating conventional finance theories, including the Capital Asset Pricing Model (CAPM), adjusted discount rates, and diversification benefits, with behavioural economic thinking. This perspective intends to provide investors and corporate managers with a richer basis to analyse the role of risk within the decision-making contexts of capital budgeting, portfolio selection, and strategic decision-making. The model is instrumental in a global, high-information world where good uncertainty management can be a source of capital and a competitive edge.

1. Literature review

1.1. Types of Financial Risk and Their Implications

Risk factors are present at every stage of financial decision-making. Systematic risk is the kind that comes with the market as a whole: recessions, political upheaval and natural disasters. These risks are in all investments and cannot be diversified away (otherwise known as non-diversifiable risk). On the other hand, unsystematic risk concerns individual companies or industries and may include, for example, the new CEO's decisions, product recalls or regulation changes. According to (Aswath Damodaran, 2008), there is no way to remove systematic risk via diversification, and this type of risk must be priced by using models like CAPM. Meanwhile, unsystematic risk can be managed by choosing an appropriate asset allocation. (diversification).

Business risk, which is characterised by fluctuations in operating performance, and financial risk, which stems from operating with both leverage and fixed financing commitments, are essential to both shareholders and corporate managers (Chen et al., 2010). Highly leveraged companies are particularly at risk in turbulent conditions. Warren Buffett often notes that risk should not be confused with volatility but rather be defined as “the probability of permanent loss of capital” and emphasises that investors and managers across the world should act responsibly against the misallocation of financial risk on their balance sheets (Buffett & Cunningham, 1998).

1.2. Risk Perception and Capital Budgeting

Risk perception inevitably colours capital allocation judgments. While the standard financial practice has long endorsed employing Risk-Adjusted Discount Rates to appraise investment propositions, uncertainty remains an inexact science. This valuation approach likewise reconsiders the discount rate contingent on a project's risks, ascribing elevated risks to higher rates and accordingly diminished present values. Though fraught with unpredictability, some ventures offer outsized returns sufficient to justify looser security standards. Overall, quantifying vulnerability informs but does not dictate choice, the final call demanding a blend of calculation and intuition.

The Capital Asset Pricing Model (CAPM) is necessary for calculating the reasonable required rate of return for an investment, considering the risk-free rate, the beta of the investment, and the expected market return (Investopedia, n.d.). However, CAPM has faced criticism for relying on assumptions such as investor rationality and market efficiency.

Behavioural finance calls into question such premises, indicating that investors' behaviour is often irrational as they are influenced by several cognitive biases (Gervais et al., 2009)

While behavioural finance identifies several psychological factors influencing investment choices, like over-trading due to overconfidence skewing risk assessment, optimising decision-making requires acknowledging such cognitive biases. A manager underestimating downside risks from overestimating a project's returns could lead to subpar capital allocation (Gervais et al., 2009). Conversely, loss-averse investors, disproportionately fearing the potential for losses compared to probable gains, may spurn worthwhile opportunities. However, recognising how the human mind frequently diverges from rationality opens doors to compensating for inherent cognitive limitations and improving outcomes.

Ulrich Reinhardt points out that "danger perception isn't just about calculations; it's also strongly influenced by personal experiences and emotions." Research has shown that individual psychological traits and personal financial habits significantly affect how much financial risk someone is willing to take and their investment choices.

Although traditional capital budgeting principles are a helpful guide, a richer analysis must take into account the behavioural dimension affecting investment calculus. Traditional models tend to feature rational agents who take a dispassionate look at risk and return. But psychological tendencies shade our outlook and our choices more than we realise. By considering cognitive biases, emotional influences, and real-world constraints, the analysis assesses investments more similar to reality. Sophisticated projects with high levels of uncertainty cause us to feel more anxiety, which influences our risk tolerance in ways that are less predictable than perfect models provide. By acknowledging that both rational and emotional explanations of behaviour matter, and with a blended quantitative and qualitative approach, insight is gained beyond that offered by the numbers into how strategies will be perceived and whether the risks entailed in them will appear to be worth taking.

1.3. Behavioural Aspects Influencing Financial Decisions

Contrary to classical economic postulates, findings from behavioural finance uncover that emotional biases considerably colour fiscal determinations. Aversion toward unpredictability, overconfidence in one's forecasts, and intensified melancholy from deficits are regularly observable investor behaviours which psychologists have demonstrated for years. Such prejudices can lead to irrational allotments of assets, insufficient diversifying of holdings, or excessive interchange of properties.

Bunyamin and Abdul Wahab (2022) find that an investor's risk tolerance is a product of financial behaviour, particularly in a highly volatile market. This is supported by Damodaran (2008), who states that inconsistencies in behaviour often derail strategic risk management. "The stock market is there to transfer money from the Active to the Patient." This is a warning against the trap of buying and selling in response to fear and greed (Buffett & Cunningham, 1998).

The Dot-Com Bubble is a typical example of FOMO (fear of missing out) and syndicated inflexibility driving investors away from basic risk fundamentals to chase speculative returns. During periods of behavioural entrenchment, these kinds of events illustrate how emotions can come before objective assessment, resulting in violent mispricings and resets.

1.4. Integrating Traditional and Behavioural Perspectives

Financial decisions today require a union of quantitative models and psychological insights. As (Musa et al., 2015) argues, effective governance frameworks must balance strategic risk controls with consciousness of behavioural risks. CAPM, WACC, and risk-adjusted return models provide us with the structure to make such assessments, but the actual effect on people's lives, so far as anyone can smell, depends heavily on human judgment.

This is where Warren Buffett's approach becomes relevant. He emphasises simplicity, rational thinking, and a long-term perspective, focusing on a business's fundamentals, quality, and integrity of management (Wiley, 2010; Hathaway Inc, n.d.). His impressive track record of consistently outperforming the market illustrates that a solid grasp of intrinsic value and emotional discipline can often surpass even the most advanced financial models.

(Aswath Damodaran, 2008) points out that the ideal risk level in a company's risk-taking strategy should align with its ability to handle risk and the manager's capability to evaluate it. This perspective highlights the importance of connecting traditional financial frameworks with the realities of human behaviour, which is essential for making sound, resilient financial decisions.

2. Methodology

This study presents a qualitative case analysis aimed at exploring the influence of risk perceptions and behavioural biases on capital budgeting and investment decisions. Our objective is to better understand how these elements may affect decision-making processes when individuals encounter real financial challenges.

Cases were selected on the basis that they met the following criteria:

1) Relevance: A direct relationship existed between risk perception and behavioural biases on the one hand and capital budget or investment decisions on the other.

2) Documentation: Evidence could be found in academic journals, financial periodicals that are well-known to professionals in finance and business, or industry reports.

3) Diversity: Cases gave an example of an industry or context other than one already covered to broaden your knowledge.

2.1. Case 1: Behavioural Biases in Investment Decision-Making

Rohatgi (2021) presents a case study examining how behavioural biases influence investors' decisions in financial markets. The study suggests that cognitive biases such as overconfidence and loss aversion can stray from traditional financial models, influencing portfolio performance and investment outcomes. Investigating the interaction between psychological predisposition and market operation displays intricacies every investor should understand when making choices.

2.2. Case 2: Risk Perception and Decision-Making in Stock Market Trends

According to a study carried out in *Risk Perception and Decision-Making: A Behavioral Finance Approach to Stock Market Trends, n.d.),* the biases above have a combined effect on people's investment decisions, leading investor behaviour to become risky behaviour, and also suggest that markets will then use their experience for no clear purpose. Psychological

factors and stock market movements are the focus of this research. It seeks to discover whether cognitive biases will be responsible for shaping investor behaviour and market trends.

2.3. Case 3: Risk-Adjusted Discount Rates in Capital Budgeting

A fundamental concept in assessing the profitability of investments is the risk-adjusted discount rate. An informative paper by Haktanır and Kahraman (2023) provides a comprehensive overview of this concept. It elucidates how the risk-adjusted discount rate modifies the standard market discount rate to account for the specific risks associated with a given project or investment. Additionally, the article discusses methodologies such as the Capital Asset Pricing Model (CAPM), which is employed to calculate these rates. This model incorporates factors such as beta to evaluate the expected returns of a particular investment in relation to the overall market.

3. Research

This section offers an extensive examination of life experiences demonstrating the impact of risk perception and psychological tendencies on capital allocation and investment practices. We aim to uncover the practical intersection of mental influences and conventional economic models by exploring distinctive real-world scenarios.

3.1. Case 1: Behavioural Biases in Investment Decision-Making

Rohatgi (2021) examined the behaviour of individual investors in India and found that psychological factors significantly distort rational financial decision-making. The study utilised survey data that revealed a prevalent overconfidence bias, leading many investors to overestimate their ability to select profitable stocks while neglecting fundamental value metrics. Additionally, loss aversion emerged as a critical factor; investors experienced greater distress from losses than from equivalent gains, resulting in delayed closure of positions for underperforming assets. These psychological tendencies contributed to suboptimal portfolio diversification and heightened exposure to market risk. The findings underscore the dominance of personal beliefs and emotions over technical and financial evaluations, suggesting that education in behavioural finance is essential for enhancing the investment outcomes of retail investors.

3.2. Case 2: Risk Perception and Decision-Making in Stock Market Trends

In a survey of behaviour during periods of market turmoil, focus specifically on the responses of retail investors to extreme volatility within emerging markets. Through qualitative interviews and sentiment analysis, the authors identified herd behaviour and anchoring as essential factors influencing investors during both market rallies and declines. In their experience, they noted that price movements and collective sentiment are the primary concerns of most investors. Simply put: Investors often trade based on hunches rather than calculating their risks rationally. Surprisingly, they found that investors' perception of risk follows the market mood from upswing to downswing. This can cause them to act irrationally, including panic selling and even speculative buying. The case illustrates the weakness of human nature regarding risk appetite and suggests that ongoing siege warfare may be futile in the struggle to change people's thinking (Sravan Kumar. M et al., 2025).

3.3. Case 3: Risk-Adjusted Discount Rates in Capital Budgeting

Risk-Adjusted Discount Rates (RADR) and capital budgeting are discussed by Haktanır and Kahraman (2023). Their article presents instances where project evaluations did not yield favourable outcomes, often due to the misapplication of discounted risk premiums. One notable case outlined in the chapter involves a high-tech company whose management exhibited excessive optimism regarding the volatility of incoming cash flows from a new product line. Instead of employing a project-specific discount rate, they utilised a general corporate Weighted Average Cost of Capital (WACC). This decision led to speculative financing with overly ambitious return projections, resulting in cost overruns and revenue shortfalls. The case underscores the importance of aligning the discount rate with the specific risks associated with the project, highlighting models such as the Capital Asset Pricing Model (CAPM) that incorporate beta, which reflects efficient, systematic risk.

These examples highlight the influence of behaviour biases and risk perception on investment decisions and capital budgeting procedures. They emphasise the importance of incorporating behavioural finance observations into the conventional financial model to rationalise and improve the efficiency of the decision-making process.

DISCUSSION

The case studies analysed demonstrate that a multiplicity of factors influences financial decision-making under conditions of uncertainty: quantitative models, the natural human mind's tendency to distort reality through a series of cognitive biases that cause us to think wrongly and, therefore, put lives at stake. Unfortunately, this makes our judgments a little more than half right, while three-quarters of people believe they are usually correct. In the concluding section, I compare my findings and previous financial theories or ways of thought. I also look at how these latest discoveries might influence managers and investors.

The Relationship Between Risk Perceptions and Financial Models

Traditional financial theories, such as the Capital Asset Pricing Model (CAPM) and the Risk-Adjusted Discount Rate, operate on the premise that decision-makers in pricing are rational (Aswath Damodaran, 2008). However, the cases presented illustrate that this rationality is often compromised in practice. For instance, in Case 3, discount rates were not appropriately adjusted to account for project-specific risk; a generalised Weighted Average Cost of Capital (WACC) was employed. This oversight led to overly optimistic projections of expected returns and resulted in suboptimal capital budgeting decisions (*A Quick Guide to the Risk-Adjusted Discount Rate, n.d.*). Such instances underscore a critical vulnerability inherent in rigid adherence to financial theory, highlighting the necessity for greater consideration of project-specific circumstances.

Behavioral Influences on Risk Perception and Investment Strategy

Exploring the intersection of investment outcomes and behavioural finance reveals that psychological factors play an important role in decision-making. The overconfidence, loss aversion, anchoring and herding illustrated in these first two cases can lead to irrational financial choices. These findings are consistent with prior research on behavioural finance:

individuals frequently fail to process danger rationally when they are emotionally engrossed or unclear about the future. (Gervais et al., 2009)

Rohatgi (2021) has observed that investors are often hesitant to realise losses in investments and too quick to take profits from winners — evidence supporting the behavioural concept of loss aversion. Additionally, Sravan Kumar. M et al. (2025) underline the market's inefficient features, deriving from overconfidence and the overreaction effect, as agents on the market tend to herd rather than analyse. This phenomenon resonates with Warren Buffett's insights on the importance of temperament in investing. Buffett asserts that the most crucial attribute for an investor is not intellect but rather temperament. He differentiates between reactive market behaviours and the ability to engage thoughtfully with other investors in real-time, especially in periods of market euphoria and fear (Buffett & Cunningham, 1998;Wiley, 2010).

Implications for Investors and Corporate Managers

As an individual investor, these cases remind us that it is necessary to self-examine our investment decisions. These messages remind us that financial education should be more than simply how to use tools. It should also include a discussion of cognitive biases and decision-making psychology itself. Some tools available for controlling mistakes caused by emotionalism include decision journals, the addition of cool down times, and scheduled portfolio rebalancing. Adapting to that unique risk profile of the project requires corporations to make their capital budgeting procedures flexible, as the misplaced discount rates in Case 3 show. Over-reliance on one uniform corporate Weighted Average Cost of Capital (WACC) means ignoring the risk levels and market conditions associated with every project. For example, managers can consider adopting methods like Capital Project Assessment Models (CPAM), conducting scenario analysis, and subjective adjustments that consider behavioural factors (Aswath Damodaran, 2008;Dempsey, 2015).

Governance is another critical factor. Organisations that foster open communication and encourage questioning of assumptions may be better equipped to identify and address behavioural deviations from optimal decision-making (Musa et al., 2015;(*A Quick Guide to the Risk-Adjusted Discount Rate*, n.d.; *Behavioral Factors In Capital Budgeting - FasterCapital*, n.d.; *Capital Asset Pricing Model (CAPM): Definition, Formula, and Assumptions*, n.d.; *Fast Tips: Discount Rate Uses in Behavioral Econ*, n.d.; *(PDF) Risk Perception and Decision-Making: A Behavioral Finance Approach to Stock Market Trends*, n.d.-b; *Risk Adjusted Discount Rate: Adjusting for Uncertainty: Risk Adjusted Discount Rates in Capital Budgeting - FasterCapital*, n.d.; *The Psychology of Investing: A Behavioural Economics Perspective on CAPM — QUTEFS - QUT Economics and Finance Society*, n.d.; *The Psychology of Risk: The Behavioral Finance Perspective - The Big Picture*, n.d.; *Understanding Behavioral Aspects of Financial Planning and Investing | Financial Planning Association*, n.d.; Almansour et al., 2023; Asbaruna et al., 2023; Aswath Damodaran, 2008; Biondi & Marzo, 2013; Buffett & Cunningham, 1998; Bunyamin & Abdul Wahab, 2022; Business & Research, 2015a, 2015b; Chen et al., 2010; Décaire et al., 2020; Dempsey, 2015; Fama & French, 2015; Gallagher & Ryan, n.d.; Gervais et al., 2009; Haktanır & Kahraman, 2023b, 2023a; Hathaway Inc, n.d.; Musa et al., 2015; Ricciardi, 2008; Rohatgi, n.d.; Solomon et al., 2000; Sravan Kumar. M et al., 2025; Wiley, 2010).

Theoretical and Practical Integration

This study suggests that an integrated perspective combining financial theory and psychology underlies the findings. Quantitative models, such as the Capital Asset Pricing Model (CAPM) and Risk-Adjusted Discount Rate (RADR), offer structured methods for estimating risk and return; however, they are not without limitations. By incorporating insights from behavioural finance, investors and managers can navigate real-world complexities, such as psychological responses to risk factors, that traditional models often overlook.

By combining these views, financial decision-makers can construct more resilient strategies, which involve not just the quantification of risk but also its perception and effects on behaviour.

CONCLUSIONS

This article explores how perceptions of uncertainty can sway judgment and presents a conceptual framework depicting the relationship between hazard and monetary or investment selections. It draws on a comprehensive theoretical structure that combines both traditional and behavioural theories. Through literature reviews, case reports, and theoretical dialogues, we demonstrate how the Risk Appraisal Model enables utilizing financial instruments (like CAPM and WACC) to account for hazards. However, it is necessary to note that this representation has constraints, as psychological prejudices can regularly undermine its potency. Real-world examples have revealed that leanings such as exaggerating self-assurance, loss aversion, and herd behaviour can significantly affect how investors and companies form resolutions, often guiding them away from what would be considered optimal fiscal choices. Balancing risk and return is difficult, as emotion and biases frequently overpower rational analysis. While models offer a starting point, accurately anticipating behaviour often proves elusive.

By connecting risk notions to venture outcomes, this analysis spotlights the gaps between theoretical expectations and the realities of risk-taking. It emphasises that fiscal decisions involve more than just crunching the numbers; they require understanding human behaviour, the perception gained from situational judgment, and the flexibility to adapt. For investors and managers, combining the extensive range of quantitative tools available with a realistic understanding of risk is essential to make informed and forward.

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THE EFFECT OF MONETARY POLICIES ON THE ECONOMY OF THE WESTERN BALKAN COUNTRIES

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Abstract: *Monetary policies have one of the key roles in the creation of economic policies of all countries of the world. Although the main task of monetary policy is to regulate the required amount of money, the objectives of monetary policy can have a development and stabilization character, which affects the entire economy of a country. In accordance with that, this paper analyzes development goals through economic growth and employment growth, as well as stabilization goals through price stability and balance of payments. The aim of this paper is to point out the effects of monetary policy on the economies of the Western Balkan countries, which have been striving for integration into the European Union for years. The research is based on a systematic review of theoretical frameworks and empirical verification of results. In addition to the introduction, the paper consists of three parts. The first part of the paper evaluates the monetary policies of the Western Balkan region over time, while the second part analyzes the development goals of these countries. The third part of the paper examines the stabilization goals of the countries of the Western Balkans. Finally, concluding remarks are given. The results of the research indicate that the monetary policies of the region are designed to be in line with the requirements of the EU, focusing on integration and socio-economic convergence with the EU. In addition, the Western Balkan countries record lower economic growth rates compared to the EU, while on the other hand they record significantly higher average inflation and unemployment, which is not in line with the goals of European integration in the future.*

Keywords: *monetary policy, EU integration, Western Balkans countries.*

INTRODUCTION

Monetary policies play a key role in creating economic policies in all countries of the world. Although the primary task of monetary policy is to regulate the required amount of money, monetary policy goals can have a developmental and stabilization character, which affects the entire economy of a country. Accordingly, this paper analyzes development goals through economic growth and employment growth, as well as stabilization goals through price stability and the balance of payments.

The goal of the countries of the Western Balkans (Albania, Bosnia and Herzegovina, North Macedonia, Montenegro, Serbia) (Kosovo) (Figure 1) is to join the European Union, but also economic growth and an increase in the standard of living (Filipović & Ignjatović, 2022). By strengthening economic growth, the standard of living in the Western Balkans would

gradually approach that enjoyed by the citizens of the more advanced economies of the European Union, but structural reforms are necessary for this (World Bank, 2024).

Figure 1. *Western Balkans countries*



Source: https://dijalog.net/pojam-zapadni-balkan-nestace-kada-citav-region-bude-u-evropskoj-uniji/

The main goals of the monetary policy relate to the creation of an environment of low and stable inflation that will be in accordance with the EU accession criteria, greater trust and greater use of the domestic currency, greater flexibility and adaptability of the economy to various domestic and external shocks and changes in the domestic environment that will occur in the process of convergence towards the EU (Belgrade University, 2014).

The aim of this paper is to point out the effects of monetary policy on the economies of the countries of the Western Balkans, which have been striving for integration into the European Union for years. The research is based on a systematic review of theoretical frameworks and empirical verification of the results. The research questions of the article relate to the comparison of economic growth rates, inflation and unemployment in the countries of the Western Balkans region. The research results indicate that the monetary policies of the region are designed to be in line with EU requirements, focusing on integration and socio-economic convergence with the EU.

1. Evaluation of the monetary policy of the Western Balkans region

These countries also share certain similarities (Filipović et al. 2024; Filipović & Ignjatović, 2023). Regional cooperation has become an important indicator for evaluating the countries of the Western Balkans, not only in the context of their approach to the European Union (Mašović, et. al., 2024)., but also for strengthening mutual economic connections. All regional initiatives and organizations strive for alignment with EU programs and policies, so the EU sees regional cooperation as one of the key criteria for progress towards membership. In addition, governments in the region rarely place regional cooperation high on the list of political priorities. However, many initiatives launched in the region did not yield significant results, mainly due to poor mutual relations and lack of capacity for their implementation. (Balkans Policy Research Group, 2021).

The region of the Western Balkans is already integrating or rapidly approaching the European Union in many areas - such as trade, investments, energy, transport, telecommunications, scientific and research work, but also police cooperation and border protection. In some segments this process has already progressed a lot, while in others it is just at the beginning. Due to the strong economic connection with the EU, the economic crisis from the EU easily spread to the Western Balkans. After a brief recovery in the previous decade, the region fell back into recession and stagnation, leading to increased unemployment, corruption, organized crime and political instability. Also, due to the lesser involvement of the EU and its members, other powers such as Russia, China, Turkey and Saudi Arabia began to enter the region, gaining significant political and economic influence (The European Movement in Serbia,2016).

In the last few years, many regional initiatives have been launched in the Western Balkans, and new ones still appear from time to time. However, these initiatives generally have weak structures, are easily subject to political crises and fail to bring major changes in regional cooperation or concrete benefits for citizens. Initiatives such as the Regional Economic Area (REA), "Mini-Schengen", the Common Regional Market (CRM) and the Modernization of Payments in the Western Balkans attracted the most attention (Balkans Policy Research Group, 2021).

The Regional Economic Area (REA) of the Western Balkans is an initiative that aims to create a single market within the region, modeled on the internal market of the European Union. Its main objective is to enable the free and unimpeded flow of goods, services, capital and highly skilled labor among the countries of the Western Balkans. REA is based on four key components: trade, investment, mobility and digital integration. Through this initiative, the countries of the region strive to improve mutual economic cooperation, facilitate business and prepare for future EU membership.

"Mini-Schengen" is an initiative launched in 2019 by Serbia, Albania and North Macedonia, with the aim of facilitating the free movement of people, goods, services and capital between the countries of the Western Balkans - similar to the Schengen zone in the EU. The idea is that citizens of those countries can travel without a passport, speed up customs procedures and increase economic cooperation. Later, this initiative was renamed Open Balkans, but the main goal remained the same – strengthening regional connectivity and preparing for EU membership.

The Common Regional Market (CRM) aims to establish a Western Balkans market that functions according to the rules and procedures of the European Union, which would gradually bring the region closer to the EU single market. The initiative received the support of the leaders of the countries of the region and builds on the experiences and achievements of the previous initiative - the Regional Economic Area (REA), which had variable results. The new Action Plan for CRM, to be implemented by the end of 2024, includes measures in four key areas: regional trade, investments, digitization and industry with innovations (Balkans Policy Research Group, 2021).

The "Modernization of Payments in the Western Balkans" project is part of the reforms within the Berlin Process and is being implemented with the support of the European Commission, the Regional Cooperation Council and the World Bank. Its goal is for the

countries of the Western Balkans to harmonize their payment systems with EU standards, in order to create a common regional market and improve their competitiveness and attractiveness for business. Due to the different level of development of payment systems in the region, modernization aims to adopt European legal and technical standards, in order to prepare the countries for joining the SEPA zone (Single Euro Payment Area). This would enable faster, simpler and cheaper mutual payments within the region, as well as with SEPA member countries. Currently, these payments are made through correspondent banks, which is the slowest and most expensive way to process transactions (National Bank of Serbia, 2024).

All countries of the Western Balkans have a common goal - membership in the European Union and express their readiness for mutual cooperation. However, unresolved conflicts and disputes between states create serious mistrust, which often leads to instability and hinders joint initiatives. This deep mistrust is an obstacle to both regional economic integration and progress towards the EU. In order for the region to progress, the countries of the Western Balkans will have to work on solving mutual problems and building better relations. Also, it is necessary to strengthen the capacities for implementing cooperation and place regional cooperation on a higher position among political priorities (Balkans Policy Research Group, 2021).

2. Development goals of the Western Balkan cuntries

The Growth Plan for the Western Balkans aims to (European Commission, 2023):

- integrate the Western Balkan partners into the EU's single market,
- advance regional economic cooperation,
- deepen EU-related reforms
- increase pre-accession funding in view of accelerating socio-economic convergence of the Western Balkans to the EU.

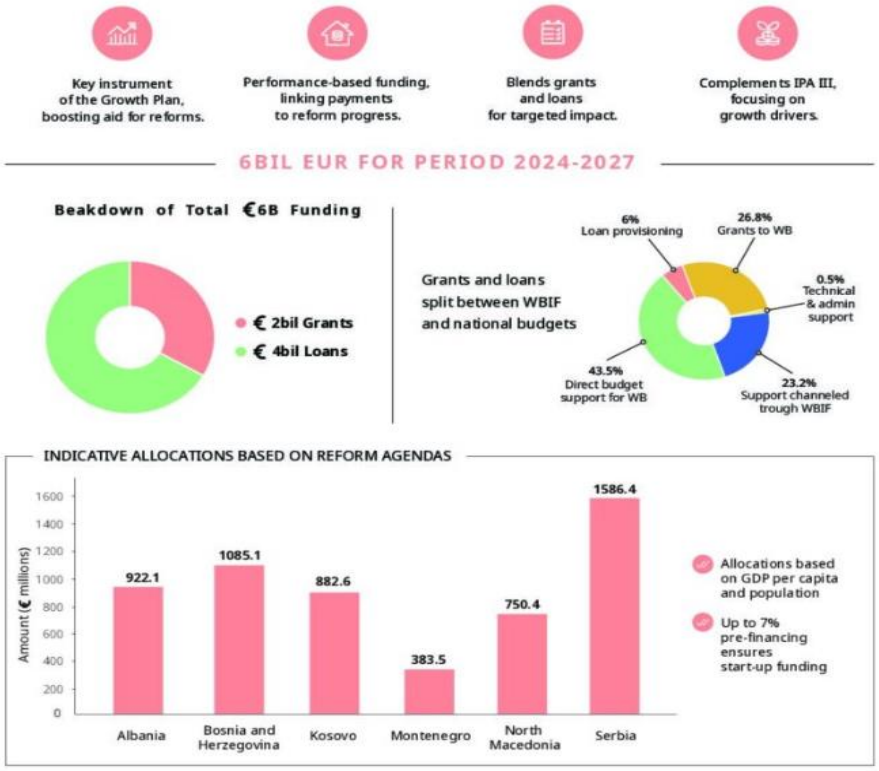
The new EU Growth Plan for the Western Balkans (represents a chance to stimulate economic growth through reforms and investments, especially in the area of the green economy. To accelerate this growth, these countries should improve trade both within the region and with the European Union, integrate their payment systems, address demographic and labor market challenges (full focus on human capital development), and improve education and health systems (which are crucial for the transition from middle to upper income levels) (World Bank, 2024).

The European Commission presented the Economic and Investment Plan for the Western Balkans, which aims to encourage long-term recovery of the economy and stronger economic connection of the Western Balkans with the European Union. The focus is on supporting the green and digital transition, implementing key reforms for progress towards EU membership and bringing the region closer to the EU single market. All these activities aim to contribute to sustainable economic development and the creation of new jobs (European Commission, 2020).

The plan predict ten main investment initiatives that include important areas for economic development, such as sustainable transport and energy connectivity, green and digital transformation, strengthening the private sector and support in health, education and social protection. Special focus is placed on young people, through programs that encourage youth

employment. The European Commission will consider the costs, benefits and impact of priority areas and proposed projects within the framework of the green and digital transition, in order to enable their successful and efficient implementation (European Commission, 2020). Also, the Western Balkans still needs to improve its investment by implementing more economic, administrative and legal reforms and developing the infrastructure network (Mashovic et al., 2024).

Figure 2. Growth plan for Western Balkan



Source: https://epi.org.mk/post/30461?lang=sq

3. Stabilization golas of the Western Balkans countries

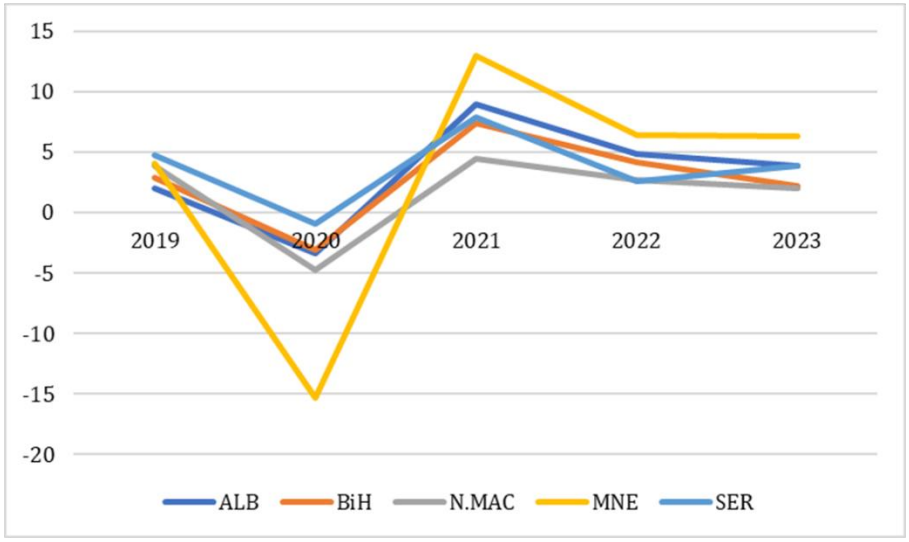
The stabilization goals of the Western Balkans are related to:

- economic growth,
- controlled inflation and
- reduction of unemployment.

Accordingly, the work analyzed data for the period 2018-2023 for the Western Balkans region.

Economic growth is in the period 2019-2023. averaged 2.9% (Western Balkans), 6.6% (EU). The growth in the Western Balkans is expected to accelerate to 3.4% (2025) and 3.5% (2026) (Figure 3) supported by easing price pressures and growing availability of credit and a resilient labor market (World bank, 2025).

Figure 3. *Economic growth (%), Western Balkans, 2018-2023.*

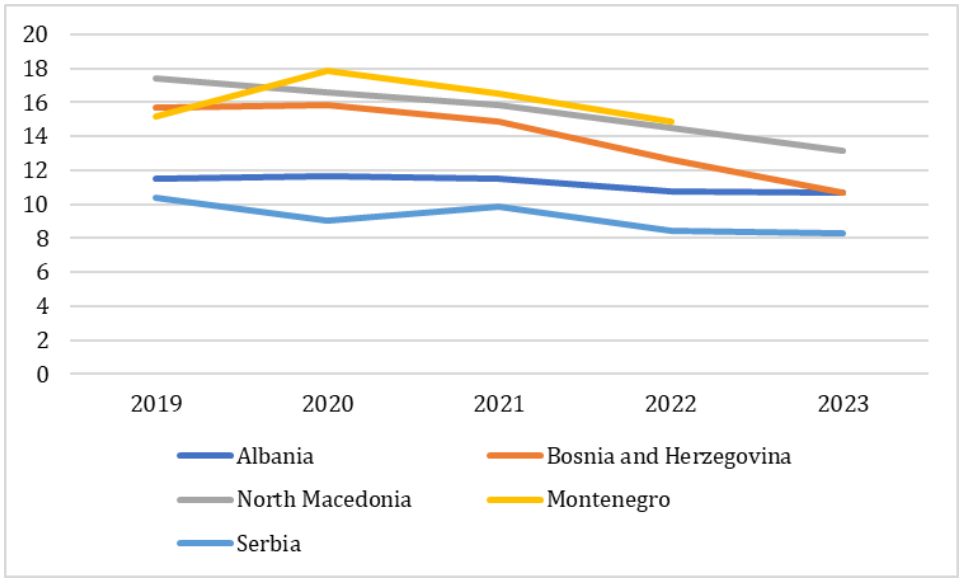


Source: World bank, 2025.

As almost a quarter of the citizens of the Western Balkan countries currently live abroad, better management of the global workforce from the Western Balkans could be a key driver of economic development in this region. While emigration can lead to challenges, such as labor shortages, there are also clear opportunities to use migration for economic benefits (World Bank, 2024).

Unemployment is in the period 2019-2023. averaged 11% (Western Balkans), and 6.6% (European Union) (Figure 4). The highest level of unemployment in region, was recorded in Montenegro (15.5%), North Macedonia (15.5%), Bosnia and Herzegovina (14%), and followed by Albania (11%) and Serbia (9.2%) (World bank, 2025).

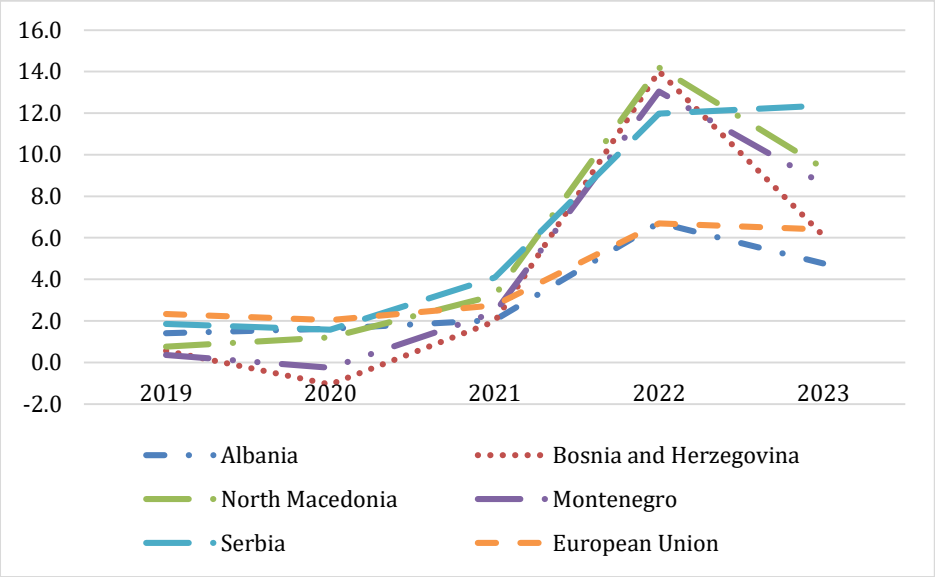
Figure 4. *Unemployment (%), Western Balkans, 2018-2023.*



Source: World bank, 2025.

Reducing inflation is one of the biggest tasks of the countries of the Western Balkans, especially in Serbia. According to the data World bank (2025) in the period 2019-2023. year, the regional average was 4.9% (Western Balkan), 4% (European Union). The highest level of inflation was recorded by Serbia (6.4%), followed by North Macedonia (5.8%), Montenegro (4.8%), Bosnia and Herzegovina (4.3%) and Albania (3.3%) (Figure 3). The highest level of inflation in Serbia was 12.4% (2023).

Figure 5. *Inflation (%), Western Balkans, 2013-2013.*



Source: World bank, 2025.

DISCUSSIONS/CONCLUSSIONS

Monetary policies are key in creating economic policies in all countries of the world. In addition to the fact that the primary task of monetary policy is to regulate the required amount of money, monetary policy goals can have a developmental and stabilization character, which certainly affects the overall economy of an economy. The Growth Plan for the Western Balkans aims to integrate the Western Balkan partners into the EU's single market, advance regional economic cooperation, deepen EU-related reforms increase pre-accession funding in view of accelerating socio-economic convergence of the Western Balkans to the EU. The stabilization goals of the Western Balkans are related to economic growth, controlled inflation and reduction of unemployment. Effects of non-compliance with stabilization: the region's monetary policies designed to be in line with EU requirements, focusing on specific actions or policies that support integration and socio-economic convergence with the EU; the countries of the Western Balkans record lower rates of economic growth compared to the EU, while on the other hand they record a significantly higher average of inflation and unemployment. This has been the case for the last 30 years, however, there is still a desire for European trends. The Western Balkans should adjust their monetary policies to better meet the goals of EU integration in the future.

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THE IMPORTANCE OF TOUR GUIDES TRAINING IN ADJARA REGION, GEORGIA

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Abstract: The aim of the study was to analyze the influence of training on guides' job satisfaction, as well as the relationship between service satisfaction and demographic variables. The research was conducted among independent tour guides, agency-based tour guides, and customers. Although the relationships among these variables have been widely studied by scholars, there is a lack of empirical data specifically in the context of Georgia's Adjara Region. Adjara is one of the most visited destinations in Georgia (Georgian Tourism Association 2024). Considering the region's Geographical, political and diverse religious characteristics, tour guides require relevant qualification, particularly, in terms of providing precise information. It is also quite interesting to examine the international practice about managing tour guides. In various countries, such as Singapore (Board, n.d.), Japan (Huang & Weiler 2010; (Thomson, Tanaka, & Morikoshi, 2021) and so on, tour guides are well-trained and licensed (Huang, S. & Weiler, B. 2010). Empirical findings claim that training influences employee performance and job satisfaction (Nauman, Bhatti, Jalil, & Riaz, 2021) (Okechukwu, 2017). The research employed a mixed-methods approach as it consists of quantitative as well as qualitative components. The collected data was analyzed by widely applied software SPSS that gives scholars the opportunity to process large numerical data through performing various analytical approaches. Despite the contributions of the research, it has certain limitations.

***Keywords*:** tour guides, training, job satisfaction, challenges.

Introduction

The study examines the influence of tour guides' training on the level of their job satisfaction and also the impact of demographic variables on customer satisfaction. Moreover, it was identified certain challenges faced in the sector. There is much theoretical findings describing the relationship, however, research novelty is applying the empirical approach in the specific regional context.

Literature review includes the theoretical overview about the international practices regarding managing guides' competences, the empirical findings about the relationship among job satisfaction and tour guides training, the influence of job satisfaction. The research is designed based on mixed approach, including application of focus groups and surveys. The first hypotheses about the relationship among tour guide training and their job satisfaction. It was also interesting to find the influence of demographic variables on the customer satisfaction.

Despite the research limitations, specifically, the lack of generalizability on the country level, findings can be interesting for the local context and has certain implication for the relevant stakeholders to promote sustainable tourism.

Literature Review

Local Context of Adjara Region

Adjara is an autonomous region located in the southwestern part of Georgia (Georgia, n.d.) near Black Sea and Turkey. It is unique due to its cultural, political, religious context. It combines Georgian and Turkish elements expressed by diverse religions, customs, architecture, cuisine, music and so on. It has a status of an autonomous republic within Georgia. The region itself is diverse in terms of landscape as it consists with mountainous districts. Government of Adjara provides different trainings for hospitality sector, including guides (www.adjara.gov.ge) however, this approach is not obligatory for them, important topics and, finally, there is not utilized by all guides. The city Batumi is strategically important due to tourism, transportation, and trade. Satisfaction level of international tourists was significantly increased from 2022 till 2023. Statistics of international nonresident tourists from 15 years old are increasing from 2022 till 2023 according to (Geostat, 2024). In the first quarter of 2023, 1,208,462 International visits, which is the 74.7% of the data before pandemics 74.7%-ოო International practice of managing tour guides (Administration, n.d.)

International Practices

International practices regarding the licensing of tour guides vary significantly from country to country. They ensure that tour guides have the necessary knowledge and skills to provide high-quality experiences for travelers while also upholding safety and professionalism standards. Here are some common examples and practices found internationally:

- The UK has a professional body called the Institute of Tourist Guiding (ITG, 2024), which offers certification for tour guides. Guides can obtain badges in specific regions such as London or Scotland after completing training and passing exams. These badges signify that the guide has met certain standards of knowledge and professionalism.
- In some European countries, tour guide licensing is regulated at the national level, while in others, it may be managed at the regional or local level. The European Federation of Tourist Guide Associations (FEG, 2024) works to promote professional standards and cooperation among tour guides across Europe.
- In Australia, tour guide licensing requirements vary by state and territory. For example, in New South Wales, guides need to complete a training course and obtain accreditation from the state tourism authority. Similar requirements exist in other parts of the country (TGA, n.d.).
- In Japan, tour guide licensing is managed by local governments. Guides must pass exams administered by their local tourism authority and obtain a license to operate legally. The Japan National Tourism Organization (JNTO, 2024) provides information on licensing requirements and training programs for guides.

Tour Guides' Competences

There are verious references covering various aspects related to the importance of training for tour guides, including interpretation, trip planning, tourism management, tourism impacts, and the role of guides in delivering quality experiences to tourists. The article "The Role of the Tour Guide in Interpretation: A Case Study from the Australian Outback" underscores the importance of tour guides in providing interpretation services that enhance visitor experiences and contribute to the sustainable management of tourism destinations, using the Australian outback as a case study to illustrate these points. (Prideaux & Carson, The role of the tour guide in interpretation: A case study from the Australian outback, 2003). Another piece of empirical work article provides insights into the shifting dynamics of travel planning in the digital age and offers valuable implications for destination marketers, travel service providers, and researchers in the field of tourism. (Xiang, Wang, O'Leary, & Fesenmaier, 2007). The article "Progress in Tourism Management: From the Geography of Tourism to Geographies of Tourism – A Review" offers a comprehensive review of the evolution of tourism management, particularly focusing on the transition from a geographical perspective to a more holistic understanding of tourism as a multidisciplinary field. The author introduces the concept of tourism management and highlights its interdisciplinary nature, drawing from fields such as geography, economics, sociology, and environmental studies. (Leask, 2005). A book "Tourism: Principles, Practices, Philosophies" covers various areas of the tourism, including the dirverse practices and components of the industry, such as transportation, accommodation, attractions, tour operations, and hospitality services. It examines the operational aspects of tourism businesses and their role in delivering quality experiences to travelers (Goeldner & Ritchie, Tourism: principles, practices, philosophies, 2009).

Training and Job satisfaction

There are strong empirical findings about the realationship among employee training and their job satisfaction. Zawistowska (2020) explores the potential application of the Sectoral Qualifications Framework for Tourism (SQFT) in developing descriptions related to tourism. It is a comprehensive framework designed to outline the qualifications, skills, and knowledge required for various roles within the tourism sector. It may encompass different levels of proficiency and expertise, catering to the diverse needs of the industry (Zawistowska, 2020). Tour guide training can have a positive influence on job satisfaction by enhancing guides' skills, providing professional recognition, fostering career advancement opportunities, improving performance, promoting a sense of purpose, creating a supportive work environment, and encouraging continuous learning. The article "Effect of tour guide service quality on tourist satisfaction: The mediating role of tourist–tour guide rapport" includes discussion about the implications of the findings for tour guide training and management practices. It emphasizes the importance of equipping tour guides with not only technical skills and knowledge but also interpersonal skills to establish rapport and enhance the overall tourist experience (Li, Wang, Jia, & Li, 2016). The meta-analysis about effectiveness of training provides insights into the overall effectiveness of training programs in organizations. It identifies factors that contribute to successful training outcomes, such as clear learning objectives, active learning methods, and opportunities for practice and feedback (Arthur, Bennett, Edens, & Bel, 2003). Various scholars underline the importance of training for

employee satisfaction (Colquitt, LePine, & Noe, 2000). Noe introduces in his book a comprehensive coverage of employee training and development practices, including the role of training in enhancing job satisfaction, motivation, and performance (Noe, 2013). Numerous authors explore the relationship between tour guide competency, service quality, and tourist satisfaction specifically among Chinese tourists (Ninpradith, Viriyasuebphong, & Voraseyanont).

Customer Satisfaction

In other words, tour guide competence is expected to positively influence tour quality, which in turn enhances tourist satisfaction and loyalty (Wang, Li, Li, & Wang, 2017). Studies state, that tour guide performance has influence on tourist satisfaction (Zhang, Deng, & Wang, 2016) as they are co-creators of tourist experience (Sotiriadis & Shen, 2017). Moreover, Tourists' perceptions of tour guide performance are found to be influenced by factors such as the quality of information provided, the clarity and enthusiasm of delivery, the ability to engage and interact with tourists, and the level of personalization and attention to individual tourists' interests (Kontogeorgopoulos & Palmer, 2010). At the same time, Key factors that contribute to customer loyalty include employees' customer service skills, responsiveness to customer needs, personalized interactions, and the organization's overall commitment to customer satisfaction (Nepomuceno & Laroche, 2014).

Sustainable Tourism and Tour Guides

Different scientific literature is dedicated to supporting guides (Prideaux, The role of the tour guide in sustainable tourism, 2000)) .To be specific, “Sustainable Tourism: A Small Business Handbook for Success" (Dodds, 2010) offers practical guidance for small tourism businesses, including tour guides, while, "The Responsible Tourist Guide: Tourism, Responsibility, and Sustainability" examines the role of tour guides in promoting responsible tourism practices and fostering sustainability (Gössling & Hall, The Responsible Tourist Guide: Tourism, Responsibility, and Sustainability, 2010). Moreover, "Tourism and Hospitality: Issues and Developments" edited by Manuel Rivera, Salvador Anton Clavé, and José Luis González-Sánchez (2018) - includes chapters on sustainable tourism and the role of tour guides in destination management and interpretation. It provides insights into the challenges and opportunities facing tour guides in promoting sustainability. A book "Tourism Ethics" (Fennel, 2016) explores ethical issues in tourism, including the role of tour guides as interpreters of culture, heritage, and environmental issues. It discusses the ethical responsibilities of tour guides in promoting sustainable tourism practices and minimizing negative impacts on destinations. Another textbook "Tourism Management: An Introduction" includes a chapter on sustainable tourism management, which covers topics such as destination planning, stakeholder engagement, and the role of tour guides in delivering sustainable tourism experiences (Page S. , 2019). Their role is also important in promoting community-based tourism, ecotourism, and cultural heritage conservation (Mowforth & Munt, 2009) and interpreting environmental and cultural resources (Page S. J., 2011), therefore, it is important to educate tourists about environmental and social issues, as well as engaging with local communities to minimize negative impacts (Gössling & Hall, The Responsible Tourist Guide:

Tourism, Responsibility, and Sustainability, 2010). In order to " shape destination competitiveness" (Ritchie & Crouch, 2003), tour guide training and certification programs ensure quality standards and professionalism within the tourism industry. To be specific, formal trainings acquire the necessary knowledge, communication skills, and cultural competence to effectively lead tours and enhance visitor experiences (Goeldner & Ritchie, Tourism: Principles, practices, philosophies, 2009).

Research Design

The research considered mixed approach as it consisted of quantitative as well as qualitative components. Tour guides Job satisfaction was studied by utilization of a survey (Brayfield & Rothe, 1954) with 19 research items. These criteria aims to determine whether employees experienced job satisfaction. Their performance was measured based on their costumers' evaluations through filling out the survey (Meng & Sirakaya-Turk, 2010). Training evaluation was assessed by the adapted version of the instrument introduced by Francis (Kabii, Okello, & Kipruto, 2017)

The regional context and challenges characterized for the specific geographical location was identified by approaching focus group of tour guides and tourists. The respondents for focus group were identified with nonprobability approach, specifically, snowball method introduced by Dave Ramsey. Potential respondents received the Informed Consent Letter with description of the research objectives and rights of the respondents. Several research instruments were translated into Georgian language and vice versa, were slightly modified and adapted to Georgian context, several research items were added, specifically, questions about demographic characteristics. As mentioned previously, data was collected from independent as well as agency-based tours guides working in Adjara region and their customers. The respondents for the quantitative data were selected randomly. The links with uploaded research items were sent to potential respondents electronically. The sample size was 190 tour guides and 190 costumers.

Research Ethics

The respondents were sent and asked to sign the form of Informed Consent to approve the participation in the research after obtaining information about the research objectives. The research was conducted based on the research ethical standards.

Data Analysis

Two focus groups were performed with 15 individuals presenting tour guides and costumers. Focus group identified certain challenges and trends faced by the tour guides and tourists to have more comprehensive overview of the situation. There are numerous services and entertainment activities for tourists, but more diverse opportunities for young people. Due to the climate with abundant precipitation in the region, the utilization of outdoor activities becomes limited. Moreover, in some village's infrastructure is not fully available, specifically, proper roads and bridges limits the inclusive access. Moreover, it was stated, some of the guides had the lack of educational background and experienced lots of challenges related to customer satisfaction. Vast majority of the guides stated that capacity building activities, such as trainings

will promote their performance. One tourist mentioned that some Georgian political facts were misinterpreted, most of them relate low level of their job satisfaction due to their lack of knowledge and proper guidance**.**

Quantitative as well as qualitative data was prepared, cleaned from missing values as well as outliers and Microsoft Excel file was imported to analyze by widely known and scholarly utilized SPSS to process big numeric data through performing various approaches. The response rate was quite high, specifically, approximately, 65 percent. The respondents were balanced in terms of sex, age, education level, tenure. Fifty percent of the respondents represented tour agency and the rest – individual tour guides. Data was obtained from individual tour guides and the rest of them – from agency-based guides.

Tour guides' job satisfaction

Data was analyzed through different statistical approaches, specifically, descriptive statistics and univariate statistics (frequency, central tendency measurement, variation measurements, T-test, correlation analysis, regression analysis).

H^1: The relationship of tour guides training and their job satisfaction.

Table 1.1 Distribution of Parameters and mean

	1	2	3	4	5	6	7	6+7, in inverses1+2	The mean characteristic is reversed in inverses
Q1.1 There are some conditions concerning my job that could be improved	0.0%	0.0%	0.0%	0.5%	18.0%	53.4%	28.0%	81.5%	6.1
Q1.2 My job is like a hobby to me	0.0%	0.0%	0.5%	23.3%	42.9%	15.3%	18.0%	33.3%	5.3
Q1.3 My job is usually interesting enough to keep me from getting bored	0.0%	0.0%	1.1%	11.6%	24.3%	39.2%	23.8%	63.0%	5.7
Q1.4 seems that my friends are more interested in their jobs	**19.0%**	**39.2%**	**32.3%**	**9.5%**	**0.0%**	**0.0%**	**0.0%**	**58.2%**	**5.7**
Q1.5 I consider my job rather unpleasant	**40.2%**	**37.0%**	**20.1%**	**2.1%**	**0.0%**	**0.5%**	**0.0%**	**77.2%**	**6.1**
Q1.6 I enjoy my work more than my leisure time	5.3%	7.4%	19.0%	34.9%	24.3%	8.5%	0.5%	9.0%	3.9
Q1.7 I am often bored with my job	**37.0%**	**28.6%**	**18.5%**	**12.7%**	**0.0%**	**3.2%**	**0.0%**	**65.6%**	**5.8**
Q1.8 I feel fairly well satisfied with my present job	0.0%	6.9%	10.1%	36.0%	31.2%	6.9%	9.0%	15.9%	4.5
Q1.9 Most of the time I have to force myself to go to work	**35.4%**	**38.6%**	**21.2%**	**1.1%**	**0.5%**	**0.0%**	**3.2%**	**74.1%**	**5.9**
Q1.10 I am satisfied with my job for the time being	0.0%	0.5%	5.3%	16.9%	26.5%	26.5%	24.3%	50.8%	5.5
Q1.11 I feel that my job is no more interesting than others I could get	**10.1%**	**11.1%**	**28.6%**	**22.8%**	**16.4%**	**7.9%**	**3.2%**	**21.2%**	**4.4**
Q1.12 I definitely dislike my work	**53.4%**	**40.2%**	**2.6%**	**0.5%**	**0.0%**	**0.0%**	**3.2%**	**93.7%**	**6.3**
Q1.13 I feel that I am happier in my work than most other people	0.0%	0.0%	3.7%	19.6%	33.9%	32.8%	10.1%	42.9%	5.3

Q1.14 Most days I am enthusiastic about my work	0.0%	0.0%	7.9%	29.6%	40.2%	14.8%	7.4%	22.2%	4.8
Q1.15 Each day of work seems like it will never end	**30.2%**	**41.8%**	**16.9%**	**7.9%**	**2.6%**	**0.0%**	**0.5%**	**72.0%**	**5.9**
Q1.16 I like my job better than the average worker does	0.0%	0.5%	3.2%	10.1%	38.6%	33.9%	13.8%	47.6%	5.4
Q1.17 My job is pretty uninteresting	**45.5%**	**38.6%**	**13.2%**	**2.6%**	**0.0%**	**0.0%**	**0.0%**	**84.1%**	**6.3**
Q1.18 I find real enjoyment in my work	0.0%	0.0%	0.0%	16.9%	30.7%	36.5%	15.9%	52.4%	5.5
Q1.19 I am disappointed that I ever took this job	**60.8%**	**38.1%**	**1.1%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**98.9%**	**6.6**

Here are inverse parameters, where 1 and 2 answers are positive. From the first table, it can be seen that the problematic parameters are:

Table 1.2

	6+7, in inverses1+2	The mean characteristic is reversed in inverses
Q1.6 1.6 I enjoy my work more than my leisure time	9.0%	3.9
Q1.8 1.8 I feel fairly well satisfied with my present job	15.9%	4.5
Q1.11 1.11 I feel that my job is no more interesting than others I could get	**21.2%**	**4.4**
Q1.14 1.14 Most days I am enthusiastic about my work	22.2%	4.8
Q1.2 1.2 My job is like a hobby to me	33.3%	5.3
Q1.13 1.13 I feel that I am happier in my work than most other people	42.9%	5.3
Q1.16 1.16 I like my job better than the average worker does	47.6%	5.4
Q1.10 1.10 I am satisfied with my job for the time being	50.8%	5.5

From the 19 parameters mentioned above, we created a job satisfaction index, which becomes a minimum value of 0 or a maximum value of 1. The average value of the job satisfaction index is equal to: 71.46% - which is high enough. Let's find its average characteristic in terms of trainings:

Table 1.3

Having received training on tour planning and pricing	Job satisfaction (JS)
1 Yes	75.07%
2 No	69.66%
Total	71.46%
p	0.001

The index of job satisfaction among respondents who have undergone trainings is 75.07%, and the index of job satisfaction among respondents who have not undergone trainings is equal to 69.66%. That is, the satisfaction index among trained respondents is 5% higher, and this difference is statistically significant P=0.001<0.05.

According to the findings, respondents indicated that they have not received training on tour planning and pricing (65%). They think that training in history and culture(65%), foreign language (66%) reptiles and marine ecosystems (51%), eco-tourism (62%), customer service, communication (82%) and computer (56%) skills can improve their job performance. It can be seen that the majority of the respondents evaluate the trainings positively.

Let's take a look on demographic data:

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 18-24	41	21.7	21.7	21.7
	2 25-34	57	30.2	30.2	51.9
	3 35-44	59	31.2	31.2	83.1
	4 45-54	23	12.2	12.2	95.2
	5 55-64	9	4.8	4.8	100.0
	Total	189	100.0	100.0	

Table 1.4. **Age group**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 Female	103	54.5	54.5	54.5
	2 Male	86	45.5	45.5	100.0
	Total	189	100.0	100.0	

Table 1.5 Sex

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2 Competed basic education	35	18.5	18.5	18.5
	3 BA	97	51.3	51.3	69.8
	4 MA	57	30.2	30.2	100.0
	Total	189	100.0	100.0	

Table 1.6 Educational level

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2 From 2 up to 5 years	64	33.9	33.9	33.9
	3 From 5 up to 10 years	98	51.9	51.9	85.7
	4 More than 10 years	27	14.3	14.3	100.0
	Total	189	100.0	100.0	

Table 1.7 Tenure

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 I am tour agency-based guide	95	50.3	50.3	50.3
	2 I am an independent guide	94	49.7	49.7	100.0
	Total	189	100.0	100.0	

Table 1.8 Choose one from the following list

Relationship of the job satisfaction index with demographic variables:

Age group	JS/Job Satisfaction
1 18-24	69.19%
2 25-34	70.47%
3 35-44	72.49%
4 45-54	83.65%
5 55-64	50.20%
Total	71.46%
P	0.001

Table 1.9 Mean

It can be seen from the table that respondents aged 45-54 have the highest job satisfaction (83.65%), and respondents aged 55-64 have the lowest satisfaction (50.20%).

Tenure	JS/ Job satisfaction
2 From 2 up to 5 years	68.47%
3 From 5 up to 10 years	72.32%
4 More than 10 years	75.44%
Total	71.46%
P	0.01

The more experience the guide has, the higher the satisfaction with the trainings. Job satisfaction does not have an influence on gender, profession, education, type of guide.

Table 1.10

Costumers Satisfaction

H^2: The relationship of Costumers' satisfaction and demographic variables.

Univariate analysis and Statistics

	2	4	5	6	7	6+7	Mean
Attending my needs promptly	**0.00%**	**1.05%**	32.11%	47.37%	19.47%	66.84%	5.85
Interested in solving my problems	**0.00%**	**0.53%**	26.84%	53.16%	19.47%	72.63%	5.92
Understanding my specific needs	**0.00%**	**0.00%**	16.32%	48.95%	34.74%	83.68%	6.18
Made traveling more enjoyable/	**0.00%**	**0.00%**	17.37%	47.37%	35.26%	82.63%	6.18
Pre-tour briefing (references to shopping; food, fees etc.)	**0.00%**	**0.00%**	11.58%	42.11%	46.32%	88.42%	6.35
Visiting scenic spots (manner and content of the guide's interpretation of scenic-spots, additions or deductions of scenic-spots)	**0.00%**	**0.00%**	8.42%	43.68%	47.89%	91.58%	6.39
Got things right first time	**0.00%**	**0.00%**	23.68%	49.47%	26.84%	76.32%	6.03
Travel guide never too busy to respond	**0.00%**	**0.00%**	17.89%	46.32%	35.79%	82.11%	6.18
Delivered services on time	**0.00%**	**0.00%**	8.95%	42.63%	48.42%	91.05%	6.39
Knowledgeable guide	**0.00%**	**12.11%**	38.42%	34.21%	15.26%	49.47%	5.53
consistently courteous	**0.00%**	**0.00%**	7.37%	40.53%	52.11%	92.63%	6.45
guide made me to feel secure	**0.00%**	**0.00%**	9.47%	42.11%	48.42%	90.53%	6.39
Staff always willing to help	**0.00%**	**0.00%**	6.84%	48.42%	44.74%	93.16%	6.38
Travelers' best interests at heart	**0.00%**	**0.00%**	10.53%	38.42%	51.05%	89.47%	6.41
Individualized attention to travelers	**0.00%**	**4.74%**	13.68%	42.11%	39.47%	81.58%	6.16
Guide kept customers informed	**0.53%**	**4.74%**	13.16%	42.63%	38.95%	81.58%	6.14
No excessive waiting time	**0.00%**	**0.00%**	12.11%	44.74%	43.16%	87.89%	6.31

Table 2.1

From listed provisions, three research items received a relatively low rating

	6+7 sum of evaluation percentage	mean
Knowledgeable guide	49.47%	5.53
Attending my needs promptly	66.84%	5.85
Interested in solving my problems	72.63%	5.92
Got things right first time	76.32%	6.03

The rest of the provisions received a fairly high rating. Accordingly, the index consisting of these 17 variables received a sufficiently high value of 6.19 on a 7-point scale, i.e. 77.38% of the maximum value - which is quite a high indicator.

Table 2.2

Job Satisfaction Index		
Mean	6.19	77.38%

Table 2.3

Consider the correlation of the satisfaction ratio with demographic data:

		age_gr 18. Please indicate the Age group/
Satisfaction	Pearson Correlation	-0.197
	Sig. (2-tailed)	0.01
	N	190

**. Correlation is significant at the 0.01 level (2-tailed).

The satisfaction index has a statistically significant correlation with age (P=0.01<0.05), while the correlation coefficient is negative r=-0.197, that is, a negative relationship with age means that respondents of younger age are more satisfied.

Table 2.4. Correlations

The satisfaction index has a statistically significant correlation with age (P=0.01<0.05), while the correlation coefficient is negative r=-0.197, that is, a negative relationship with age means that respondents of younger age are more satisfied.

	Satisfaction Index
1 Female	6.20
2 Male	6.19
Total	6.19
P	0.76

The average index of satisfaction in women is 6.2, and in men 6.19, the difference between them is not statistically significant p=0.76>0.05. That is, satisfaction does not differ by gender.

Table 2.5 Sex

Table 2.6 Please choose one from the options below	**Satisfaction Index**
1 Service was provided by independent guide	6.19
2 Service was provided by tour agency-based guide	6.20
Total	6.19
p	0.74

Satisfaction index in relation with a1.20 is not statistically significant as p=0.74>0.05 and are not different.

Distribution of Demographic research items

Table 2.7 Age group

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 18-24	44	23.2	23.2	23.2
	2 25-34	23	12.1	12.1	35.3
	3 35- 44	52	27.4	27.4	62.6
	4 45-54	38	20.0	20.0	82.6
	5 55-64	9	4.7	4.7	87.4
	6 65+	24	12.6	12.6	100.0
	Total	190	100.0	100.0	

Table 2.8 Sex

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 Female	94	49.5	49.5	49.5
	2 Male	96	50.5	50.5	100.0
	Total	190	100.0	100.0	

Table 2.9 Please choose one from the options below

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 Service was provided by independent guide	95	50.0	50.0	50.0
	2 Service was provided by tour agency-based guide	95	50.0	50.0	100.0
	Total	190	100.0	100.0	

Research Findings and Implications

According to the findings, there is higher level of job satisfaction for those that have undergone the trainings compared with others. Only age influences the level of costumers' satisfaction. The findings can be interesting and beneficial for representatives of the management of the tourism sector in Adjara region to plan the relevant intervention or prevention mechanisms to promote development of tourism in Adjara region.

To conclude, there can be drawn several recommendations to promote sustainability.

- To provide relevant Infrastructure, roads, bridges in rural areas to make the destinations inclusive.
- Managing the competencies of independent as well as agency-based tour guides. If we consider, that in Adjara region, there is a high demand of providing service for international tourists, it is crucial to equip guides with proper information about our history, political, cultural contexts.
- Introducing mandatory training and certification courses for guides.
- Performing research systematically to focus on total quality control and improvement of guides' service.
- Providing more diverse touristic services for older generation.

Limitations and Future research

Despite the reliability and validity of the research instruments, as they have been utilized in other studies, major limitation is about the sample size, which is not significantly big. Even though all the statistical procedures were performed properly, there is still the issue of social desirability of the tour guides that could negatively influence the responses. Also, the findings are relevant for regional context and might need additional research in different context. Moreover, the qualitative instrument, discussion plan about the challenges in the field is created by the author and has lack of generalizability as well as validity.

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NOVEL OPPORTUNITIES FOR PURCHASING INTENTION OF ORGANIC FOODS: IDENTIFYING HOW HEALTH AWARENESS, PERCEIVED HEALTH VALUE, AND THE ANTECEDENTS OF THE TECHNOLOGY ADOPTION MODEL (TAM) AFFECT CONSUMERS' PURCHASE INTENTION

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Abstract: *It is becoming more and more important to comprehend how customers purchase health friendly organic goods. The goal of the current study is to evaluate consumers' buying intentions regarding healthy products (or health friendly) shopping. This study also looks at how customer intentions to buy organic products are influenced by health awareness, perceived value of organic products, perceived usefulness, and attitude toward utilizing them. Moreover, the research expands upon Davis's (1989) Technology Adoption Model (TAM) by including exogenous factors such as perceived health value and environmental awareness. This study has been conducted through data collection via a Google form survey from 260 customers. With the collected data, structural equation modeling (SEM) and validity and reliability testing were carried out. The current study's findings demonstrate that attitudes toward utilizing organic products are positively and differently impacted by environmental awareness and perceived health value. The study also discovered that consumers' intentions to acquire organic food products are significantly influenced by their attitudes and perceptions of their utility. The current work has implications that benefit academicians, marketers, consumers, and policy makers.*

Keywords: *Organic food products; Health awareness,Perceived health value, perceived usefulness, attitude.*

1. Introduction

Health awareness and perceived health value are pivotal in shaping consumers' intentions to purchase organic foods. The organic food sector in India is experiencing a significant transformation, driven by increasing health consciousness, environmental concerns, and technological advancements. In 2024, the Indian organic food market reached a valuation of approximately USD 1,917.4 million, with projections indicating a growth to USD 10,807.9 million by 2033, reflecting a compound annual growth rate (CAGR) of 20.13% (IMARC Group, 2024; Business Wire, 2024). This surge is attributed to a growing awareness among consumers about the health benefits of organic products and the adverse effects of chemical pesticides and fertilizers. Government initiatives, such as the Paramparagat Krishi Vikas Yojana (PKVY) and the National Programme for Organic Production (NPOP), have further bolstered this growth by promoting organic farming practices.

Health awareness has emerged as a pivotal factor influencing consumer behaviour towards organic food consumption. A study by the Expert Market Research highlighted that 63% of Indian consumers are willing to pay a premium for organic food products, underscoring the perceived health benefits associated with these items. This inclination is not just limited to urban centers but is gradually permeating semi-urban and rural areas, indicating a nationwide shift in dietary preferences (Expert Market Research, 2024). The integration of health awareness with perceived health value plays a crucial role in shaping consumers' attitudes and intentions towards purchasing organic foods.

The Technology Adoption Model (TAM) offers a robust framework to understand the adoption of organic foods among consumers. According to TAM, perceived usefulness and perceived ease of use are primary determinants influencing individuals' acceptance of new technologies or products (Khan & Khan, 2020**)**. In the context of organic foods, perceived usefulness translates to the health benefits and environmental advantages these products offer. A study by Jaiswal and Singh (2024) emphasized that health consciousness, ecological trustworthiness, and functional value are significant drivers of purchase intention for organic food items in India. Understanding these antecedents can provide valuable insights into consumer behaviour and aid in formulating effective marketing strategies. The study seeks to address the following research questions:

- How does health awareness influence consumers' perceived value of organic foods?
- What is the relationship between perceived health value and consumers' attitudes towards organic food consumption?
- How do the antecedents of the Technology Adoption Model affect consumers' purchase intentions for organic foods?
- What strategies can be implemented to enhance the adoption of organic foods among Indian consumers?

The forthcoming section of this research paper will follow as literature review, research methodology, results and concluding remarks.

1.1 Literature Review

The TAM suggests that perceived usefulness and ease of use influence individuals' adoption of new technologies. In the context of organic food, technological platforms like online marketplaces and mobile applications can impact purchase intentions. A study in India highlighted that trust, convenience, and environmental concern, facilitated by technological advancements, significantly influence consumers' intentions to purchase organic foods (Kamboj & Kishor, 2024).

1.1.1 Health Awareness

Health consciousness significantly influences consumers' decisions to purchase organic foods. Studies have shown that individuals with higher health awareness are more inclined to choose organic products due to their perceived health benefits. For instance, research conducted in India found that health consciousness positively affects consumers' attitudes and intentions toward buying organic food (Singh & Verma, 2017). Similarly, a

study in New Zealand and Fiji revealed that health consciousness strengthens the relationship between self-risk perception and purchase intention of organic foods (Devi et al., 2023).

Health consciousness significantly influences consumer attitudes toward organic food. Devi et al. (2023) found that individuals with heightened health awareness are more inclined to purchase organic products, perceiving them as healthier alternatives. This health consciousness not only directly affects purchase intentions but also moderates the relationship between self-risk perception and purchasing behaviour. Similarly, Kamboj and Kishor (2024) observed that in India, health and hedonic values substantially impact attitudes toward organic food, with health awareness enhancing the attitude-intention linkage, especially when consumers are exposed to food safety information. Health-conscious individuals are more likely to form favorable attitudes toward organic products due to perceived health benefits and safety. Devi et al. (2023) emphasize that health awareness directly contributes to positive consumer attitudes and organic purchase intentions.

1.1.2 Perceived Health Value

Perceived health value, or the belief that organic foods offer superior health benefits, is another critical determinant of purchase intention. Consumers often associate organic foods with higher nutritional content and safety, leading to increased willingness to pay premium prices (Watanabe et al., 2020). In Brazil, functional and emotional values related to health were found to positively affect consumer trust and purchase intention toward organic foods (Watanabe et al., 2020).

Perceived value—encompassing functional, emotional, and social dimensions—plays a pivotal role in shaping consumer trust and purchase intentions. Watanabe et al. (2020) demonstrated that functional and emotional values positively influence consumer trust, with emotional value directly motivating purchase intentions. In the Indian context, Kamboj and Kishor (2024) highlighted that hedonic value exerts a stronger influence than health value on green purchase attitudes, suggesting that consumers derive significant pleasure and satisfaction from consuming organic products. Perceived value, including emotional and functional aspects, positively impacts consumer attitudes. Watanabe et al. (2020) found that consumers who see high value in organic products tend to form stronger positive attitudes.

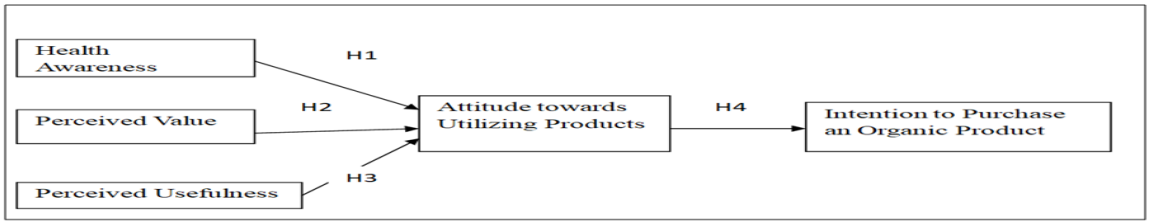
1.1.3 Perceived Usefulness

Perceived usefulness, often linked to the functional benefits of organic products, is crucial in attitude formation. Roh et al. (2022) integrated the Theory of Consumption Value and the Theory of Reasoned Action to reveal that green perceived value significantly affects consumer attitudes and trust, which in turn influence purchase intentions. Their study underscores the importance of consumers' perceptions of the utility and benefits of organic products in shaping positive attitudes. Health awareness strengthens the impact of perceived usefulness on attitudes. Consumers who are aware of health risks are more likely to value and appreciate the functional benefits of organic food (Roh et al., 2022; Khan & Khan 2018).
Perceived usefulness, tied to health and environmental benefits, significantly influences attitudes. According to Roh et al. (2022), perceived usefulness is a key determinant in shaping positive consumer attitudes toward green products.

1.1.4 Attitude towards Utilizing Organic Products

Consumer attitudes toward organic products are influenced by a combination of perceived value, quality, and price. A recent study in India by Chandra et al. (2024) found that perceived price and quality are significant mediators in the relationship between attitude and purchase intention. This suggests that while consumers may have a positive attitude toward organic products, their actual purchasing decisions are contingent upon their perceptions of the product's value proposition.

Figure 1: Conceptual Model



Source: Prepared by Author

Based on the above literature review, the following four hypotheses have been formulated for the study.

H1: Health awareness has a positive and significant impact on consumer attitude toward utilizing organic products.

H2: Perceived value of organic products has a positive and significant impact on consumer attitude toward utilizing organic products.

H3: Perceived usefulness of organic products positively influences consumer attitude toward utilizing organic products.

H4: A positive attitude toward utilizing organic products significantly influences the intention to purchase organic products.

2. Research Methodology

To carry out this study, five dimensions i.e. Health Awareness, Perceived Value, Perceived Usefulness, Attitude toward Utilizing Organic Products and Purchase Intention have been considered. Questionnaire has been adapted from the previous studies based on 7-point Likert scale (1 = Strongly Disagree, 7 = Strongly Agree).

The survey to collect the responses was carried out online from the respondents who have experience of shopping organic food items from December 2024 to February 2025.

Table 1: Questionnaire Adaptation

Items	**Dimension**	**Source**
I am highly concerned about my health.	Health Awareness	Adapted from Devi et al., 2023
I regularly monitor my diet for health reasons.		
I actively seek out information about healthy food.		
I avoid foods that may have harmful ingredients.		
My health is a primary concern when making food choices.		
Organic products offer good value for money.	Perceived Value	Adapted from

I believe the benefits of organic products justify their price.	of Organic Products	Watanabe et al., 2020
Organic products improve my quality of life.		
I feel emotionally satisfied when I consume organic products.		
I trust that organic food is better for the environment.		
Organic products help me maintain a healthy lifestyle.	Perceived Usefulness	Adapted from Roh et al., 2022; Khan, A., & Khan, S. (2022).
Organic food is more beneficial than non-organic food.		
Eating organic reduces my exposure to harmful substances.		
Organic products help in preventing health issues.		
I find organic products useful for my overall well-being.		
Organic food improves my diet quality.		
I have a positive attitude toward organic products.	Attitude Toward Utilizing Organic Products	Adapted from Kamboj & Kishor, 2024
I think consuming organic products is a good idea.		
I enjoy buying organic products.		
I feel good about using organic products.		
Organic products are an important part of a healthy lifestyle.		
I intend to buy organic products regularly in the future.	Purchase Intention	Adapted from Ajzen. 1991; Khan (2024)
I will make an effort to purchase organic products when available.		
I am likely to choose organic products over non-organic ones.		
I intend to buy organic products regularly in the future.		

Source: Prepared by Author

2.1 Sample attributes

While portraying the monthly income, 30 (11.54%) respondents have their income less than ₹30,000, 60 (23.08%) respondents were in the range of income more than ₹30,000 and less than ₹60,000 and around 63 percent respondent were having income greater than ₹60,000.

Table 2: Demographic Characteristics

Characteristic		**Frequency**	**Percentage**
Age	Less than 20	55	21.15
	20-29	75	28.85
	30 -39	90	34.62
	40 and Above 40	40	15.38

Gender	Male	150	57.69
	Female	110	42.31
Educational Background	Graduation	125	48.08
	Post Graduate and Above	135	51.92
Income	Less than ₹30000 (~358 USD)	30	11.54
	₹30000-₹59,999 (~358 USD to 716 USD)	60	23.08
	₹60,000-₹89,999 (~716 USD to 1074 USD)	65	25
	₹90000 and more (~1074 USD and more)	105	40.38

Source: Prepared by Author based on responses

The reliability of each dimension was measure through Chronbach's alpha by using SPSS 25.0. It was found that value of α was greater than 0.7 For Each Variable i.e. Health Awareness (α=0.819), Perceived Value (α=0.861), Perceived Usefulness (α=0.798), Attitude towards utilizing (α=0.783), Purchase intention (α= 0.763). Therefore, the variables were considered for data analysis as per criterion given by Hair et al. (2010). Since, author has already adapted the tested items by the previous researchers, therefore, results of exploratory and confirmatory factor has not been reported in this paper.

3. RESULTS

Structural Equation Modelling (SEM) is employed for path analysis to measure the effects of study variables to assess the attitude towards utilising variables and intention to purchase. SEM enables the researchers to assess the causal relationship between items and constructs as well as the inter-constructs average relationship. The path estimates for hypotheses testing have been calculated through AMOS 25.0, which shows the path estimates for the respective casual relationships. Further, the SEM model has been found a good fit as other statistics indicating values within limits ($\chi 2$=242.056, df = 104, $\chi 2$/df =2.327, CFI= .915, RMSEA=.06). Items under each construct were statistically significant with respective variable. Results of structural equation modelling have been indicated below in table 3. Indirect effects of these variables have been measured through the SPSS AMOS 25.0.

Table 3: Results of Structural Equation Modeling

Hypotheses	**Estimates**	**C.R.**	**p- value**
H1: Health Awareness→ Attitude towards Using	0.400	5.570	.000
H2: Perceived Value→ Attitude towards Using	0.350	4.350	.000
H3: Perceived Usefulness → Attitude towards Using	0.647	8.359	.000
H4: Attitude towards Using → Purchase Intention	0.589	5.249	.000
Source: By Researcher			

Table 3 also displays the outcomes of the four hypotheses that this study put forth. According to Hypothesis 1, Health awareness is significantly positively impacts on attitude towards Using. The findings show that Indians' perceived usefulness is significantly influenced by environmental awareness (beta = 0.400, $p < 0.00$). Therefore, results are consistent with hypothesis 1.

According to Hypothesis 2, perceived value is significantly positively impact on Attitude towards Using. According to the findings, perceived usefulness is significantly impacted by green perceived value (beta = 0.350, $p <.05$). The outcome does lend credence to hypothesis 2. The third hypothesis examined how attitudes toward using are greatly influenced by perceived usefulness. The analysis demonstrates a significant relationship between attitude toward using and perceived usefulness (beta = 0.647, p is less than 0.00). Therefore, hypothesis 3 is supported by the results.

Hypothesis 4 assumed that attitudes toward using exert substantial impact on purchase Intention. The output of regression analysis explains that Perceived Usefulness shows significant influence on purchase Intention (beta = 0.589, $p < 0.00$). Thus, hypothesis 4 is supported.

4. DISCUSSIONS/CONCLUSIONS

This research has been conducted to assess the intention of consumers for purchase of organic food products. In this research, it has been found out that perceived usefulness, health awareness and ease of use play a key role for determining the purchase intention of consumers. For structural equation modelling, AMOS 25.0 has been employed as analytical tools. Further, reliability analysis was conducted with the help of SPPSS 25. Notably, our results portray that health awareness and health perceived value positively influence the attitude towards the organic food products. Presently, there is a much more focus on sustainable consumption to promote the environmentally friendly practices all over the world.

These results are consistent with previous studies which indicate that health and environmental awareness positively influence consumer attitudes (Hoang & Tung, 2024; Toros et al., 2023). Therefore, customers are more aware to adopt such practices and find the health perceived value useful for attitude formation. Perceived value significantly positively impacts attitude towards using. This outcome is in line with previous literature, where green perceived value was found to affect attitudes toward eco-friendly behaviour and products (Raksadigiri & Wahyuni, 2020; Braimah et al., 2022). Perceived usefulness greatly influences attitudes toward using. These results highlight the pivotal role of perceived usefulness in shaping user attitudes (Toros et al., 2023; Raksadigiri & Wahyuni, 2020). In this study, attitudes toward using significantly influenced on purchase intention. This result is well supported by existing literature that underscores attitude as a crucial antecedent to consumer purchasing behaviour (Shastry & Dayananda, 2020; Hoang & Tung, 2024). Further, policies of all government are incorporating the use of organic products so that little harm may be recorded to the on the human health. Though, this research has been conducted carefully. Further, the market of organic food items in India is in development stage.

Therefore, the respondent experience may not have such level. Future research may be done with moderating effect based on socio-economic variables. Further, cross country research may be done by the researcher based on these variables.

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FUNDAMENTALS OF INNOVATION IN MODERN BANKING SERVICES

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Abstract: *In today's constantly evolving technological world, banks need to implement modern innovations to remain competitive in banking environment and meet the growing needs of their customers. Innovative advancements help banks digitize their banking services, operations and management, improve efficiency, productivity and functionality, reduce costs, create new banking products and improve existing ones. In addition to their countless benefits, innovations also create numerous potential risks and challenges for banks.*

Using a mixed research methodology, this article examines the main types of innovation implemented by banks in banking services and management, highlights their main characteristics and analyzes their common benefits and challenges. Demographic analysis part of the article explores the number of users of digital banking services worldwide and the factors influencing their adoption of modern innovations. Based on the findings of this article, the conclusion part offers brief recommendations to banks for the effective implementation of modern innovations and maximizing their benefits.

Keywords: *banking innovation, innovative banking services, incremental innovation, disruptive innovation, substantive innovation*

1. INTRODUCTION

Until the 20th century, the primary activity of banks was accepting deposits and granting loans to individuals and legal entities. But, the invention of the computer in the 1960s and subsequent technological advances revolutionized all sectors, including finance and banking. They enabled banks to expand their operations and create new banking services.

Modern innovative technologies bring countless benefits to banks, improving their efficiency, productivity, and functionality, and making banking services more accessible to customers. However, there are several innovation strategies in the banking industry and banks should analyze and decide what type of innovation should be implemented to stay ahead of competitors. (Campanella & Peruta, 2020).

The purpose of this article is to explore the main types of innovation in the banking sector, analyze the benefits and challenges of innovative banking services, and provide a detailed overview of how they are reshaping the banking environment.

2. Types of Innovation in Modern Banking Services

Innovation in banking refers to the creation of new services, products, or processes that enhance the existing banking experience. It is essential for meeting growing customer needs, improving efficiency and remaining competitive in the banking environment. Below are examples of the main types of innovation implemented by banks to achieve different goals.

Incremental Innovation in Banking Services

Incremental innovation plays an important role in improving banking services and products. Instead of developing completely new services and products, incremental innovation concentrates on existing ones. It gradually and continuously improves the functionality, efficiency and convenience of existing banking services. Incremental innovation has lower risks compared to other types of innovation strategies and allows banks to achieve noticeable results in a short period of time. (Ravi, 2021).

One of the main benefits of incremental innovation is the ability to facilitate customer access to banking services and products, meets their needs and increases customer satisfaction. From an internal banking management perspective, incremental innovation automates a large part of banking tasks, helps banks reduce operational costs and improve management processes.

The main purpose of incremental innovation is to enable banks to respond immediately to new emerging market trends, meet growing customer needs, maintain their competitiveness and gain a technological advantage over their competitors in the banking sector.

Mobile banking applications perfectly illustrate the incremental innovation approach of banks. They regularly update banking apps to improve performance, strengthen security methods, add new features and improve the interface to make it more user-friendly. (Parameswar & Dhir, 2023).

While incremental innovation helps banks reduce costs and optimize operational efficiency, implementing such minor technological improvements in banking management and services also requires financial investments. Moreover, with the constant growth of customer needs and expectations and the rapid evolution of technological advancements, incremental improvements alone may not always be sufficient. In such cases, banks need to implement more advanced innovations in order to achieve long-term profits.

Disruptive Innovation in Banking Services

Disruptive innovation fundamentally transforms the banking services landscape, brings new solutions to traditional services and drastically changes customer behavior. It introduces new banking services and financial products or creates cheaper, simpler, and more accessible alternatives to existing offerings. The primary objective of disruptive innovation is to offer banking services and products to underserved markets and people who are unbanked or live in remote regions and may not have access to conventional financial services. Typically, such innovation begins with limited market adoption and offers fewer features compared to existing services. However, over time, it gradually expands its offering, demonstrates its value, and attracts new customers. As customer acceptance of disruptive innovation increases and it gains traction in the market, innovation begins to disrupt traditional banking business models in the banking sector and challenge the dominance of banking institutions.

Neobanks are a classic example of disruptive innovation. These digital financial institutions allow customers to use banking services completely online, without visiting a bank branch. Unlike traditional institutions, neobanks operate only in digital format, without specific infrastructure or branches. By minimizing overhead expenses, they offer digital banking services with lower rates than traditional banking services. (World Bank, 2023).

Peer-to-peer (P2P) lending platforms are another example of disruptive innovation. These platforms offer direct lending and borrowing services to customers and disrupt traditional banking models in two ways: By removing intermediaries (banks) between individuals, P2P platforms offer more favorable interest rates for both lenders and borrowers. Secondly, these platforms facilitate access to credit for people who are not eligible for bank loans.

Despite its countless advantages, disruptive innovation also carries several risks. Although it aims to offer more innovative services, customers accustomed to traditional banking services may refuse to adopt new and unfamiliar services. Developing such innovative services and products also requires considerable financial investment. Project failure can result in heavy financial losses for the organization. (Sharma, 2022). Additionally, newly developed services may present security and regulatory issues that require special attention from service providers.

Substantive Innovation in Banking Services

Substantive innovation involves making major changes or improvements to existing banking services, products, management processes and banking business models to significantly improve productivity, efficiency and effectiveness. This type of innovation falls somewhere between incremental and disruptive innovation. Substantive innovation does not completely disrupt existing business models, but it brings more significant improvements than incremental innovation and exerts a stronger impact on the banking sector. (Kittiwat, 2023).

Substantive innovation often introduces new services, products, technologies or systems that improve the functionality and efficiency of banking operations, meets new customer expectations and brings additional value to the overall banking experience. It sometimes relies on customer feedback to improve banking services and products or find solutions to previously unmet needs.

One of the most shining examples of substantial innovation is the integration of Artificial Intelligence (AI) technologies in the banking. These technologies enable banks to predict potential risks and identify signs of fraud and suspicious transactions. AI-powered programs help banks analyze large volumes of data in a short time and speed up the decision making process. (World Bank, 2023).

Open Banking is another example of substantial innovation, which is reshaping the relationship between banks, customers and third-party service providers. Thanks to this technological innovation, banks securely share their customers' data (with their consent) with third-party service providers and enable them to create new banking services and financial products. These platforms then allow customers to access a wider range of financial services than those offered by banks. (Arnaboldi, 2021).

Substantive innovation is characterized by a deeper and broader transformative impact on banking services, products, or management. The development of such innovation takes

considerable time and requires significant financial resources, but once introduced, it ensures long-term benefits and efficiency for banks. After the introduction, it is also necessary to train the bank staff, to teach them how to use the new technological advances correctly. To develop a substantial innovation, banks typically collaborate with other banks and financial institutions. By combining their resources and experience, banks and financial organizations accelerate the process of developing new technologies, share associated costs and maximize end results.

Open and Closed Innovations in Banking

The primary objective of each of the above-mentioned types of innovation is to improve banking services and management, as well as increase functionality and efficiency. However, there are also two sources of innovation in terms of banks obtaining these innovations: Open and closed.

Open innovation involves banks acquiring a new technology, application, or service from external sources, such as technology companies or other financial institutions. Acquiring from external sources allows banks to avoid research and development expenses and quickly access the latest innovations on the global market. However, innovation developed by third-party organizations sometimes do not offer banks exactly what they are looking for. Additionally, such innovation is more sensitive in terms of security and increases the risks of cyberattacks, data theft and financial losses. (Parameswar & Dhir, 2023).

Technological advancement developed by banks themselves are called Closed innovation. This innovation relies heavily on the internal resources of banks, which are developed based on the banks' ideas and research. (Balkon, 2022). Closed innovation helps banks develop innovation that meet their needs. Furthermore, these types of innovations are more secure because they are known and used only by the bank. However, developing closed innovation can be time-consuming and more expensive than open innovation.

3. Benefits of Innovation in Banking Services

From increased accessibility and efficiency to faster transactions and advanced features, innovation in banking services offer numerous advantages to both banks and customers. Here's a brief overview of the key benefits:

Accessibility and convenience. Innovative banking services such as mobile banking apps and online banking sites are available 24/7, anytime and anywhere, making them accessible and convenient for customers. With innovative advancements like live chat and robo-advisors, banks offer 24/7 customer support, resolving customer issues and answering their questions.

Transparency. Innovative banking technologies allow banks and customers to view the details of all transactions and financial operations. Customers can check their bank accounts and track the history of transactions. Transparency also helps banks identify fraud and suspicious activities. (Lin, Liu & Wei, 2023).

Cost efficiency. Innovation helps banks automate most of the processes, which helps them reduce costs by reducing the need for large numbers of bank personnel and physical bank branches. Reducing costs allows banks to offer banking services with lower fees.

Faster credit approval. Innovative advances such as AI and big data allow banks to collect relevant customer data, analyze it quickly and speed up the loan decision-making process. (Sharma, 2022).

New services and products. Innovation helps banks analyze market trends, identify unmet needs and develop new banking services and other financial products. It also allows banks to offer more personalized services to customers. (Harchekar, 2021).

Improved Financial Inclusion. With the help of innovative banking platforms, anyone with internet access can open a bank account, obtain a loan, and send and receive money, regardless of their location. By offering banking services to the unbanked people, innovative technologies help improve financial inclusion. (Indriasari, 2022).

4. Challenges of Innovation in Banking Services

Despite the numerous advantages that innovation brings to banking services and the banking environment, it also has a number of disadvantages. The following are the main challenges of innovative banking services:

Privacy concerns. Innovative banking services collect and store a significant amount of personal and financial data about customers. Although this data is used only to personalize financial services, customers are concerned about privacy and the risk of misuse of their personal data. (Revathi, 2019).

Security risks. Digital banking platforms are always under attack from fraudsters and cybercriminals. Although banks use advanced security methods to protect themselves and their customers, the risk of manipulation and hacking remains. Cybercriminals' access to digital banking systems can lead to financial losses for banks and their customers.

Technical problems. Innovative banking services depend heavily on technology and failures, downtime or bugs in banking system can prevent customers from accessing banking services.

High implementation costs. Innovations improve the efficiency, functionality and productivity of banks. However, developing or acquiring modern innovative achievements is very expensive. Due to these high costs, many banks postpone or refuse to implement the latest technological innovations. (Valverde, 2019).

Customer experience issues. Customers accustomed to traditional services may struggle to adopt and use innovative banking services. Additionally, online customer support may sometimes be unable to resolve more complex issues, which can lead to frustration.

Digital exclusion. While innovative banking services promote financial inclusion, they also drive digital exclusion. People without access to technology and the internet are unfortunately excluded from the benefits of modern banking services. (Indriasari, 2022).

5. Methodology

This article employs a qualitative research approach to study the types of innovation in modern banking services, assess their benefits and challenges, and analyze the demographic adoption of digital banking services across the globe.

A literature review was conducted to write this article using relevant academic articles, books, and journals. In addition, information is collected from both academic and industry sources including reports, regulations, customer surveys and comments from banking professionals to analyze the benefits and challenges of innovation.

The demographic analysis of digital banking services was conducted using statistical data from official sources such as the World Bank, International Monetary Fund (IMF), and various national banks of the countries. These data were used to study the adoption of digital

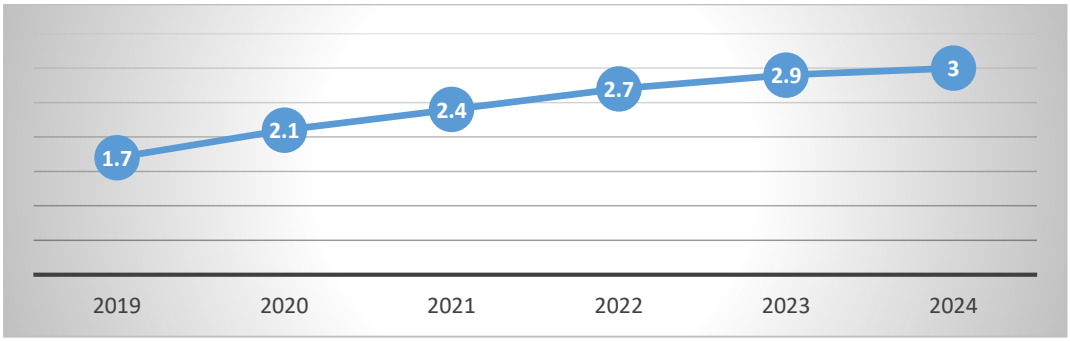
banking services across key demographic variables including age, education level, income level, etc. However, the lack of detailed data on the adoption of digital banking services in developing countries is a major limitation of this study.

Although this article does not rely on primary data collection, it provides a comprehensive overview of the existing knowledge on innovation in modern banking services.

6. Results - Demographic Analysis of Innovative Banking Services

From a customer perspective, the primary banking innovation is digital banking services, which directly influence their behavior. This part of the article analyzes the demographic structure of innovative digital banking services, focusing on socioeconomic factors.

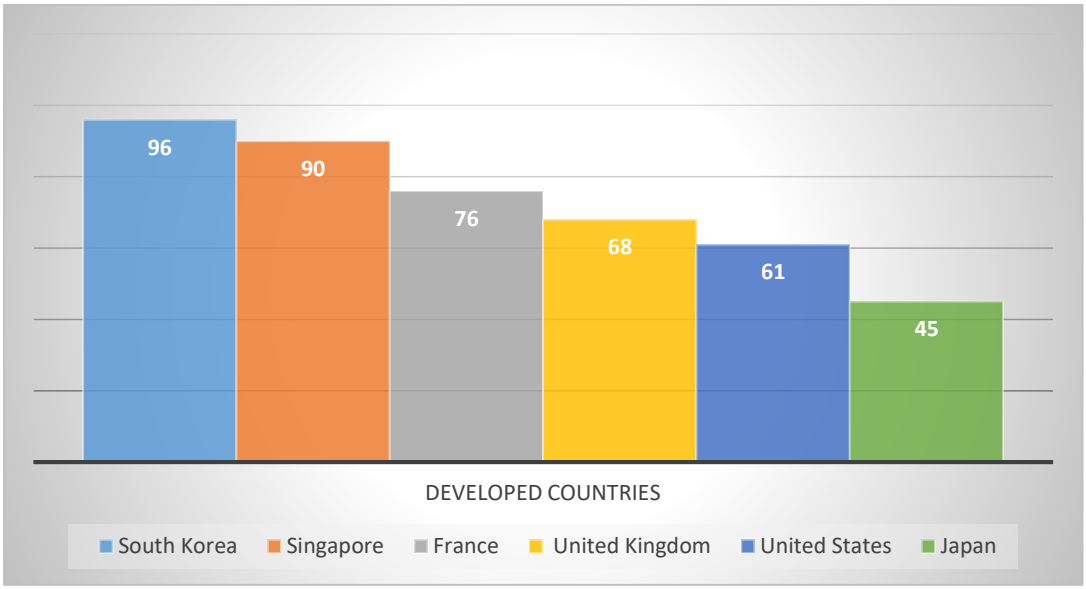
Figure 1: *Number of digital banking users 2019-2024 (in billions)*



Source: World Bank and IMF reports.

As shown in Figure 1, the number of users of modern digital banking services continues to grow worldwide every year. Especially during the Covid-19 pandemic, lockdowns have boosted the use of these services. By 2024, more than 3 billion people use at least one digital banking service during the year.

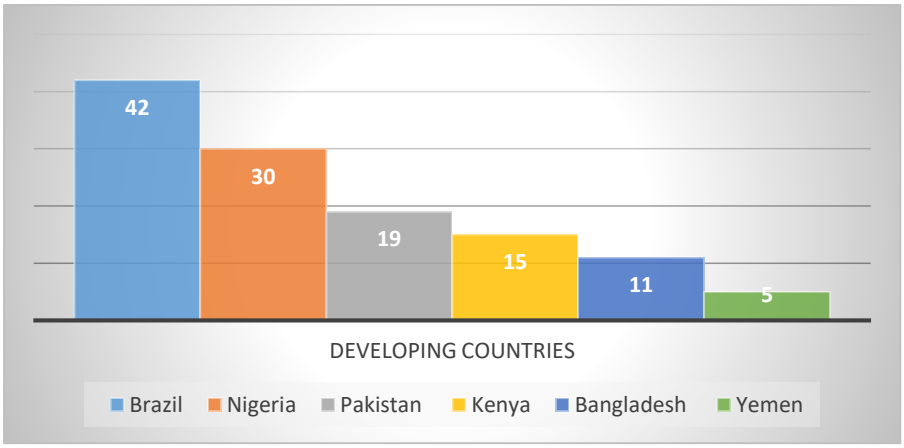
Figure 2: *Percentage of adults using digital banking services in developed countries (2024)*



Source: World Bank and official websites of banks.

The percentage of the adult population using innovative banking services is generally higher in developed countries. (Figure 2). A Higher HDI, strong technological infrastructure, higher income and literacy levels are the main factors that positively influence the adoption rate of innovative advances by the population.

Figure 3: *Percentage of adults using digital banking services in developing countries (2024)*



Source: World Bank and official websites of banks.

Figure 3 shows that the adoption rate of innovative banking services among adults in developing countries is significantly lower than in developed countries. Factors such as weak technological infrastructure, poor internet quality, low incomes and poverty slow down the adoption of modern innovations.

Younger generations are the primary users of innovative banking services globally. According to a 2024 survey, 93% of Millennials and 81% of Gen Z use digital banking platforms for at least one financial service. While Gen Z customers adapt quickly to every innovation, Millennials are the main users of innovative banking services. Older generations favor traditional face-to-face banking services and the adoption rate of innovative services is relatively low among these customers.

Income level of customer has a direct impact on the adoption rate of innovative banking services. Higher-income individuals tend to use modern banking platforms more frequently and require a wide range of financial services, such as investment advice, wealth management or cryptocurrencies. (Brown & Nyarondia, 2023).

Education is another factor influencing customer behavior. More educated customers generally have better financial literacy, easily understand and use digital banking services, and quickly adopt new innovations.

7. DISCUSSIONS/CONCLUSIONS

Like other industries, modern innovation is transforming the traditional banking concept. Application of innovation in banking services improves their accessibility, makes them more convenient for customers, increases transparency and efficiency, and reduces costs for both banks and customers. (Lin, Liu & Wei, 2023). However, they also come with a number of challenges such as privacy, security and technical problems. These challenges require careful attention from banks and financial institutions.

The demographic analysis in this article reveals that several socioeconomic factors, such as quality of life, country infrastructure, education level and income level of customers influence their adoption of digital banking services. (Brown & Nyarondia, 2023). Moreover, analysis by customer age shows that older customers are more reluctant to use these services and prefer traditional banking methods.

But today, the banking industry is unimaginable without innovative advances. Every bank must implement innovation in banking services and management to remain competitive in the financial sector. To minimize the risks and problems associated with innovation, banks should follow these recommendations:

- Strengthen security mechanisms to protect data and prevent potential financial losses for both the bank and its customers.
- Regularly check innovative banking systems to identify errors, vulnerabilities, and potential risks.
- Implement 24/7 monitoring systems to prevent cyberattacks and detect suspicious transactions.
- Train bank employees on the proper use of technological devices and innovative programs used in the bank.
- Collaborate with other banks and financial institutions to share experiences in applied innovation and jointly find solutions to emerging threats and risks.

It is obvious that the future of everything is formulated by innovation advancements. Banks should always implement latest innovation in order to meet growing needs of customers and stay remain competitive in modern financial environment.

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GLOBAL MINIMUM TAX AND THE DETERMINANTS OF CORPORATE TAX REVENUE: AN ECONOMETRIC ANALYSIS FOR THE WESTERN BALKAN COUNTRIES

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Abstract: *The purpose of this paper is to analyze the global minimum tax of 15% for international corporations, the fiscal impact of this policy which is already in force internationally as of January 1, 2025, as well as the determinants of corporate tax revenues, with a particular focus on the Western Balkan countries. The paper relies on secondary data collected from World Bank, the IMF, and Eurostat reports. Data processing is carried out using the STATA software, while the analyzed period covers the last 20 years. The empirical results show that foreign direct investment, GDP per capita, and trade openness have a positive impact on corporate tax revenues, while unemployment has a negative impact. Regarding the global minimum tax, it is seen that this tax has an effect in some countries but does not have a huge impact in some other countries.*

Keywords: *Global minimum tax, corporate tax revenue, economic determinants, trade openness, foreign direct investments, GDP per capita.*

INTRODUCTION

Corporate income tax is a crucial source of government revenue, especially in developing countries, where it accounts for 15-20% of tax revenues. However, there is a widespread perception that an increasing number of businesses, especially large ones, are paying less tax on their profits. This belief is supported by the ongoing decline in statutory tax rates and the growing competition among states to offer tax incentives, such as tax credits, income exemptions, and lower rates, to attract investments. This paper analyzes the impact of these tax incentives on reducing effective tax rates and how this effect varies depending on firm size (Bachaset al., 2023).

The global minimum tax ensures that corporate profits are taxed at a minimum effective rate of 15%, regardless of the jurisdiction in which they are recorded. If a company reports profit in a country with a lower tax rate, its home country imposes a top-up tax to meet the global minimum threshold. However, there are several important exceptions to this rule. First, the global minimum tax applies only to multinational corporations with worldwide revenues exceeding €750 million. Second, it is not designed to penalize legitimate business

activities in low-tax jurisdictions, as demonstrated by the carve-out rule, which reduces the taxable profit base by considering a firm's tangible assets and labor costs. Third, the tax does not apply to countries where a corporation has only a minimal operational presence (Johannesen, 2022).

The paper is divided into 5 sections. The first part includes the literature review, the second section includes the meta-analysis, the third section includes the scientific methodology and the details of the econometric model. The fourth section includes the statistical analysis and findings of the study, while the last section includes the conclusions and recommendations of this study.

LITERATURE REVIEW

The 137 member countries that have adopted the OECD framework for a global minimum tax of 15% have the option to either implement the OECD Model Pillar 2 Rules or comply with the adoption of these rules by other nations. The agreement establishes global anti-base erosion (GloBE) rules, ensuring that large multinational corporations with consolidated revenues above €750 million pay an effective minimum tax rate of 15% on "excess profits" generated in any jurisdiction where the effective tax rate falls below this threshold. In such cases, companies must pay the additional taxes either in their home country or in the low-tax jurisdiction. The primary goal of the global minimum tax is to decrease tax competition for investment capital and limit profit shifting by creating a standardized framework for corporate taxation globally (Schjelderup & Stahler, 2024).

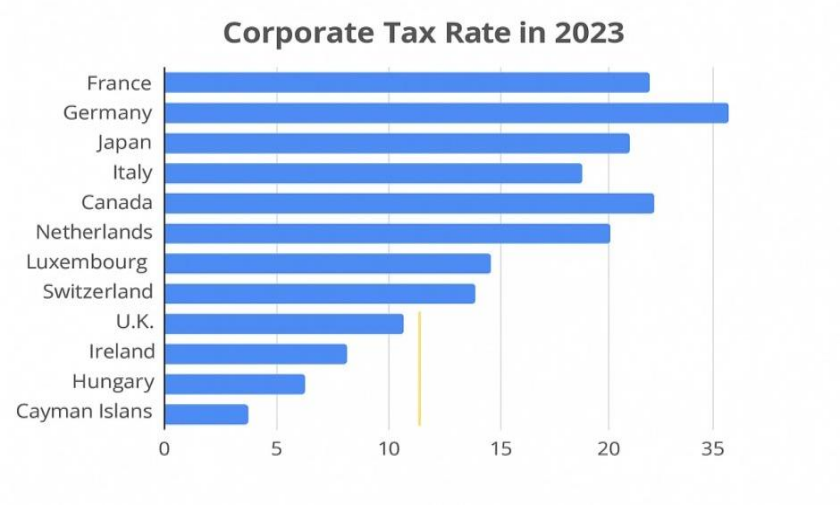
The global minimum corporate tax primarily aimed to prevent the “race to the bottom” and increase corporate income tax rates. This concept suggests that the erosion of the tax base encourages tax competition, which subsequently results in lower corporate income tax rates. Globalization has played a key role in this phenomenon, as financial structures, transfer pricing, and intellectual property licensing have made income more mobile. This trend is evident in empirical data: the average corporate income tax rate, weighted by GDP across 94 countries, dropped from 34.1% in 2005 to 25.4% in 2020, a decline of 8.7 percentage points. Notably, in 2018, the U.S. recorded a significant decrease in the federal corporate income tax rate from 29.7% in 2017 to 26.4%, following a 14% reduction. This shift was greatly influenced by the U.S., which accounts for nearly 25% of the GDP among the 94 analyzed countries(Mintz & Tulkens, 1986).

The goal of the global minimum corporate tax is to mitigate the negative effects of tax base shifting. This is achieved by imposing a minimum tax on profits transferred to low-tax jurisdictions. As a result, this could lead to an increase in corporate tax revenues for tax havens in the Caribbean and low-tax countries like Ireland, which have experienced revenue losses (Mintz, 2022).

According to the research, a global tax deal would look equitable in the long run, with individual countries either gaining or losing tax revenue. As a result, countries would have to adjust their budgets. The corporate tax rates in each country are shown in this chart along with the recommended floor of 15%. Countries that are currently in deficit and/or below the line will move quickly to enact regulations in order to become global tax collectors.

Similarly, countries with surpluses and effective tax rates above the threshold may be reluctant to adopt regulations designed to address this issue (Mrozek, 2023).

Figure 1. *Corporate tax rate in 2023*



Sources: (Mrozek, 2023)

The objective of a global minimum tax is to change the nature of international tax competition. According to Devereux et al. (2021), the structure of the tax base for the surcharge has an impact on how the second pillar affects tax competition. Corporations in low-tax countries experience downward pressure on their corporate tax rate due to the methodology used to calculate the surcharge. Furthermore, because source nations can collect the surcharge themselves, they have a tremendous incentive to do so, see Perry (2023). It is argued that the Second Pillar is effective in creating a floor for tax competition in source countries (Devereuxet al., 2022).

Table 1. *Definitions of Global Corporate Minimum Tax for Western Balkan Countries*

Definitions of Global Corporate Minimum Tax
The Corporate Income Tax (CIT) system in Kosovo is based on the principle of worldwide taxation. Taxpayers subject to CIT are Corporations and other legal entities. Organizations and businesses operating with public/state assets. Non-resident persons with permanent residence in Kosovo. Resident taxpayers are generally subject to tax on both foreign and Kosovo-sourced income, while non-resident taxpayers are generally subject to tax only on their Kosovo-sourced income. The CIT rate is 10%.
In Albania, non-resident individuals and entities are taxed only on income earned within the country. In contrast, resident entities are subject to taxation on all sources of income, both domestic and foreign. The corporate income tax (CIT) in Albania is set at a rate of 15%. Cit applies to taxable gains, which are determined by deducting deductible expenses from taxable income.
Corporate income tax (CIT) is progressively imposed on businesses operating in Montenegro. The realized profit of taxpayers determines the applicable tax level, which varies from 9% to 15%. Residents are subject to profit taxes around the world. Montenegro origin or income attributed to a non-resident taxpayer of Montenegro is subject to taxation. Moreover, non-residents have to pay the

retention tax for income earned in Montenegro.
Serbia - Domestic and foreign income earned by residents is subject to tax. Only income derived from a permanent establishment within Serbian territory is subject to tax for non-residents, the corporate income tax (CIT) rate is 15%.
In North Macedonia, CIT is generally due by all resident and non-resident legal companies that conduct business through permanent establishments. Entities that reside in Macedonia are subject to taxes on their international income. The profit realized by non-resident entities through its PE in North Macedonia is subject to taxation. 10% is the CIT rate.
The two entities that makeup Bosnia and Herzegovina are the Federation of Bosnia and Herzegovina and the Republika Srpska. Both entities also govern a third territory, the Brčko District (BD). While indirect tax laws are implemented at the state level, direct taxes are imposed at the entity or district level. The Republika Srpska, the Brčko District, and the Federation of Bosnia and Herzegovina are all tax - resident corporations globally. Income earned in the regions of the Federation of Bosnia and Herzegovina, Republika Srpska, and Brčko District is subject to non-resident tax.

Source: Collecting data from the author (2025)

The corporate income tax (CIT) rate in Singapore stands at 17%, one of the lowest globally, and has played a key role in fostering a pro-business environment by supporting domestic firms and attracting foreign investment (World Bank, 2019). In contrast, Bhutan imposes a CIT rate of 30% on fully taxable firms and 25% on those with limited tax liability, which may hinder entrepreneurial growth. Consequently, the government could consider reviewing tax rates to encourage the establishment of new businesses and allow existing companies to retain a larger share of their profits. This would help increase retained earnings, supporting expansion, growth, or reinvestment in research and development (Shrivastava et al., 2024).

According to the latest data, in 2023 there was an increase in tax revenues in the capital of Ukraine and in 18 other regions, compared to 2022. However, this growth was not evenly distributed across all regions, as only 13 of them showed improvement compared to the same period of the previous year. These findings are consistent with existing literature, which highlights the vulnerability of economic sectors to geopolitical and fiscal contexts, particularly in conflict-affected areas (Mazaraki et al., 2024).

Transfer pricing practices used by multinational companies pose a significant challenge for national economies, especially in developing countries such as those in the Western Balkans. As highlighted in the study on the impact of transfer pricing on the Romanian economy, these practices can lead to substantial losses in fiscal revenues for the state budget, undermining fiscal capacity and the ability to finance public services. Therefore, governments need to strengthen the monitoring and regulation mechanisms of transfer pricing, in line with international best practices, aiming to strike a balance between encouraging foreign investment and preserving the integrity of the tax system. This underlines the need for a global minimum tax that ensures a fair and sustainable framework for taxing multinational corporations, addressing tax avoidance, and contributing to sustainable economic development in the region (Ivan & Ladar, 2017).

Meta–analysis of research paper

In this part, a considerable number of scientific works analyzed by the following authors will be analyzed, which will be presented in tabular form and which deal with works with the same theme as our work.

Table 2. *Meta-analysis of research*

Author	*Year*	*Title*	*Methodology*	*Finding*
(Mintz, 2022)	2022	The Global Corporate Minimum Tax: A Cure or Not?	Panel data	The results suggest that, to ensure that passive income is taxed, many countries could take action to tighten their foreign business control rules. It is unclear whether a minimum corporate tax worldwide would be more effective in reducing profit shifting than other focused initiatives, given the complexity of all these regulations.
(Johannesen, 2022)	2022	The global minimum tax	Meta analysis	From the findings, we can say that the global minimum tax increases the welfare of individuals on the one hand, but also increases government revenue by preventing profit shifting. However, by raising tax rates and shifting resources away from businesses, this reduces their welfare. When profit shifting is paused in some form and the global minimum rate is high enough, there is an undeniable positive net welfare effect.
(Mrozek, 2023)	2023	The Global Minimum Tax: Hurdles to Implementation of an Effective Tax	Meta analysis	According to the research findings, the OECD will not be able to implement its two -pole strategy by 2024 unless it is noted by all legislative bodies. Large multinational firms, governments around the world, the accounting sector, and the global economy in general should consider these results. The research shows that legislation can be approved and only succeed if the stakeholders cooperate to an extreme extent.
(Schjelderup & Stahler, 2024)	2023	The economics of the global minimum tax	Meta analysis	It follows that if SBIE is positive, a minimum 15% corporate tax for low-tax subsidiaries is not met. We demonstrate that while Pillar 2 reduces tax motivated transfer prices, it changes employment, investments, and import incentives. Moreover, we show that SBIE is comparable to a production subsidy for a very high part

				of work and/or capital.
(Haufler & Kato, 2024)	2024	A Global Minimum Tax forLarge Firms Only: Implications for Tax Competition	Meta analysis	The results say it is not certain that tax discrimination always results in lower levels of taxes for small multinational corporations in a business environment. Including a response separated by multinational corporations to take advantage of lower tax levels for small MNEs would be the third and last extension.

Source: Collecting data from the author (2025)

SCIENTIFIC RESEARCH METHODOLOGY

The aim of this paper is to analyze the global minimum tax of 15% for international corporations, focusing on the factors that influence corporate tax revenues, particularly in the Western Balkans. To carry out the research, will use secondary data provided by reliable sources from the World Bank, the International Monetary Fund, Eurostat, and others. Also, in the literature review part, we will focus on the works of different authors,together with relevant books by experts in the fields of finance, economics, and taxes. Also, we will focus on various international conferences, numerous reports and safe resources from the Internet. The study will use panel data covering 20 years (2004-2023) and the countries we will analyze are (Bosnia and Herzegovina, Kosovo, Montenegro, North Macedonia, Serbia, and Albania). For data processing, we will use the STATA software program. The importance of the paper lies in its aim to provide real and consistent results that can shed light on corporate taxes and economic growth. The variables included in this research are: dependent variable (CIT) and independent variables (Foreign direct investment, Gross domestic product per capita, Trade openness,and Unemployment).

The data will be processed in the STATA program and to prove the validity of the hypotheses of this study, we will apply the following statistical tests: descriptive statistics, correlation analysis, linear regression, random effect, fixed effect, Hausman – Taylor regression and GMM. Arellano Bond Valuation Model, Generalized Valuation Equations (GEE Model).

The hypothesis of the study is:

H0: Economic determinants have a positive and significant impact on corporate tax revenues in the countries of the Western Balkans.

H: Economic determinants don't have a positive and significant impact on corporate tax revenues in the countries of the Western Balkans.

The research questions of the research are:

1. What are the effects of the Global Minimum Tax on the economic determinants in these countries?
2. Does the impact of the Global Minimum Tax differ between the different countries of the Western Balkans?
3. What are the main economic factors affecting corporate tax revenues in Western Balkan countries?

Table 3. *Description of the variables included in the econometric models*

Variables	Description of variables	Data source
Dependent variable (Y)	Corporate Tax Revenues (% GDP)	Annual reports of the Bank World (2004-2023)
Independent variable (X1)	Foreign direct investment (% of GDP)	Annual reports of the Bank World (2004-2023)
Independent variable (X2)	Gross domestic product per capita (annual %)	Annual reports of the Bank World (2004-2023)
Independent variable (X3)	Trade openness (% GDP)	Annual reports of the Bank World (2004-2023)
Independent variable (X4)	Unemployment (%)	Annual reports of the Bank World (2004-2023)

Source: Data obtained by authors (2025)

The econometric model that will be used in this study is specified as follows:

$$CTI = \beta_0 + \beta_1 FDI + \beta_2 GDPC+ + \beta_3 TO + \beta_4 UNMP + \gamma it$$

Where:

CTI – Corporate Tax Revenues

FDI – Foreign direct investment

GDPpercap – Gross domestic product per capita

TO– Trade openness

UNMP – Unemployment

γ – stochastic variables (other factors not considered in the model)

i – code and t – time period

ECONOMETRIC ANALYSIS AND FINDINGS OF THE STUDY

In the chapter, the results will be presented through econometric analysis, where in this part the hypotheses presented in the research will be tested and we will try to get answers to the research questions presented earlier. Initially, descriptive statistics, correlation, linear regression, fixed effect model, random effect model, Hausman Taylor Estimation, GEE Model, and GMM Model. All these results will be extracted through the STATA program.

In the following table, descriptive statistics will be presented for the variables included in the research. We will analyze the number of observations, the average, the standard deviation, the minimum, and the maximum of these variables.

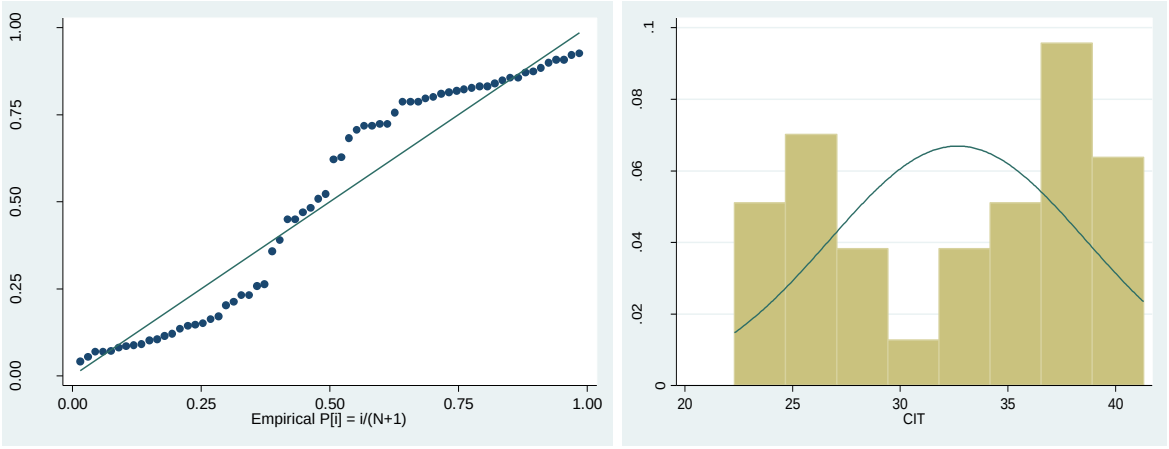
Table 4. *Descriptive statistics for the variables included in the econometric model*

Variables	Obs.	Mean	Std. Deviation	Minimum	Maximum
FDI	120	3.65	3.570326	-15.2	13.4
CIT	66	32.66515	5.961066	22.3	41.3
GDPpercap	105	6.949524	5.149517	.1	37.3
TO	120	91.9725	26.35181	0	168.8
UNMP	100	19.949	7.190348	8.7	37.3

Source: Author's calculations in Stata (2025)

Based on the data obtained from descriptive statistics, we can observe that the sample of our work is 120 observations, as for the average, we see that the variable with the highest average is TO. If we analyze the part of the standard deviation, we can notice that we have the highest value of the standard deviation in the TO variable as well, in the part of the minimum value is the CIT variable, and as for the maximum value, again the TO has the highest value.

Figure 2. *Graphic representation of the histogram*



Source: Authors' calculations in Stata (2025)

Based on the graphical representation of the histogram, we see that between the dependent variable of GDP and the independent variable, there is a normal distribution of these variables included in the analysis.

Table 5. *Correlation analysis for the variables included in the econometric model*

Variables	CIT	FDI	GDPpercap	TO	UNMP
CIT	1.0000				
FDI	-0.2172	1.0000			
GDPpercap	0.1052	0.2679	1.0000		
TO	0.0197	-0.2007	0.1035	1.0000	
UNMP	0.0856	-0.3585	0.0495	-0.0260	1.0000

Source: Authors' calculations in Stata (2025)

The correlation table shows the relationships between the five main economic variables: CIT, FDI, GDPpercap, TO and UNMP.

The correlation between CIT and FDI is -0.2172, suggesting a weak negative relationship between these two variables. This implies that an increase in corporate taxes is associated with a small decrease in foreign direct investment, although the relationship is weak.The correlation is 0.1052, indicating a very weak positive relationship between CIT and GDP per capita. This implies that an increase in GDP per capita is associated with a small increase in corporate taxes, but the relationship is negligible.The correlation is 0.0197, indicating an almost insignificant relationship between CIT and TO. This result suggests that

there is no significant relationship between corporate taxes and the level of open trade.The correlation is 0.0856, indicating a weak positive relationship between CIT and the unemployment rate. This may mean that an increase in corporate taxes is associated with a small increase in unemployment, but this relationship is weak.

The following is the analysis of statistical tests performed through the STATA program, such as linear regression, random effect, fixed effect, Hausman - Taylor Regression, GMM Model -Generalized Estimating Equations (GEE Model).

$GDP = \beta_0$-.5552252+ β_1.3855899+ β_2.0154152+ β_3.7088763+ $\beta_4$5552252+ γit

Table 6. *Econometric results and empirical findings of the study*

Variables	Linear Regression	Random Effects – GLS Regression	Fixed – Effects Regression	Hausman – Taylor Regression	GEE Model	GMM Model
CIT	-	-	-	-	-	-
FDI	-.1617591 (0.000)***	-.2958505 (0.056)**	-.5338307 (0.008)**	-.5328499 (0.008)**	-.5312379 (0.008)**	-.148731 (0.373)
GDPpercap	-.2415487 (0.249)	.3855899 (0.004)**	.4978438 (0.001)***	.4822447 (0.002)**	.4768369 (0.002)**	.5684211 (0.000)***
TO	.0049486 (0.475)	.0154152 (0.054)**	.0222733 (0.067)**	.0185606 (0.093)*	.0184015 (0.093)*	.0012802 (0.931)
UNMP	.8297792 (0.000)***	.7088763 (0.044)**	.0491625 (0.141)	.0415701 (0.174)	.0411805 (0.175)	.046002 (0.230)
Const.	1.023933 (0.144)	-.5552252 (0.703)	-.9106561 (0.600)	-1.399409 (0.558)	-.3690647 (0.826)	
R Square	0.4737	0.4095	0.0428	-		
Adj.R^2	0.4503	0.3448	0.0198	-		

Source: Authors' calculations in Stata (2025)

*Explanation: P-values are shown in brackets: *** indicates statistical significance at the 1% level; ** indicates statistical significance at the 5% level and * indicates 10% statistical significance.*

Based on the econometric results in the table above, we can conclude that some of the independent variables are significant at the 1%, 5%, and 10% levelsFor interpretation purposes, we will base our analysis on the Random Effects GLS model, where all results in this regression are significant.

β0 - If all other factors are constant, then CIT will be -0.5552252units.

β1 – If Foreign Direct Investment increases by one unit holding all other variables constant, then CIT will decrease by -0.2958505 units. This statement is correct since the values are within the 5% confidence interval, because (p-value = 0.056=0.05).Increased Foreign Direct Investment often leads to increased corporate tax revenues. This effect occurs because FDI increases economic activity and company profits. The increase in the number of companies and the improvement of the business environment stimulate more economic activity and other investments, contributing to a continued increase in corporate tax revenues.

β2 – If GDP per cap increases by one unit keeping all other variables constant then CIT willincreaseby 0.3855899units. This statement is correct since the values are within the 5% confidence interval, because (p-value = 0.004<0.05).An increase in Gross Domestic Product (GDP) per capita usually leads to an increase in corporate tax revenues. This is because a higher GDP per capita typically indicates increased economic activity and living standards, which boosts demand for products and services, and consequently, corporate profits.Better economic conditions, along with increased private consumption and investment, contribute to heightened business activity and boosted corporate tax revenues.

β3 – If the trade openness increases by one unit, keeping all other variables constant, then CIT will increase by 0.0154152units. This statement is correct since the significance value is within the 5% confidence interval, because (p-value = 0.054=0.05).Increased trade openness, which includes increased imports and exports, can boost economic activity and create new opportunities for companies. This often leads to increased profits for businesses that benefit from expanded markets and increased sales volumes. Furthermore, increased trade openness can stimulate additional investment and create a more favorable business environment, helping to increase tax revenues.

β4 - If Unemployment increases by one unit keeping all other variables constant then CIT will increaseby 0.7088763units. This statement is correct since the significance value is within the 5%confidence interval, because (p-value = 0.044<0.05). Rising unemployment typically leads to a decrease in consumption and demand for products and services, negatively impacting company profits. With less income and a weaker economic environment, companies may cut back on investment and hiring, further reducing corporate tax revenues. Additionally, increasing unemployment can deteriorate the business environment and impact economic sustainability, leading to a potential decline in corporate tax revenues.

Table 7. *Heteroscedasticity test*

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity H0: Constant variance Variables: fitted values of CIT		
Chi2 (1)	=	1.40
Prob > chi2	=	0.2365

Source: Authors' calculations in the Stata program (2025)

Breusch-Pagan/Cook-Weisberg test results indicate that there is insufficient evidence to suggest heteroskedasticity in the regression model. With a p-value of 0.2365, which is greater than the significance level of 0.05, the hypothesis of constant variance (homoscedasticity) is not rejected. This indicates that the errors in the model have a constant variance and it is not necessary to make adjustments for heteroscedasticity.

Table 8. *Tests of normality*

Skewness/Kurtosis tests for Normality					
Variable	Obs	Pr (Skewness)	Pr (Kurtosis)	adj chi2 (2)	Prob>chi2
resid	65	0.8880	0.0000	15.21	0.0005

Source: Authors' calculations in the Stata program (2025)

Skewness: The high p-value (0.8880) suggests that there is no problem with skewness of the residuals.
Kurtosis: A very low p-value (0.0000) suggests that there is a significant deviation from the normal distribution in terms of kurtosis.
Joint Test: The p-value of the joint test (0.0005) shows that, in general, the residuals do not follow a normal distribution, suggesting that the model may have problems with the assumption of normality of the errors.
Overall, this result indicates that the distribution of the residuals is not normal, mainly due to a problem with kurtosis.

Table 9. *VIF test*

Variable	VIF	1/VIF
GDPPERCAP	1.37	0.731420
UNMP	1.20	0.832592
FDI	1.15	0.872143
TRD	1.09	0.915363
Mean VIF	1.20	

Source: Authors' calculations in the Stata program (2025)

The test results (VIF) show that there is no significant collinearity problem between the independent variables in your model. All VIF values are below 10, with an average of 1.20, suggesting that the independent variables are stable and not affected by collinearity. This shows that your model is reliable and the regression coefficients are stable.

DISCUSSIONS/CONCLUSIONS

The purpose of this research was to analyze the global minimum tax of 15% for international corporations and to examine the determinants of corporate tax revenues, specifically focusing on the Western Balkan countries. We successfully analyzed several factors and developed an econometric model, which yielded some significant results.

Analysis of the results shows that foreign direct investment, GDP per capita, and trade openness positively influence corporate tax revenues. This conclusion is supported by the econometric models used in this research. The other independent variable, which is unemployment, turns out to hurt corporate tax revenues. From here we say that most of the analyzed countries have been good in this aspect, but some other analyzed countries still need to work on this issue.The Global Minimum Tax is a type of initiative led by the OECD/G20,

which aims to establish an effective minimum tax of 15% for multinational corporations with revenues over 750 million euros. As we discussed in the paragraphs above, the purpose of this tax is to reduce tax avoidance and set a floor in tax competition between countries.

Research shows that this tax is present in some Western Balkan countries, while others do not implement it.North Macedonia: The Republic of Macedonia adopted the law on the global minimum tax on corporate income in December 2024, implementing the OECD/G20 Pillar Two rules. The law entered into force on January 1, 2025. Montenegro: This country has not yet formally adopted the Pillar Two rules in its tax legislation. But importantly, this country has taken steps toward improving tax policies, including the introduction of transfer pricing rules and progressive taxation as of January 1, 2022(CMS, 2023).Serbia: although it has not yet implemented the regulations on the global minimum tax, the corporate income tax rate is 15%, in line with the rate proposed by the OECD. However, it is believed that due to various tax incentives, the effective tax rate may be lower than 15%(Karanovic, 2024).Kosovo, Bosnia and Herzegovina and Albania: so far these countries have not taken concrete steps towards implementing the global minimum tax.

The concept of this tax may still be new to many countries and involves a complex process that requires alignment with both domestic and international legislation. As a result, Western Balkan countries may be at varying stages of this process, and further developments are anticipated in the future. Examining other countries worldwide, which have been analyzed by different authors, reveals the presence of this tax in those regions as well. Given its importance, we say that this tax should be taken more seriously even by countries that do not yet implement it.

During the implementation of this research, we also encountered several limitations that sometimes made the work difficult. A major limitation was the lack of information regarding the global minimum tax for the Western Balkan countries, there was no literature review for these countries since it was an unexplored topic, and we encountered a lack of data for some variables. We hope that in the coming years, this gap in the literature review section will be filled with sufficient information.

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THE IMPACT OF STABLECOINS ON GLOBAL FINANCE

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Abstract: *Stablecoins represent a rapidly growing segment of the cryptocurrency market, aiming to overcome the high volatility of cryptocurrencies. Their primary goal is maintaining a stable value, usually pegged to fiat currencies (e.g., the US dollar), which facilitates their use in international payments, as assets within decentralized finance (DeFi), and as protection against inflation. This article explores blockchain technology, the development of stablecoins, methods of ensuring stability, and the reasons for their popularity among users. Special emphasis is placed on regulation at both the EU and US levels, evaluating the compliance of the most widely used stablecoins within legal frameworks. This research investigates advantages and risks, including their use in criminal activities, legal ambiguities, and potential instability. Quantitative and qualitative methods were utilized, including analysis of market capitalization, stability assurance mechanisms, and regulatory policies. Findings reveal that investors trust stablecoins backed by fiat currency reserves (particularly USD) the most, with Tether (USDT) holding the largest market share, despite its lack of full legislative compliance. The article highlights the key challenges and opportunities stablecoins present to individuals and financial markets.*

Keywords: *cryptocurrency, decentralised finance, stablecoin*

INTRODUCTION

In 2024, significant events occurred in the cryptocurrency market, including the emergence of financial products that mark the entry of cryptocurrencies into the traditional financial world. Among these, it is important to highlight the option of trading Exchange-Traded Funds (ETFs), which enable the indirect purchase of cryptocurrencies on traditional securities exchanges. (Lapuh Bele, 2025). In this article, we focus on stablecoins, which also serve as a bridge between traditional and decentralized finance. Decentralized Finance (DeFi) refers to financial systems built on blockchain technology that facilitate transactions without intermediaries such as banks or traditional financial institutions. These systems leverage smart contracts and decentralized protocols to enable secure, transparent, and autonomous financial interactions, reducing reliance on centralized entities while enhancing accessibility and efficiency within the financial ecosystem.

Stablecoins are cryptocurrencies that maintain their value by being tied to a specific reference asset or value, such as the fiat currency USD. A key characteristic of cryptocurrencies is their volatility—their prices can fluctuate significantly, which enables investors to gain large

profits or suffer major losses. As a result, cryptocurrencies have been popular among speculative investors. These are individuals or institutions willing to take on high levels of risk, aiming for significant returns due to short-term price movements. For cautious investors, cryptocurrencies were not appealing for a long time. They were primarily purchased by technology enthusiasts and speculative traders.

As shown by cryptocurrency market capitalization data, the crypto market has expanded considerably over the past five years (Figure 1). Many new technological solutions and their associated offerings have attracted researchers, the interested public, and investors. We decided to study stablecoins because they represent a fascinating phenomenon whose growing popularity gives rise to numerous research questions.

This article presents stablecoins and the technologies associated with them, legal considerations, and their usefulness in various contexts, including criminal activity. We formulated research questions and sought answers to them.

CRYPTO-ASSETS

The theoretical framework introduces blockchain technology and its practical relevance, placing a specific focus on stablecoins. It outlines the core concept of stablecoins, examines their regulatory treatment across major global economies, and investigates their links to illicit activities and the criminal underworld.

Blockchain Technologies

Blockchain technology and the first associated cryptocurrency, Bitcoin (BTC), were introduced by an anonymous individual using the pseudonym Satoshi Nakamoto. He envisioned a digital means of payment and a secure technology that functions transparently and reliably without the need for central institutions such as banks. Payments are made directly between users (Nakamoto, 2008).

Blockchain technology represents a significant advancement in secure data storage and transfer. It establishes a decentralized digital ledger where data is organized into sequential blocks. This system is maintained by a distributed network of computers, called nodes, which collectively verify and preserve data integrity. Since data is distributed across the network and the transaction ledger can be stored by any user, this architecture reduces the risk of cyberattacks and errors.

Before a new block is added to the chain, the network must reach consensus, typically ensured by verification algorithms. Every transaction is publicly accessible and immutable, enabling high transparency and reliable traceability (Nakamoto, 2008).

The Utility of Blockchain Technology

The original purpose of blockchain technology was to create a digital medium of exchange. However, neither Bitcoin nor any other cryptocurrency has succeeded in replacing traditional state-backed currencies, commonly referred to as fiat currencies (Lapuh Bele, 2025), despite the fact that numerous countries are in the process of developing their own official digital currencies. Nakamoto (2008) did not foresee that Bitcoin would evolve into a vehicle

for speculative investment. Due to its high volatility and substantial transaction fees, Bitcoin has become impractical as a means of payment for small transactions.

Although Bitcoin continues to hold a dominant share of the cryptocurrency market, other significant digital assets have emerged. As illustrated in Figure 1, Bitcoin accounts for the largest proportion of total market capitalization (approximately 51% when converted to USD), followed by Ethereum (12%), stablecoins (10%), while the remaining 27% consists of other crypto-assets.

Research indicates that individuals invest in cryptocurrencies for a variety of reasons, with profit-seeking being the most prominent motivation (Mitra, 2022). This profit-driven incentive, however, does not typically apply to investors in stablecoins.

Figure 1



Source: Charts (CoinMarketCap, 2025d)

Ethereum, which ranks second to Bitcoin in terms of market capitalization, was not designed as a means of payment. Rather, it serves as a decentralized platform for the deployment of smart contracts—self-executing agreements in which the terms are directly written into code and automatically enforced once predefined conditions are met. The native cryptocurrency of this platform is Ether, which functions as both a medium of exchange and a fuel for computational operations within the Ethereum network.

The versatility of blockchain-based technological solutions extends far beyond financial transactions. Blockchain enables innovative applications in logistics, supply chain management, decentralized finance (DeFi), digital rights protection, legal processes, and other domains where transparency, reliability, security, immutability, and automatic enforceability of transactions are paramount (Lapuh Bele & Turk, 2024).

A particularly noteworthy application of smart contracts is the emergence of stablecoins. Their increasing adoption and integration into financial systems have elevated their

presence in economic statistics and motivated further scholarly investigation. This growing relevance inspired us to conduct an in-depth exploration of stablecoins as a distinct phenomenon within the crypto ecosystem.

While the term cryptocurrency has become widely used, it is increasingly seen as restrictive and insufficient in capturing the diversity of digital assets being developed. Each new blockchain network inherently gives rise to its own native digital coin. In addition to these coins, tokens can also be created—typically on existing blockchains like Ethereum—through the deployment of smart contracts. For instance, a project that issues a smart contract on Ethereum will have its own token, even though it does not create a new blockchain.

To more accurately describe this complex landscape, the term crypto-asset has emerged as the most inclusive and appropriate designation. This terminology has also been formally adopted by the European Union in its Regulation on Markets in Crypto-Assets (MiCA) (EU, 2023). The regulation establishes a comprehensive legal framework for crypto-asset markets and is binding across all EU member states, marking a significant step toward regulatory harmonization and investor protection in the digital asset space.

Stablecoins

Stablecoins are a form of cryptocurrency whose value is pegged to an external reference, such as a fiat currency (e.g., the US dollar), a commodity (e.g., gold), or a financial instrument. Their primary objective is to mitigate the high volatility associated with leading cryptocurrencies, such as Bitcoin (BTC), which renders many crypto assets unsuitable for everyday transactional use (Hayes, 2024).

The first stablecoin, BitUSD, was introduced in 2014 and promised a one-to-one peg with the US dollar. This innovation marked a significant step toward expanding the cryptocurrency market to a broader user base (Hayes, 2024). However, as illustrated in Figure 1, significant interest in stablecoins only emerged around 2021, with market capitalization steadily growing since then.

Two prominent examples of USD-pegged stablecoins are Tether (USDT) and USD Coin (USDC). Among them, USDT dominates the market share, followed by USDC (CoinMarketCap, 2025b).

Most stablecoins are deployed on existing blockchain infrastructures. For instance, USDT was initially launched as an Omni Layer token on the Bitcoin blockchain. Today, it is available on several blockchains, including Ethereum (as an ERC-20 token), Tron (TRC-20), Binance Smart Chain (BEP-20), and others (CoinMarketCap, 2024).

USDT is issued by Tether Limited Inc., while USDC is issued by Circle. Market data suggest that investors favor coins with a track record of price stability and institutional credibility. However, it is crucial to note that investor trust in stablecoins is largely based on confidence in the issuing entities, as there are no institutional guarantees akin to those backing sovereign currencies like the US dollar.

Typically, crypto coins and tokens are issued by individuals or companies, often accompanied by the publication of a white paper. A stablecoin white paper usually includes the following key components (Mattos, 2023):

- Introduction – explanation of the coin's purpose and an overview of the current cryptocurrency market landscape;
- Technical architecture – details of the technological implementation, including blockchain selection, smart contract frameworks, and algorithms used to maintain price stability;
- Stability mechanism – description of how price parity is maintained, whether through fiat reserves, crypto collateral, or algorithmic strategies;
- Use of funds – disclosure of how the funds raised through issuance will be utilized and managed;
- Regulatory framework – explanation of how the coin addresses legal compliance and potential regulatory challenges;
- Team and partners – introduction of core project contributors and strategic collaborators;
- Development roadmap – timeline for future development, expansion, and technical improvements.

Stablecoin issuers pursue price stability using different forms of backing (Hayes, 2024), yet it is important to recognize that investors receive no guarantee for the preservation of their capital. For instance, purchasing a USD-pegged stablecoin does not entail any guarantee from the U.S. government, the Federal Reserve, or any other institutional authority. This raises a pertinent question: why would an investor choose to hold USDT instead of actual U.S. dollars? This issue will be examined in the empirical section of this article.

Fiat-backed stablecoins maintain value parity through reserves of fiat currency. In the case of Tether, for each USDT in circulation, an equivalent amount of U.S. dollars is held in reserve at a financial institution (Tether, 2025a). This model operates on a simple principle: each stablecoin must be redeemable at any time for its fiat equivalent (Mattos, 2023).

Crypto-pegged stablecoins, such as DAI, are collateralized by other cryptocurrencies, usually Ethereum. Despite Ethereum's robust infrastructure and history of successful smart contract deployments, assets on its network—including ETH and tokens—remain highly susceptible to market fluctuations. Consequently, crypto-backed models offer less reliability than fiat-backed alternatives. Some stablecoins rely on algorithmic stabilization mechanisms. These do not involve backing by any tangible assets; instead, they utilize pre-programmed rules that automatically adjust coin supply in response to market demand, thereby maintaining a stable value (Kwon, 2024). Notable algorithmic stablecoins include USDD, USTC, USDX, CUSD, and AMPL (CoinMarketCap, 2025c).

Beyond price stability, two additional dimensions are vital: liquidity and regulatory clarity. Stablecoins offer high liquidity and can be swiftly converted into fiat or other assets, without the volatility experienced by most other cryptocurrencies. When issued in jurisdictions with comprehensive regulatory frameworks, the role of supervisory authorities becomes essential in ensuring transparency and investor protection.

The utility of stablecoins is evident across various use cases (Chainalysis, 2024):

- Payments – ideal for international transactions due to their low fees and fast processing;
- Inflation hedging – pegged stablecoins provide a store of value, especially in economies experiencing national official currency devaluation;
- Decentralized Finance (DeFi) – foundational tools for lending, borrowing, and providing liquidity in blockchain-based financial systems.

Nevertheless, stablecoins have increasingly been exploited in organized crime. Since 2021, law enforcement agencies have noted a declining use of Bitcoin in illicit transactions, with a concurrent rise in the use of stablecoins (Chainalysis, 2025; Europol, 2024).

Given the exponential market growth, regulators are closely monitoring stablecoin issuers, recognizing their potential to impact global financial stability (Hayes, 2024). However, regulation remains fragmented. Many issuers operate from countries with underdeveloped or ambiguous legal frameworks. For investors, it is generally safer to opt for stablecoins issued under the legal oversight of economically and institutionally robust jurisdictions.

Investor motivations vary. Some allocate portions of their portfolio to high-risk, speculative assets, including cryptocurrencies. Others seek to preserve capital or pursue modest growth. In countries with chronic inflation and currency instability—such as Turkey, Venezuela, and Argentina—citizens are increasingly turning to stable assets like the U.S. dollar and USD-pegged stablecoins to safeguard their wealth. Interestingly, stablecoins are also widely used in countries like the United States, where currency devaluation is not a primary concern (Chainalysis, 2024).

The fundamental goal of stablecoins is value preservation. Nevertheless, investors must remain aware that all cryptocurrencies are inherently risky, and no government or financial institution guarantees their value or offers protection against market losses.

Regulatory Framework for Stablecoins

Until recently, trading in crypto-assets was largely unregulated in most jurisdictions. However, as trading volumes and the share of household and institutional wealth allocated to crypto-assets increased, economically significant countries began introducing legal frameworks to govern this rapidly evolving domain. The use of cryptocurrencies is associated with several systemic risks, including money laundering, terrorist financing, illicit activities, and consumer protection issues. The International Monetary Fund (IMF, 2021) has warned that the absence of adequate regulation may cause financial instability, disruptions to traditional banking systems, and difficulties in enforcing anti-money laundering and anti-terrorism financing laws. Moreover, cryptocurrencies are frequently used as a payment method by criminal organizations. Victims often pay ransoms in crypto-assets, and cryptocurrencies are widely accepted as a medium of exchange on the dark web (Lapuh Bele, 2021).

Different jurisdictions have taken markedly different approaches to these legal challenges. This article focuses on three of the world's most influential economies—the European Union (EU), the United States (US), and China—where regulatory strategies diverge significantly. The EU has introduced a comprehensive, unified regulatory framework via the Markets in Crypto-Assets Regulation (MiCA). In contrast, the US regulatory regime remains

fragmented, with no single overarching federal law for crypto-assets. China has banned privately issued stablecoins altogether and is instead pursuing the development of its central bank digital currency (CBDC) (Adejumo, 2024). Interestingly, Hong Kong, a special administrative region of China, has adopted a more permissive stance and implemented its own crypto-asset trading regulations.

The European Union: A Unified Approach

As of December 31, 2024, the Markets in Crypto-Assets Regulation (MiCA) is in force across the EU. It provides a standardized regulatory framework for all member states and introduces legal requirements for issuers of crypto-assets as well as service providers operating within the sector.

While MiCA does not explicitly use the term stablecoins, it categorizes such instruments under two main classifications:

- Asset-Referenced Tokens (ARTs): Tokens backed by a basket of assets, including fiat currencies, commodities, or other crypto-assets.
- E-Money Tokens (EMTs): Tokens pegged to a single fiat currency, such as the euro or US dollar, and functionally similar to electronic money.

MiCA thereby covers both fiat-pegged stablecoins and those linked to other asset types. The regulation sets specific compliance requirements for both categories, including reserve backing, transparency standards, and regulatory oversight to ensure price stability and consumer protection. Issuers must publish a white paper and comply with disclosure and governance obligations, under the supervision of the European Banking Authority (EBA).

According to MiCA, white papers for ARTs and EMTs must contain key investor protection information, including:

1. Details about the issuer;
2. Token characteristics – type, technical description, and total supply;
3. Stability mechanisms and reserve management procedures;
    - For ARTs: a detailed description of the underlying assets or asset baskets (e.g., currencies, commodities) and the methods used to maintain price stability;
    - For EMTs: clear identification of the fiat currency peg (e.g., the euro) and an assurance of 1:1 convertibility;
4. Holder rights and obligations;
5. Risk disclosures;
6. Governance and compliance policies – Description of the issuer's internal policies on anti-money laundering and counter-terrorism financing; information on compliance with MiCA regulatory requirements, including permissions obtained from the competent authority.

Notably, MiCA prohibits algorithmic stabilization for both ARTs and EMTs. The stability of these tokens must be supported by real, liquid reserves, such as fiat currencies or other high-quality liquid assets.

The United States: A Fragmented Regulatory Environment

In the United States, the regulatory landscape for cryptocurrencies is highly fragmented, with different agencies overseeing distinct aspects of the crypto-asset market. The Securities and Exchange Commission (SEC) is currently the primary authority responsible for overseeing crypto-assets, asserting that many digital coins and tokens meet the legal definition of securities under the Securities Act.

We asked ChatGPT-4o how the U.S. currently regulates stablecoins and which agencies are involved. The model responded: The SEC is actively evaluating whether stablecoins qualify as securities. If they do, the issuers must comply with the full scope of U.S. securities laws. The Commodity Futures Trading Commission (CFTC) classifies certain crypto-assets as commodities or derivatives, and enforces regulatory actions where applicable.

Indeed, the CFTC has already taken enforcement actions against stablecoin issuers. In October 2021, it fined Tether Holdings Ltd. $41 million for misrepresenting that its stablecoin USDT was fully backed by U.S. dollar reserves (CFTC, 2021).

Stablecoin regulation in the U.S. is still under active development, with multiple legislative initiatives and regulatory bodies seeking to address the complex challenges posed by these instruments. As of now, no unified federal statute exists that comprehensively governs stablecoins, although legislative efforts are underway. One key proposal is the Clarity for Payment Stablecoins Act, which aims to provide clear regulatory guidelines for stablecoin issuers (Congress.gov, 2023). According to analysts, if enacted, the bill could curb the market dominance of non-compliant stablecoins (Wynn, 2024).

Stablecoins and Criminal Activity

Cryptocurrencies have become both a target and a medium of exchange in various forms of cybercrime as well as broader criminal activity, including terrorist financing, sanction evasion, illicit trade, and money laundering (Chainalysis, 2025). In 2023, a marked increase was observed in the use of cryptocurrency swapping services, which enable the conversion of one digital asset into another. These services are often exploited by criminal actors to obscure transaction trails and preserve the value of illicitly acquired funds.

Swaps are generally executed for two primary reasons: anonymity and stability. For anonymity, widely used cryptocurrencies such as Bitcoin are exchanged for privacy coins, such as Monero, which offer advanced obfuscation techniques. For price stability, criminals increasingly convert their holdings into stablecoins, such as USDT (Tether) (Europol, 2024).

While the regulated financial system has significantly reduced the incidence of money laundering through stringent laws and robust enforcement, this success has prompted criminal networks to seek alternative financial channels. Stablecoins are emerging as a preferred vehicle for laundering illicit proceeds. According to recent data, 63% of all cryptocurrency transactions linked to criminal activity involved stablecoins, making them the dominant instrument for illicit finance within the crypto ecosystem (Chainalysis, 2025).

RESEARCH QUESTIONS

Given the substantial market share and dynamic growth of stablecoins (Chainalysis, 2024), this study aims to explore several key aspects of their development and usage. We therefore formulate the following research questions:

1. Which stablecoins have the highest market capitalization, and what share of the total stablecoin market do they represent?
2. To what extent are the most capitalized stablecoins compliant with relevant regulatory frameworks?
3. What are the main motivations for consumers to purchase a USD-pegged stablecoin instead of holding actual USD?
4. Which factors most significantly contribute to the volatility of stablecoins?
5. Does the mechanism of value stabilization influence consumers' choice of stablecoin?

RESEARCH METHODOLOGY

We applied the following quantitative methods:

- Analysis of market capitalization data for major stablecoins;
- Evaluation of market share data for stablecoins across global regions and individual countries;
- Comparative analysis of inflation rates in countries where stablecoin-based saving holds a significant market share.

Additionally, we employed a qualitative document analysis method, examining regulatory frameworks and whitepapers of selected stablecoins. For this purpose, we used the Grok 3 artificial intelligence model to support our analytical process.

All data on market capitalization were collected on March 13, 2025, which is also the date on which Grok 3 was prompted to generate regulatory and whitepaper analyses.

ANALYSIS AND RESULTS

Due to the methodological challenge of acquiring a representative global sample of stablecoin users, we were unable to conduct an empirical survey. Instead, we addressed the research questions using publicly available statistical data and qualitative analyses relevant to our study objectives.

Stablecoins by Market Capitalization and Market Share

As of March 13, 2025, data retrieved from CoinMarketCap indicate that the four largest stablecoins by market capitalization were:

- Tether (USDT): 64.90%
- USD Coin (USDC): 26.87%
- Ethena (USDe): 2.51%
- Dai (DAI): 2.47%

All other stablecoins combined accounted for only 3.25% of the market. These proportions are calculated after excluding data marked as self-reported and potentially unreliable, in accordance with the platform's data transparency notices.

Regulatory Compliance of Leading Stablecoins

On February 20, 2025, the European Securities and Markets Authority (ESMA) published a list of ten entities authorized under the MiCA regulation, collectively issuing 15 MiCA-compliant stablecoins (Coinspaidmedia, 2025). Among the top four stablecoins by market capitalization, only USDC, issued by Circle, meets MiCA compliance requirements.

Tether (USDT) has faced regulatory challenges in the United States, including fines and trading restrictions on platforms like Coinbase and Crypto.com due to non-compliance with MiCA (Adejumo, 2024b). Furthermore, Tether's involvement in high-risk jurisdictions (e.g., Iran, Venezuela, Russia) has attracted scrutiny for facilitating transactions outside traditional financial oversight. Despite lacking full regulatory approval in both the U.S. and EU, Tether claims to actively cooperate with regulators to enhance compliance (Tether, 2025b).

Investor confidence remains disproportionately concentrated in Tether and Circle, suggesting either a lack of awareness regarding regulatory risks or trust in issuer assurances. This concentrated exposure increases systemic risk and underscores the need for greater transparency.

Motivations for Purchasing USD-Pegged Stablecoins Over USD

Using Grok 3, ChatGPT-4o, and Microsoft Copilot, we conducted a qualitative inquiry into consumer motivations for choosing USD-pegged stablecoins over fiat USD. Sources cited by AI models were cross-verified for accuracy and relevance. The key motivations include:

- International Payments: Stablecoins facilitate fast, low-cost cross-border transactions, especially in countries with limited access to stable currencies (e.g., Ethiopia, Nigeria).
- Accessibility: They are globally accessible, even in jurisdictions with restricted access to USD (e.g., Venezuela, Nigeria).
- Decentralized Finance (DeFi): Stablecoins enable access to DeFi services in regions with advanced crypto infrastructure (e.g., U.S., U.K., Vietnam, India).
- Anonymity: They offer higher transactional privacy compared to traditional banking systems, appealing to privacy-conscious individuals, businesses in sensitive sectors, users in sanctioned economies, crypto advocates, and illicit actors.

Factors Influencing the Instability of Stablecoins

We conducted a qualitative study using ChatGPT-4. We posed the following query: "What factors most significantly influence the instability of stablecoins?" We requested sources in APA7 format and specific examples for each factor. We utilized the Deep Research function and received a comprehensive response, which we have summarized for this report.

Stablecoins have experienced sudden value losses or deviations from their target value in practice. In recent years, several high-profile cases have revealed various causes for this phenomenon. According to Moody's analysts (2023), the factors contributing to instability include technical, financial, legal, and other issues, such as governance problems or unexpected events within the crypto ecosystem.

Technical Factors

Software bugs, algorithmic flaws, or protocol vulnerabilities can cause de-pegging. For instance, the DAI stablecoin faced a crisis in 2020 due to an Ethereum crash and smart contract malfunction. TerraUSD (UST) collapsed due to inherent design weaknesses in its algorithmic stabilization.

Financial and Economic Factors

Instability may result from:

- Inadequate or illiquid reserve assets
- Insufficient collateralization
- Exposure to volatile macroeconomic conditions

A notable example occurred in March 2023, when USDC briefly de-pegged following the collapse of Silicon Valley Bank, which held ~8% of Circle's reserves (Howcroft & Jaiswal, 2023). Although Circle rapidly restored confidence, the event highlighted even fully collateralized stablecoins' exposure to systemic banking risks. Similar concerns have affected Tether (USDT) due to doubts over reserve transparency, as in the October 2018 Noble Bank incident.

Legal and Regulatory Factors

The lack of legal clarity and supervision has led to instability. Regulatory crackdowns, such as the SEC's 2023 action against Binance USD (BUSD), caused sharp declines in market capitalization. Investigations into Tether and Bitfinex revealed periods of insufficient fiat backing, further affecting trust.

External Ecosystem Shocks

Contagion from broader crypto market events, such as the collapse of FTX in 2022, impacted stablecoin prices, including USDT. Mass redemptions and fear-based sell-offs led to temporary de-pegging.

Governance and Market Psychology

Poor issuer governance and delayed responses can erode market confidence. Fear-induced sell-offs may lead to self-fulfilling devaluation spirals. Effective communication and credible reserve audits are thus essential for maintaining peg stability.

Impact of Collateralization Mechanism on Investor Choice

Due to the lack of global survey data, we assessed investor preferences through market capitalization and the nature of reserve backing.

Our findings indicate that the most popular stablecoins—USDT and USDC—are fully backed by fiat USD reserves. These two coins jointly control over 90% of the market, suggesting a strong investor preference for fiat-collateralized coins over crypto-backed or algorithmically stabilized alternatives. Algorithmic stablecoins attract the least trust due to their instability history.

CONCLUSIONS

Stablecoins serve as a bridge between traditional and decentralized finance, playing an increasingly vital role in global financial systems. Their use in inflation-prone economies and international payments demonstrates their practical utility and potential for financial inclusion.

However, stablecoins also present significant risks, particularly in the realms of regulatory uncertainty, technical flaws, reserve opacity, and market vulnerabilities. The dominant market share of USDT, despite its incomplete regulatory alignment, underscores either user misinformation or complacency about legal compliance.

The MiCA regulatory framework introduces greater safeguards and could enhance investor trust, although it may also constrain innovation. The future of stablecoins will depend on a delicate balance between technological advancement, legal clarity, and user confidence.

Further empirical research is essential to uncover user perceptions and attitudes toward different stabilization mechanisms, which will likely shape the trajectory of stablecoins and the broader digital asset ecosystem.

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IMPLEMENTING SUSTAINABLE STRATEGIES: A CASE STUDY ANALYSIS OF THE SLOVENIAN BUSINESS ENVIRONMENT

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Abstract: *A sustainable business strategy integrates economic, environmental, and social considerations into core operations, aiming for long-term value creation for both the organization and its stakeholders, while ensuring resource conservation. This paper examines the implementation of sustainable business strategies and compliance with European Sustainability Reporting Standards (ESRS) within the Slovenian business environment. It analyzes their content and strategic importance, particularly concerning evolving EU regulations. Employing a methodology that combines a review of relevant literature, analysis of the ESRS, and case study analysis of the Slovenian business environment the research investigates the current state of sustainability practices in Slovenia. The study examines a public initiative to boost Slovenian enterprises' international competitiveness via sustainable business transformation. Case studies showcase best practices in sustainable strategy implementation, emphasizing their critical role in maintaining competitiveness. Supported by national programs like SPIRIT Slovenia and the GZS Sustainability Chains, Slovenian companies are increasingly adopting these practices, reflecting global trends and leveraging local opportunities.*
Keywords: *sustainable business strategy, ESRS, sustainability practices, Slovenian companies.*

1 INTRODUCTION

Sustainability means meeting present needs without jeopardizing those of future generations. It's about balancing economic growth, environmental responsibility, and social well-being. Beyond ethical considerations, sustainability drives value by fostering efficiency, attracting new customers, and creating competitive advantage (etoso, 2025).

The European Union (EU) is prioritizing the shift to a circular economy and sustainability, as demonstrated by the European Green Deal and the 2020 New Circular Economy Action Plan. This focus on circularity is now integrated into EU policies and funding mechanisms for 2021-2027, including cohesion policies, pre-accession policies, and the Connecting Europe Facility. The core principle of a circular economy is to replace the traditional linear model of production, consumption, and disposal with a system that maximizes product lifespan and minimizes waste of materials and energy. The shift to circular economy means a shift towards sustainability (Jaspers, 2022, pp. 5-6).

Consequently, the principles of the circular economy and sustainable development, originating from the EU's decision-making level and subsequently influencing national,

regional, and municipal policies, are now inexorably permeating business systems, compelling them to operate within and adhere to these evolving frameworks.

A sustainable business strategy integrates economic, environmental, and social considerations into core operations, aiming for long-term value creation for both the organization and its stakeholders, while ensuring resource conservation (PeopleThriver, 2025).

Sustainable strategy development relies on both enabling contextual factors and motivating drivers. These create opportunities for success and incentivize businesses to adopt new sustainable approaches (Long, 2019). The global capitalist system and its markets generate sustainability issues like inequality, exploitation, and environmental problems. However, they also offer opportunities for sustainable strategies: for example, industrialization causes environmental damage and inefficient production leads to waste. The undervaluation and finite nature of natural resources also present opportunities for sustainable strategies through more accurate pricing, new products, and sustainable resource management. Local community control can promote sustainable use and local benefits. Finally, the lack of perfect information in markets leads to uninformed consumer choices, creating opportunities for sustainable strategies that address this knowledge gap (Long, 2019).

By establishing a prioritized framework, a sustainability strategy guides investment and performance, while simultaneously engaging internal and external stakeholders in corporate responsibility efforts (Hardyment, 2015, pp. 2).

1. 1 Different Approaches to Defining Sustainable Business Strategies

Sustainable business strategies aim for positive environmental and/or social impact alongside shareholder benefits, with leaders increasingly recognizing their role in addressing global challenges and driving firm success. The triple bottom line framework measures success beyond profit, considering a company's impact on people and the planet (Harvard Business School Online, 2020). This "three P's" (see Table 1) approach encourages businesses to integrate sustainable practices to benefit society and environment while remaining profitable.

Table 1. *Three P's of the Triple Bottom Line*

Profit	The financial return an organization generates for shareholders.
People	An organization's commitment to positively impacting society.
Planet	An organization's effect on the environment.

Source: Harvard Business School Online, 2020.

The triple bottom line framework does not position societal and environmental impact as trade-offs against financial profitability. Rather, numerous organizations have demonstrated that a commitment to sustainable business practices can yield tangible financial benefits. Sustainable business strategies not only allow companies to tap into the growing market for sustainable goods but also enhance investor appeal. While the triple bottom line is used internally, Environmental, Social, and Governance (ESG) metrics provide external validation and public accountability for a company's commitment to sustainable practices alongside financial profitability

Many companies dilute their sustainability efforts by tackling too many issues simultaneously, resulting in a lack of focus and minimal impact. That is why (Jay et. al, 2025) introduced the framework of four lenses. The framework empowers leaders to refine their sustainability strategies through four critical lenses: business value, stakeholder influence, scientific data, and organizational purpose (as presented in Table 2).

Table 2. *The Four Lenses Framework*

Lens	Key Questions	Tools
Purpose *(What do we stand for?)*	• What is our purpose, or put another way, why do we exist? • What are the values that drive the way we do business? • - What is our vision: What is the future we want for our company, industry, and world?	• Facilitated dialogues across the organization • Customer value proposition • Mining organizational history
Stakeholder Influence *(What are people trying to tell us?)*	• What do internal stakeholders—employees and close venture partners, for instance—care about? • What do immediate external stakeholders—current and prospective customers, creditors, investors, suppliers, and regulators—care about? • What do other stakeholders—media, NGOs, future talent, thought leaders, industry associations, and even policymakers—care about? • How do we gather their input, and how could we do it more proactively?	• Customer and employee roundtables • Surveys that include ranking or point allocation • AI sentiment analysis
Science and Technology *(What does the data tell us about our impact and future?)*	• Are there planetary boundaries (and ecological thresholds) that our firm is contributing to crossing? • Are there net-positive impacts that our firm is creating? • Are there social needs that are significant in the societies that are critical to our firm? • How will planetary changes affect our business? • What emerging technologies could create opportunities or threats to our impacts and profitability?	• Life-cycle analysis • Living-wage analyses • Climate physical-risk analysis • Technology and reserve modeling
Business Value *(What affects our bottom line?)*	• How do regulations, fees, waste disposal, turnover, and reputation affect our costs? • When and where are customers willing to pay a premium for better business? • What risks do we face for inaction or increased cost?	• Cost/benefit analysis • Risk analysis • Investor research

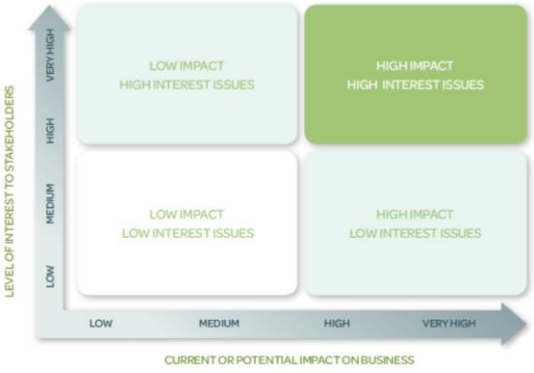
Source: Jay et. al, 2025.

By analysing issues through these interconnected perspectives (through these Lenses Framework), leaders can identify strategic priorities that align with both internal goals and external pressures, ultimately driving impactful sustainability outcomes (Jay et. al, 2025).

Corporate Citizenship together with Richard Hardyment (Hardyment, 2015, pp. 4-13) prepared a guide that simplifies sustainability strategy development by providing clear steps for creation or revision. It highlights opportunities and risks, and addresses key aspects like buy-in, target setting, and implementation. These steps are presented and explained in Scheme 1.

Scheme 1. *Corporate Citizenship's Steps in Developing a Sustainability Strategy*

Step 1: Vision, Mission, Values	**Definition**	**Relevance to sustainability strategy**
Vision	The desired end-goal; a picture of the future world that the organization wants to create.	Inspirational and business-relevant language to tie the strategy back to what the company is trying to achieve.
Mission	How the organization plans to deliver its vision – what it does, who it does it for, and sometimes how.	The mission of the company is a critical starting point for strategy as it explains what the business is setting out to do. Whilst financial viability is still fundamental to success, many more companies are articulating a purpose beyond profit.
Values	The guiding principles by which the organization lives and judges its behaviors.	Values should be reflected in the sustainability strategy. The strategy should provide some tangible means by which to bring the values to life.

Step 2 Identifying the issues that matter	Materiality means identifying and understanding what issues are significant to the business, and its stakeholders, and prioritizing them for action. No business can address all the issues that all stakeholders are interested in. A rigorous process of identifying issues for inclusion in the strategy is therefore an essential starting point. A standard materiality matrix is illustrated to show how the issues are typically mapped.	

Step 3 Prioritizing effectively	Simply identifying the most important issues is not enough for a strategy. A good strategy involves deciding which issues to really focus on, and uniting the elements into a framework for setting targets.

Step 4 **Targets and KPIs**	**Target / Goal:** **What you are trying to achieve** *Key characteristics of good targets:* • Meaningful – targets should set out measurable improvements in performance (the change in a KPI) over a specified time period (e.g. we will reduce carbon emissions by x% over the next z years). • Material – targets should be clearly linked to the key strategic goals and impact areas of the business. • Complete – targets should cover the most important social, environmental and economic impacts of the business. • Consistent – targets should remain relatively consistent over time, so internal and external stakeholders can assess how performance is changing year-on-year. • Ambitious – companies should set targets that move beyond business as usual.	**Key Performance Indicator (KPI): Quantifiable measure used to monitor and evaluate performance towards a target/goal** *Key characteristics of good KPIs:* • Accessible – performance measures should be easily understood and interpreted by all stakeholders. • Relevant – measures should make sense for business managers. They should tie into existing data collection systems and reflect other business performance measures. • Responsive – KPIs should reflect the major concerns of key stakeholders that are considered to be relevant by the business. • Comparable – KPIs should reflect measures that are recognized and significant to the industry in which a company operates.

Step 5 **Implementation**	A sustainability strategy is only as successful as its delivery. It is too easy to overlook the implementation stage when designing a strategy. But putting plans in place to deliver on the programs and targets before the strategy is launched can help to maximize performance in the years ahead.

Source: Hardyment, 2015.

Developing a sustainability strategy allows businesses to assess progress, reassess risks and opportunities, and create a unique framework for focused, authentic action that differentiates them. This framework also streamlines reporting and communication and fostering meaningful stakeholder dialogue. Effective sustainability strategies can drive innovation for growth, establish market leadership and competitive advantage, enhance risk resilience, strengthen reputation and brand, yield cost savings, and motivate employees (Hardyment, 2015, pp. 13).

1. 2 European Sustainability Reporting Standards

Under EU law, larger companies must publicly disclose how social and environmental issues affect their business (risks and opportunities), and how their operations impact people and the environment. This transparency, part of the European Green Deal, helps investors, NGOs, consumers, and other stakeholders assess a company's sustainability performance (European Commission, Finance, 2025).

Starting in January 2024, the European Sustainability Reporting Standards (ESRS), mandated by the Corporate Sustainability Reporting Directive (CSRD), are transforming sustainability reporting in Europe. The first companies have applied these new rules to their 2024 financial year, with reports published in 2025. These 12 standards aim to standardize and improve the transparency of environmental, social, and governance (ESG) reporting, bringing it to the level of financial reporting. This initiative requires in-scope companies to disclose their ESG impacts, risks, and opportunities, driving greater accountability and a more sustainable marketplace (PlanA, n.d., b).

Reporting under the CSRD follows the European Sustainability Reporting Standards (ESRS). These standards are drafted by EFRAG (formerly the European Financial Reporting Advisory Group), an independent multi-stakeholder body (European Commission, Finance, 2025).

The CSRD significantly expands sustainability reporting requirements compared to the Non-Financial Reporting Directive (NFRD), which previously only applied to companies with more than 500 employees. Currently, the CSRD mandates reporting for all large companies exceeding at least two of these thresholds: 250 employees, €50 million turnover, or €25 million in total assets. Additionally, all listed companies (except micro-enterprises) are now required to report. This will encompass around 50,000 EU companies, accounting for 75% of the EU's total turnover. In the future, the CSRD will also apply to non-EU companies with substantial EU operations (€150 million+ net turnover within the EU) (PlanA, n.d., a).

The CSRD expands sustainability reporting obligations to more companies and demands a higher level of detail than the NFRD. Beyond previous requirements, companies must now provide in-depth reports on segments described in Table 3.

Table 3. *Corporate Sustainability Reporting Directive – Reporting Topics*

Reporting topic	Description
Environmental protection measures	Businesses must disclose specific initiatives to reduce their environmental footprint, including resource conservation and pollution prevention strategies.
Social responsibility and treatment of employees	This includes everything from employee health and safety protocols to employee benefits and company culture.
Respect for human rights	Companies must discuss their policies on human rights and how they ensure these rights are not violated within their operations.
Anti-corruption and bribery measures	Businesses must explain their strategies to prevent corruption and bribery, including corporate governance measures and ethics training programs.
Diversity on company boards	The CSRD requires companies to provide a detailed breakdown of the diversity of their board members, focusing on aspects such as gender, age, and nationality.

Source: PlanA, n.d., a.

These standards comprehensively address environmental, social, and governance issues, such as climate change, biodiversity, and human rights. Designed to inform investors about companies' sustainability impact, they also ensure high interoperability with global standards (International Sustainability Standards Board - ISSB, Global Reporting Initiative - GRI) to minimize redundant reporting for businesses. The International Sustainability

Standards Board (ISSB) and the European Commission services, together with EFRAG (organization, that serves the European public interest in financial and sustainability reporting), have worked together during the development of the European Sustainability Reporting Standards (ESRS) and the IFRS Sustainability Disclosure Standards (ISSB Standards) to achieve a high degree of alignment of the respective standards, with a specific focus on climate-related reporting (EFRAG & IFRS, n.d., pp 2-3).

2 METHODOLOGIES

The initial chapters provided background on sustainability and sustainable business strategies through desk research. Subsequent chapters employed a combination of scientific methods, including abstraction, concretization, generalization, specialization, qualitative research (observations, case study), analysis, and synthesis, to determine relevant knowledge and its application to the Slovenian business environment. The research specifically investigated companies' approaches to developing sustainability strategies, the tools they use, and the resulting business advantages, particularly concerning the complexities of sustainability practices and their impact on competitive advantage.

The organizations for the analysis were selected based on the following criteria:

- Recognition in the field of sustainable development: Organizations publicly recognized for their activities and efforts in the field of sustainability were selected. This was determined based on data from the agency SPIRIT Slovenija (Slovenian Agency for the Promotion of Entrepreneurship, Innovation, Development, Investment and Tourism) and the results of online searches (review of company websites, sustainability reports, media publications, etc.).
- Diversity of industries: Organizations from various economic sectors in Slovenia were intentionally selected to gain a broader insight into the diversity of approaches to sustainable strategies.
- Availability of public information: Organizations with sufficient publicly available information regarding their sustainable strategies and practices were prioritized for the analysis.
- Online search results: Targeted online searches using keywords related to sustainability and the names of the selected organizations were conducted to gather relevant information about their strategies, sustainability reports, projects, and achievements.

The analysis of the collected data was conducted using the content analysis method, through which key themes, patterns, and best practices in the field of sustainable strategy implementation in the Slovenian business environment were identified.

3 A CASE STUDY ANALYSIS OF THE SLOVENIAN BUSINESS ENVIRONMENT

Slovenia, as a member state of the European Union, actively aligns its national sustainable development strategies and policies with the overarching EU Green Deal and related directives. The Slovenian government translates these EU guidelines into national frameworks, often prioritizing areas such as the transition to a low-carbon circular economy, biodiversity conservation, and resource efficiency, as outlined in national development plans and legislative acts. For example, The Slovenian Development Strategy 2030, also includes sustainable development goals in order to implement the global development plan set out in

the UN's 2030 Sustainable Development Agenda (2030 Agenda) (Government Office for Development and European Cohesion Policy, 2017). These national strategies then inform regional development priorities, which are frequently supported by various EU funding mechanisms, including the European Regional Development Fund, the Cohesion Fund, and specific programs dedicated to green transition and innovation. This financial support enables regions to implement projects aligned with EU and national sustainability goals, such as developing green infrastructure, promoting sustainable mobility, and supporting the adoption of circular economy practices at the local level. Lazar (2024) highlighted the progress in understanding and funding sustainable development and the circular economy through different EU funds and schemes. EU funding opportunities offer municipalities and regions a way to partially finance their green transitions. Consequently, Slovenian companies operating within these regions are influenced by these developments through new regulations, incentives for sustainable practices, and evolving market demands driven by the broader green transition. Furthermore, EU directives like the Corporate Sustainability Reporting Directive (CSRD) directly mandate sustainability reporting for a significant number of Slovenian companies, pushing them towards greater transparency and integration of sustainable practices into their core operations, thereby reflecting the top-down influence of EU policy and funding on the Slovenian business environment.

3. 1 Slovenian Business Environment and Sustainability

The green, sustainable, and circular development of the economy is both a trend and a necessity for maintaining long-term international competitiveness. The transition to a low-carbon circular economy in Slovenia is among its strategic development priorities. Slovenia will achieve this goal by promoting innovation, new business models, digital transformation, the efficient use of raw materials by closing material and energy flows, and adaptation to climate change (GZS, 2022).

With growing awareness of the environmental, social, and economic impacts of business operations, a rising number of Slovenian companies are focusing on sustainable practices, and this is how it reflects on Slovenia business environment based on the studies done by the portal Električna prihodnost (Električna prihodnost, 2023):

- *Regulatory Framework*: In recent years, Slovenia has adopted numerous laws and strategies promoting sustainable development. The European Union, of which Slovenia is a member, also dictates many guidelines and requirements in the field of sustainability, which influence the operations of companies in the country.
- *Green Economic Orientation*: Slovenia is recognized for its natural resources and biodiversity. Many companies are leveraging this natural heritage by promoting sustainable practices, green technologies, and ecological products.
- *Certificates and Labels*: Numerous Slovenian companies are obtaining international certifications such as ISO 14001 (environmental management) or EMAS (Eco-Management and Audit Scheme). These certifications help companies establish sustainable practices and communicate with stakeholders.

- *Stakeholder Engagement*: Sustainability efforts are reflected not only in internal company practices but also in interactions with customers, suppliers, local communities, and other stakeholders.
- *Sustainability Reporting*: An increasing number of Slovenian companies are publishing sustainability reports, where they transparently communicate about their environmental, social, and economic impacts.
- *Education and Training*: Successful implementation of sustainable practices requires continuous education and training of employees. Many companies and organizations in Slovenia organize seminars, workshops, and other events focusing on sustainability and corporate social responsibility.
- *Partnerships and Collaboration*: Slovenia has an active network of organizations, associations, and institutions that promote sustainable development. Companies often collaborate with them for knowledge exchange, joint projects, and initiatives.
- *Innovations for Sustainability*: Many Slovenian companies are investing in research and development to find new, more sustainable solutions, whether in the field of production, services, or technologies.

Many Slovenian companies have consciously decided to overhaul their business operations and integrate sustainability aspects into every segment of their processes. Naturally, companies are approaching this in various ways. The majority have addressed it in only one segment, primarily at the development-product level, often driven by customer requirements or positioning within global value chains. However, only a smaller proportion of companies have adopted a comprehensive or strategic approach (Obrtno podjetniška zbornica Slovenije, 2021).

3. 2 Sustainable Business Transformation in Slovenian SMEs: An Analysis of a Public Support Initiative

The study we conducted, examines a public call aimed at enhancing the international competitiveness and export intensity of Slovenian enterprises through the implementation of sustainable business strategic transformation. SPIRIT Slovenija, the public agency, actively began introducing comprehensive and strategically oriented sustainable business practices as early as the beginning of 2016 with a two-year pilot project titled *Establishing Sustainable Business Strategies and Business Models in Practice*. Nine Slovenian companies, selected through a public call, participated in the project, becoming the first to embark on the path of strategic sustainable transformation: M Sora, trgovina in proizvodnja d.d., Lumar IG d.o.o., Iskraemeco, merjenje in upravljanje energije d.d., Hotel Sava Rogaška d.o.o., Engrotuš podjetje za trgovino d.o.o, Anton Blaj d.o.o., Sij d.d., Steklarna Rogaška d.o.o., Talum d.d. (Rejc Buhovac, et. al, 2019).

SPIRIT Slovenija afterwards prepared a handbook *Sustainable Business Strategies and Sustainable Business Models in Slovenian Practice* based on the experiences from the national pilot project mentioned above, which was implemented in the years 2016-2017 and in which the before-mentioned 9 Slovenian companies have participated in (Rejc Buhovac, et. al, 2019). It was also created based on the experiences that the authors of this handbook gained in collaboration with leading global corporations in the field of sustainable business, such as Nike,

P&G, The Home Depot, Nissan North America, Patagonia, and others. The manual offers: *(I)* precise explanations of concepts, *(II)* answers to questions, why sustainable business is beneficial to business, *(III)* the central part of the manual provides instructions on how to implement sustainable business into strategic and operational processes effectively, (*IV*) it also explains, how companies can benefit from the help of an external expert in implementing the process of sustainable corporate transformation.

Additionally, the indicated handbook advises on steps for Slovenian companies to follow for sustainable transformation (Rejc Buhovac, et. al, 2019):

- *Selection of strategic team members*, where the key challenges are:
    - identifying the key experts and opinion leaders who are open to the changes required by sustainable business practices;
    - engaging participants to willingly cooperate;
    - ensuring the entire team works openly and with commitment, despite potential disagreements due to different perspectives;
    - achieving consensus.
- *Identification of sustainable business opportunities*, where the key challenges are:
    - including representatives of all key stakeholders in the sample of participants (survey respondents, interviewees);
    - many sustainable business opportunities are hidden behind the guise of sustainability risks.
- *Analysis of the existing business strategy and business model*, where the key challenges are:
    - to openly and critically identify gaps or weaknesses in the company;
    - to recognize the interconnectedness of the company's units and their interdependence when they influence these gaps and weaknesses.
- *Writing the vision*, where the key challenges are:
    - to reach an agreement on what the company should look like in the target year;
    - to include all essential sustainability challenges and their related risks, and to anticipate innovative solutions and target states.
- *Developing a sustainable business strategy*, where the key challenges are:
    - to select the right priorities;
    - to map out the sustainable business strategy as a logical series of hypotheses about cause-and-effect relationships, which also include stakeholder responses.
- *Defining indicators for strategic control and their target values*, where the key challenges are:
    - to define indicators that can be easily supported by information systems;
    - to anticipate which methods will allow for the efficient collection of new data needed to calculate the indicators;
    - to set meaningful target values (considering the variability of the environment and the company's capabilities.

- *Developing a plan of projects and measures that support the implementation of the strategy*, where the key challenges are:
    - to find the most suitable organizational solution to support sustainable business practices;
    - to find the most appropriate way to motivate employees to strive for the realization of the sustainable business strategy;
    - to appoint a colleague who can take on the tasks of project management – a coordinator of strategic activities and those participating in them.
- *Preparation of a new business model*, where the key challenges are:
    - to identify all the areas where the business model has changed;
    - to know how to document and emphasize its sustainable elements.
- *Monitoring the implementation of the sustainable business strategy*, where the key challenges are:
    - to consistently monitor progress; not to allow operational, day-to-day challenges to hinder regular monitoring and strategy review;
    - to insist that all those responsible for strategic activities participate in progress reporting.
- *Communicating sustainable and business performance*, where the key challenges are:
    - to prepare engaging yet credible content for the sustainability report;
    - to ensure regular, truly frequent communication.

Insights from practice confirm the weaknesses and strengths that companies face during the sustainable transformation of their operations. Building on the exceptional results and impacts achieved by the aforementioned pilot project, an additional public call was open for Slovenian companies aiming at enhancing the international competitiveness and export intensity of Slovenian small and medium-sized enterprises (SMEs) through the implementation of sustainable business strategic transformation. The primary objective of the initiative was to facilitate the adoption of sustainable practices and the development of new business models within these enterprises. This was pursued through two key activities: *(I)* the engagement of at least 60 SMEs in a strategic transformation process, leading to the formulation of sustainable business strategies, novel business models, and proposals for implementation projects; and *(II)* the provision of financial support for a minimum of 60 implementation projects demonstrably contributing to the realization of the aforementioned sustainable business strategies. This intervention, conducted between 2019 and 2021, represents a targeted effort to integrate sustainability principles into the core operations of Slovenian SMEs to bolster their global market position (SPIRIT Slovenija, 2019). Key insights of the intervention reveal that successful strategic sustainability transformation hinges on mature awareness, and motivated leadership capable of addressing identified weaknesses. While awareness of sustainable business needs varies, its direct link to financial improvement is often poorly understood. Companies tend to under address their weaknesses, which become critical in crises. Tailoring the transformation process to each company (considering its specifics) and broadly engaging employees are vital for building trust and commitment. Many SMEs lack long-term strategies and defined KPIs, hindering monitoring and timely action. Establishing clear, fact-based indicators can drive improvement and accountability. Crucially, rapidly detecting changes and

risks is increasingly important for proactive action and future success (Obrtno podjetniška zbornica Slovenije, 2021).

3. 3 Slovenian Practices and Sustainable strategies

The Chamber of Commerce and Industry of Slovenia (Gospodarska zbornica Slovenije – GZS) introduced the Sustainability Chains (Tranjostne verige), a platform and community dedicated to connecting, educating, and empowering Slovenian companies on their journey of sustainable transformation. They recognized that sustainability is a path they build together with employees, partners, companies, institutions, and individuals – united by the vision of creating a fair, responsible, and green future. The experiences and challenges in establishing sustainable strategies for individual companies included in this community/platform are listed as examples of good practices below (GZS, 2025):

- *Adria Mobil* already developed its first sustainability strategy in 2020. In 2021, they calculated the company's carbon footprint. In 2023, they updated their sustainability goals, and in 2024, they also began sustainability reporting.
- *Iskraemeco* has a holistic approach to sustainable development, which is increasingly embedded in the company's strategy, values, and culture. They strive for complete transparency in their operations and conduct. Since 2024, they have also had a working group within the company with a responsible person for sustainable development.
- Corporate social responsibility, ecological efforts, and the sustainable orientation of the company are also part of the business strategy of *Unichem*. They also invest heavily in the education of employees and the wider society through their Gaia magazine.
- *SID Bank* promotes the financing of sustainable projects and companies through its SID zelen (SID Green) program. Insurance is provided through the EIF guarantee scheme. SID Bank is also transitioning to sustainability reporting in accordance with CSRD for its 2025 reporting. It is also aligning its requirements for companies' ESG data with the disclosure requirements of the CSRD directive and ESRS standards.

A good case example in the field of sustainable operation of companies in Slovenia is the *Talum Group* (Talum, n.d.). The sustainable development of the Talum Group is based on increasing the scope and complexity of products and services, improving productivity and efficiency, and ensuring the highest quality with an emphasis on environmental protection and efficient energy use, health and safety at work, fair treatment of employees, information security, risk management, and the code of business conduct within the Talum Group. The Talum Group has adopted a Sustainable Development Policy of the Talum Group, which covers the aforementioned areas, together with set goals, in accordance with which it also operates. The Sustainable Development Policy has been in effect since June 1, 2023, and defines the foundations of operation in the areas of quality, working conditions and human rights, which include respect for human rights, the right to equal opportunities and treatment of employees, the prohibition of child and forced labor, the limitation of working hours, and the right to freedom of association and collective bargaining. An effective occupational health and safety system, an efficient environmental and energy management system are established, where they are particularly committed to mitigating and adapting to climate change, preserving

biodiversity, and the use and consumption of natural resources and energy. They care for the quality of air, soil, and groundwater, and in waste management, they follow the waste management hierarchy. They are committed to the responsible sourcing of input materials, especially critical minerals from conflict zones. They operate in accordance with the adopted business code of conduct, effectively manage risks, and with the established information security system (TISAX), we protect confidential data and information from unauthorized access, use, disclosure, alteration, or destruction. They also prepare a Sustainable Development Report of the Talum Group (available online for 2022 and 2023) (Talum, n.d.).

Another example of the successful implementation of a sustainable business strategy is the company Menerga. Menerga is a high-tech engineering company that provides energy-efficient air conditioning, ventilation, heating, and cooling solutions. At the end of 2021, the company presented the Sustainable Strategy 2022 – 2025. The strategy outlined activities defined by a broader group of Menerga employees based on the co-creation of a shared company vision for 2025. The Sustainable Business Strategic Transformation preparation program, which resulted in the Sustainable Strategy document, aimed to establish sustainable strategic foundations for business operations and adopt appropriate values that serve as the basis for building true, better company value in new business, social, environmental, and economic situations (Menerga, 2021).

DISCUSSIONS/CONCLUSSIONS

To build lasting organizations and thriving communities, leaders must prioritize sustainability today. In an era of heightened transparency, a robust sustainability strategy that integrates employee well-being and environmental responsibility is not just a future trend, but the essential path to enduring prosperity (PeopleThriver, 2025). While businesses have historically contributed to environmental problems, they are also uniquely positioned to drive positive changes through the adoption of sustainable practices.

Adopting sustainable business practices offers numerous benefits, driving internal innovation by prompting a reassessment of operational inefficiencies and material sourcing, potentially leading to cost savings. Investing in renewable resources also improves environmental and supply chain risk management. Furthermore, a strong sustainability program attracts and retains talent, particularly millennials, and expands audience reach by appealing to sustainably minded consumers, ultimately building brand loyalty. Utilizing fewer or more sustainable resources directly reduces production costs. Opting for sustainability can also generate positive publicity, enhance a company's standing in a competitive market by differentiating its brand, and even set industry trends, potentially inspiring broader adoption of sustainable practices (Harvard Business School Online, 2021).

Corporate sustainability in Slovenian companies reflects global trends while also capitalizing on local opportunities and specificities. With the increasing need for sustainable business operations and the commitment to the Sustainable Development Goals, this trend is expected to continue to grow in Slovenia.

As presented herein, a significant number of Slovenian companies have already embarked on their journey towards sustainable business practices and the development of sustainable business strategies. To further facilitate this transition, companies can leverage

insights from the outcomes of past SPIRIT Slovenija calls for proposals (presented in this paper), utilize available resources such as the aforementioned handbook "Establishing Sustainable Business Strategies and Business Models in Practice", and engage with initiatives like the GZS Sustainability Chains program, which is empowering Slovenian companies on their journey of sustainable transformation.

Also financing SME projects and investments for reducing environmental impact is important. Two most used financing possibilities for Slovenian companies are (Obrtno podjetniška zbornica Slovenije, 2021):

- *SID Bank* provides financing in the areas of renewable energy sources, efficient energy use, clean transport, pollution prevention and control, and the circular economy, etc.
- *The Eco Fund* offers non-refundable grants and favorable loans to companies planning environmentally friendly investments in areas such as heating and ventilation, insulation and windows, efficient energy use, electricity self-sufficiency, construction or comprehensive renovation of buildings, vehicles and sustainable mobility infrastructure, water, air pollution reduction, waste management and asbestos removal, and initial investments in environmental technologies.

Reconciling economic profit with social and environmental value creation is central to sustainability, requiring a delicate balance often explored in strategy literature through 'win-win' scenarios. While legitimizing sustainability, this focus can limit action by overlooking opportunities where significant social or environmental gains necessitate minor economic trade-offs. Consequently, potentially impactful initiatives with slight economic costs may be deemed illegitimate, hindering substantial societal and environmental improvements (Long, 2019).

Looking ahead, integrating sustainable business strategies is a fundamental imperative for long-term viability and competitive advantage. Future success depends on organizations proactively embedding environmental, social, and governance factors into their core operations, recognizing the interconnectedness of planetary health, societal well-being, and economic prosperity. This requires systemic transformations, fostering innovation in circular economy models, resource efficiency, and equitable value creation, driven by increasing stakeholder demands and the urgency of global challenges.

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STRATEGIC AND ECONOMIC FEASIBILITY OF HYDROGEN INTEGRATION IN AIRPORTS: A CASE STUDY OF TIRANA INTERNATIONAL AIRPORT

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Abstract: *Hydrogen and fuel cell technologies are increasingly recognized as strategic tools for decarbonizing the aviation sector, offering not only environmental benefits but also operational and economic value. However, their effective integration within complex airport ecosystems remains underexplored, particularly concerning investment planning and infrastructure management. This study evaluates the technical, environmental, and economic feasibility of deploying hydrogen technologies at Tirana International Airport (TIA), focusing on both stationary and mobility applications powered by rooftop photovoltaic (PV) systems. Scenario-based modeling shows that allocating 25% of TIA's PV output could produce approximately 5,750 kg of green hydrogen annually—sufficient to supply 96 MWh of clean electricity or support 63,889 km of hydrogen-powered vehicle travel. The environmental assessment reveals a net annual CO_2 reduction of 58,576 kg, primarily from mobility uses, which alone account for 70,181 kg of avoided emissions. Economic analysis estimates the Levelized Cost of Hydrogen (LCOH) at €6.91/kg under current conditions, with potential to decline to €4.45/kg in a lower-CAPEX scenario. The corresponding cost for hydrogen mobility ranges from €1.16/km to €0.85/km, depending on technology and investment assumptions. These results highlight the importance of capital planning, utilization rates, and cost optimization strategies for real-world deployment. A SWOT analysis is used to identify strategic enablers and barriers, revealing key opportunities such as access to EU funding, public-private partnerships (PPPs), employment creation, and the potential to position TIA as a green infrastructure leader in the Western Balkans. The study concludes that hydrogen integration, if paired with targeted investment, institutional support, and coordinated stakeholder engagement, can significantly enhance airport resilience, energy autonomy, and economic competitiveness, aligning with both national policy priorities and broader European sustainability goals.*

Keywords: *Hydrogen Technologies, Economic Feasibility, Strategic Airport Management, Green Energy Transition, SWOT analysis*

1. INTRODUCTION

Air transport is a key driver of global socio-economic development, generating direct, indirect, and induced economic impacts through employment, service provision, and supply chains (Dimitrios & Maria, 2018, p. 285; Cristureanu & Bobircă, 2007, p. 34). The expansion of airport infrastructure not only supports the aviation industry but also stimulates regional economic growth, enhances connectivity, and improves access to global markets (Zhang & Graham, 2020).

Albania has seen a significant surge in air passenger traffic, with over 10 million passengers processed at Tirana's "Mother Teresa" International Airport in 2024 (Tirana International Airport, 2024). Following its planned expansion, the airport aims to handle up to 15 million passengers annually, reinforcing its role as a key regional hub. According to ACI Europe (2023), the total economic impact of airports in Albania—including direct, indirect, induced, and catalytic effects—contributes approximately €0.4 billion to the national GDP and supports around 6,500 jobs. However, the rapid growth of tourism brings challenges related to safety, operational costs, and energy efficiency (Baroutaji et al., 2019, p. 35). Airports are high-energy consumers (Ortega Alba & Manana, 2017, p. 5), and as operations expand, so do carbon emissions due to increasing power demands from terminals, ground vehicles, and infrastructure (El Zein et al., 2025, p. 1363).

To reduce their climate footprint, airports are adopting sustainability strategies focused on decarbonization, energy efficiency, and green infrastructure (Degirmenci et al., 2023, p. 6). Tirana International Airport (TIA) has embraced this transition by installing solar panels, replacing traditional lighting with LEDs, incorporating electric vehicles, and deploying energy-efficient systems (Farabbi, 2024, pp. 6-8). Given their scale and energy demand, airports are well-positioned to adopt next-generation clean technologies. Among these, hydrogen and fuel cell systems are emerging as promising solutions for decarbonizing operations. With global hydrogen demand expected to increase nearly eightfold by 2050 (Rasul et al., 2015, p. 112), these technologies offer advantages such as high energy density, improved efficiency, and minimal noise, making them ideal for reducing emissions in airport environments (Wu et al., 2025, p. 715). Growing research highlights the feasibility of hydrogen and fuel cell systems in airport settings, including fixed installations such as microgrids and ground operations, as well as mobile applications like hydrogen-powered aircraft. Studies explore energy efficiency, emissions reductions, infrastructure needs, and cost-effectiveness. For instance, Zhou (2022) investigates hydrogen storage for low-carbon airport systems, while Xiang et al. (2021) propose a hydrogen-solar microgrid for electrification. Gu et al. (2023) address infrastructure needs for hydrogen-fueled aircraft, and Testa et al. (2014) document environmental benefits in ground handling. Degirmenci et al. (2023) assess the sustainability and cost structure of hydrogen supply chains, and Baroutaji et al. (2019) provide a comprehensive review of aviation-related hydrogen technologies. Recent literature also emphasizes the broader economic, innovation, and policy contexts driving such technological transitions. Abbasov (2024) and Korohod (2023) underline the importance of green economy frameworks and decarbonization strategies in addressing global environmental and energy challenges. Živanović et al. (2023) highlight the role of innovation management in improving sustainability

performance and business excellence, while Hysaj and Sulçaj (2024) demonstrate the positive impact of infrastructure-focused innovation on economic growth in the Western Balkans.

Framing hydrogen deployment at TIA through the lens of the enterprise ecosystem further reinforces its strategic relevance. As Nahara (2024) explains, enterprise ecosystems grounded in sustainable development promote cross-sectoral collaboration, knowledge exchange, and flexible innovation pathways. These ecosystems enable autonomous actors, such as airports, energy providers, and public institutions, to cooperate dynamically, thereby maximizing synergy and accelerating green transformation. Positioning TIA as a hub within such an ecosystem highlights its potential to contribute not only to Albania's decarbonization efforts but also to regional innovation and resilience.

This study aims to explore the potential integration of hydrogen and fuel cell technologies within the Tirana International Airport (TIA) ecosystem. Specifically, it assesses the technical, environmental, and economic feasibility of applying hydrogen solutions for both stationary and mobile airport operations. Additionally, a SWOT analysis is conducted to evaluate the strategic strengths, weaknesses, opportunities, and threats associated with hydrogen deployment at TIA.

2. METHODOLOGY

This study applies a quantitative, scenario-based methodology to evaluate the feasibility, sustainability, and strategic implications of hydrogen and fuel cell deployment at Tirana International Airport (TIA). The approach integrates technical modeling, environmental performance analysis, and economic feasibility assessments to explore the potential of green hydrogen use in stationary and mobility-related airport operations. Specifically, the methodology includes:

- Energy modeling to estimate hydrogen production from photovoltaic (PV) systems and its conversion efficiency via proton exchange membrane (PEM) fuel cells.
- Emissions analysis to quantify avoided CO_2 emissions compared to diesel-based mobility and grid-based electricity.
- Levelized Cost of Hydrogen (LCOH) and cost-per-kilometer indicators to assess economic viability under different capital expenditure (CAPEX) scenarios.
- Strategic evaluation tools, including a SWOT analysis, to capture the broader operational, regulatory, and investment dimensions relevant for airport management and policy planners.

By combining techno-economic metrics with scenario planning and strategic analysis, this methodology provides not only a sustainability assessment but also decision-support insights for infrastructure managers, energy planners, and investors evaluating green transitions in the airport sector.

2.1.Hydrogen production modelling

Hydrogen production from the airport's rooftop photovoltaic (PV) system is estimated using the following relationship:

$$H_2 \text{ produced} = \frac{E_{PV,allocated}}{EC_{H_2}} \quad \text{(Eq. 1)}$$

Where: $E_{PV,allocated}$ - Annual PV energy allocated for electrolysis (kWh/year); EC_{H_2} - Specific energy consumption of the electrolyzer (kWh/kg H_2)

The hydrogen production potential was estimated based on the annual output of Tirana International Airport's rooftop photovoltaic (PV) system (Figure 1), which generates approximately 1,334 MWh/year.

Figure 1. *Solar panels installed on the roof of a building at Tirana International Airport. Tirana International Airport.*



Source: Vega Group

For modeling purposes, it was assumed that 25% of the airport's energy consumption could be diverted to power an electrolyzer for green hydrogen production. This allocation was informed by an analysis of the official flight departure schedule for Tirana International Airport, which highlighted periods of reduced operational activity, particularly between 10:00 and 15:00. During these hours, the number of departing flights decreases significantly, as confirmed by a detailed breakdown of hourly flight data. These midday hours also align with peak solar photovoltaic (PV) generation, presenting a strategic window in which surplus solar electricity can be utilized without impacting critical airport operations. To estimate hydrogen output, the specific energy consumption of the electrolyzer was set at 58 kWh per kilogram of hydrogen, encompassing both stack performance and auxiliary system loads. In low-temperature electrolyzers like ALK, PEM, and AEM, energy consumption of about 55–60 kWh is expected per kg of hydrogen produced (Franco and Giovannini, 2023, p. 7).

2.2.Energy recovery and mobility estimation

Following the estimation of hydrogen production potential, this section evaluates two key application pathways for the generated hydrogen: stationary energy recovery and airport ground mobility. Each pathway is analyzed to estimate the energy output, operational implications, and corresponding environmental benefits.

Hydrogen produced on-site can be converted back into electricity during periods of peak demand or grid instability using proton exchange membrane (PEM) fuel cells. The energy recovered from hydrogen is calculated using the following relationship:

$$E_{recovered} = \eta_{FC} \times H_2\,produced \times LHV_{H_2} \quad \text{(Eq. 2)}$$

Where: $E_{recovered}$ - Electrical energy recovered (kWh/year); η_{FC} - Electrical efficiency of the fuel cell (assumed 50%); $H_2\,produced$ - Annual hydrogen production (kg/year); LHV_{H_2} - Lower heating value of hydrogen (kWh/kg)

Hydrogen is also considered a clean fuel alternative for ground support equipment (GSE) such as passenger transport buses, baggage tugs, and service vehicles, which are currently powered by diesel. The annual driving range achievable with the available hydrogen is estimated using:

$$Mobility\ Range_{H_2} = \frac{H_2\,produced \times 100}{C_{veh}} \quad \text{(Eq. 3)}$$

Where: $Range_{H_2}$- Total driving range (km/year); C_{veh} - Average hydrogen consumption per 100 km (kg H_2/100 km)

For the mobility analysis in this study, performance assumptions for hydrogen refueling stations (HRS) and fuel cell buses (FCBs) were drawn from established industry expectations. A specific fuel consumption of 9 kg H_2 per 100 km was used as the median value for estimating the annual driving range of hydrogen-powered airport vehicles (Buss et al., 2022). The availability of the bus fleet was assumed to be 90%, ensuring consistent service levels comparable to conventional systems. Refueling operations were modeled with a 10-minute average fill time, aligning with operational demands in airport environments.

2.3. Levelized cost of hydrogen (LCOH) calculation

The Levelized Cost of Hydrogen (LCOH) is determined by assessing all costs incurred over the lifetime of a hydrogen production system, including capital expenditures (CAPEX), fixed and variable operational expenditures (OPEX), and electricity costs, relative to the total hydrogen produced over the system's operational period (Equation (1)).

$$LCOH = \frac{LHV}{\eta_{sys,LHV}} + \left(\left(\frac{\left(\frac{i}{100} * \left(1+\frac{i}{100}\right)^n\right)}{\left(1+\frac{i}{100}\right)^n - 1} + \frac{OPEX}{100} \right) \frac{CAPEX}{\tau} + E \right) \quad \text{(Eq. 4)}$$

Where LCOH: Levelized Cost of Hydrogen [€/kgH_2]; LHV: Lower Heating Value [kWh/kgH_2]; i: Discount Rate [%]; n: Lifetime [a]; E: Electricity Costs [€/kWh]; ηsys, LHV: System Efficiency related to the LHV; τ: Full Load Hours [h]; OPEX: Operational Expenditures [CAPEX/a]; CAPEX: Capital Expenditures [€/kW]

The LCOH was calculated using the Umlaut & Agora Industry Excel tool (v1.0, 2023). The analysis assumes a capital expenditure (CAPEX) of €1,970/kW (Clean Hydrogen Joint Undertaking, 2024), annual operation and maintenance (O&M) costs equal to 3.5% of CAPEX, a 20-year system lifetime, and a 5% discount rate. To reflect real-world infrastructure conditions, an additional 15% of CAPEX was included to cover civil works, such as installation, site adaptation, safety systems, and integration.

2.4.Emission reduction potential

Both application pathways—stationary energy recovery and hydrogen-powered mobility—contribute to the reduction of carbon dioxide (CO_2) emissions at Tirana International Airport (TIA). This section outlines the methodological approach used to quantify these environmental benefits.

a) Avoided emissions from grid electricity replacement

When hydrogen is used in fuel cells to generate electricity on-site, it can reduce reliance on grid-supplied electricity. The emissions avoided from displacing grid electricity are estimated using the following equation:

$$CO_{2,avoided}^{grid} = E_{recovered} \times EF_{grid} \quad \text{(Eq. 5)}$$

Where: $CO_{2,avoided}^{grid}$ - Annual avoided emissions from grid electricity substitution (kg CO_2/year); $E_{recovered}$ - Annual energy recovered via hydrogen fuel cells (kWh/year); EF_{grid} - CO_2 emission factor for diesel combustion (3.622 kg CO_2/l), based on Eco Cost Value Idemat 2025RevA6.xlsx database.

This method provides a conservative estimate, as grid emission factors are subject to change depending on the energy mix and seasonal hydropower availability.

b) Avoided emissions from diesel replacement in mobility

Replacing diesel-powered ground support vehicles (GSE), such as airport buses and baggage tractors, with hydrogen-powered alternatives significantly reduces emissions from combustion. Avoided emissions from this substitution are calculated using:

$$CO_{2,avoided}^{diesel} = Fuel_{displaced} \times EF_{diesel} \quad \text{(Eq. 6)}$$

Where: $CO_{2,avoided}^{diesel}$ - Annual CO_2 reduction from diesel fuel replacement (kg CO_2/year); $Fuel_{displaced}$ - Diesel fuel equivalent (liters or kg) replaced by hydrogen use; EF_{diesel} - CO_2 emission factor for diesel combustion (3.622 kg CO_2/l), based on Eco Cost Value Idemat 2025RevA6.xlsx database.

The equivalent diesel displacement is estimated by comparing the hydrogen-based driving range with the average diesel fuel consumption of GSE operating under similar load conditions.

2.5.SWOT evaluation

To assess the strategic feasibility of integrating hydrogen and fuel cell technologies at Tirana International Airport (TIA), a SWOT (Strengths, Weaknesses, Opportunities, Threats)

analysis was conducted. This approach was chosen to systematically identify internal capabilities and external conditions that may influence the success of hydrogen deployment across both stationary and mobile airport applications. Insights were informed by previous SWOT analyses published in various international contexts (Ren et al., 2015; Bednarczyk et al., 2022; Khan & Kamdi, 2023; Bayssi et al., 2024; Furuncu, 2025), offering valuable comparative perspectives on hydrogen market dynamics, implementation challenges, and strategic opportunities relevant to TIA's case.

3. RESULTS

3.1.Hydrogen yield and operational potential

Table 1 summarizes the key energy conversion outcomes from the modeled integration of hydrogen systems at Tirana International Airport. Based on the assumption that 25% of the airport's rooftop photovoltaic (PV) output—equivalent to 1,334 MWh/year—is allocated to hydrogen production, approximately 333.5 MWh/year is available for electrolysis. Using an electrolyzer with a specific energy consumption of 58 kWh per kilogram of hydrogen, the estimated annual hydrogen output is 5,750 kg H_2. Assuming a 50% electrical efficiency for proton exchange membrane (PEM) fuel cells and a lower heating value (LHV) of hydrogen of 33.3 kWh/kg, the recoverable energy from hydrogen is approximately 96 MWh/year. For mobility applications, with an average consumption of 9 kg H_2 per 100 km, the produced hydrogen could enable an annual driving range of approximately 63,889 km.

Table 1. *Summary of Hydrogen production, energy recovery, and mobility potential at Tirana International Airport*

Parameter	Value	Unit
PV energy allocated for electrolysis	333.5	MWh/year
Total hydrogen production yield	5,750	kg H_2/year
Recoverable energy from hydrogen (as electricity)	96	MWh/year
Estimated annual driving range (mobility)	63,889	km/year

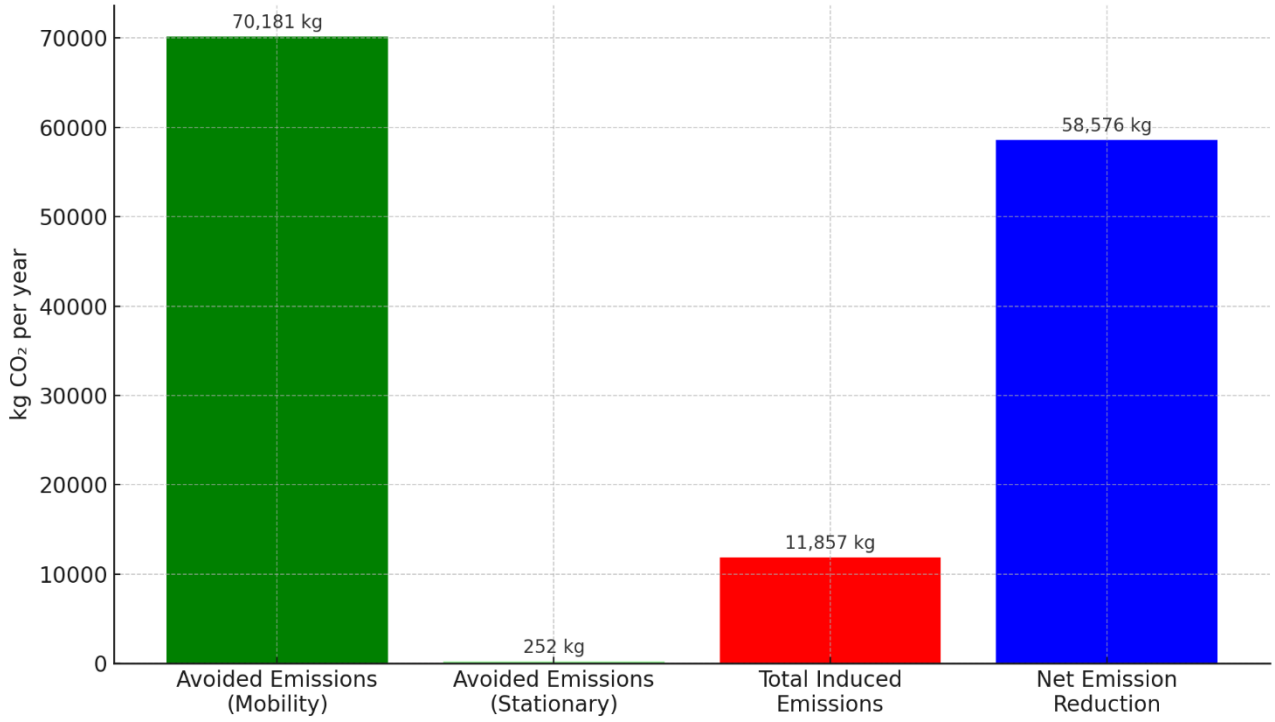
Source: Elaborated by authors

3.2.Environmental feasibility

Figure 2 shows a comparison between avoided and induced CO_2 emissions resulting from hydrogen deployment at Tirana International Airport (TIA). The environmental feasibility analysis indicates that hydrogen application at TIA offers significantly greater potential in mobility compared to stationary energy recovery. Specifically, using hydrogen for on-site electricity generation via stationary fuel cells leads to a relatively modest annual reduction of approximately 252 kg of CO_2, primarily due to Albania's already low-emission electricity mix. In contrast, replacing approximately 19,378 liters of diesel fuel used in airport ground transport yields a much larger emissions reduction of around 70,181 kg of CO_2 per year. This highlights the significantly higher environmental value of prioritizing hydrogen for transport applications at TIA.

Hydrogen production using photovoltaic (PV) sources induces emissions of approximately 2.062 kg of CO_2 per kilogram of hydrogen, resulting in a total of roughly 11,857 kg of CO_2 per year. These emissions stem mainly from upstream electricity-related processes. Literature indicates that solar-powered PEM electrolysis systems yield global warming potentials ranging from 0.61 to 2.8 kg CO_2-equivalent per kilogram of hydrogen, depending on regional and operational conditions (Ajeeb et al., 2024, p. 9). Despite these induced emissions, the overall environmental balance remains strongly favorable. Comparing the total avoided emissions (70,433 kg CO_2/year) with the induced emissions results in a net annual reduction of approximately 58,576 kg of CO_2. This outcome further reinforces the environmental feasibility and strategic advantage of emphasizing hydrogen integration in mobility solutions at TIA.

Figure 2. *Comparison of avoided and induced CO_2 emissions from Hydrogen deployment at TIA*



Source: Elaborated by authors

3.3.Economic feasibility

The economic feasibility of hydrogen production at Tirana International Airport (TIA) was assessed by calculating the Levelized Cost of Hydrogen (LCOH) and the Levelized Cost of Electricity (LCOE) for hydrogen-powered stationary applications. The analysis assumes that 25% of the airport's rooftop photovoltaic (PV) system's annual output is allocated to an on-site electrolyzer operating for approximately 2,190 hours per year. Based on a 155-kW modular electrolyzer functioning at 25% utilization, the LCOH was estimated at €6.91 per kilogram of hydrogen. This figure underscores the sensitivity of hydrogen production costs to utilization rates and infrastructure investment. Under more favorable capital expenditure (CAPEX) conditions—such as €1,300 per kW—the LCOH could decrease to approximately €4.45/kg H_2, highlighting the potential for cost reductions through technological advancements, economies

of scale, or improved operational efficiency. In parallel, the LCOE was calculated for electricity generated by converting hydrogen back into power using proton exchange membrane (PEM) fuel cells operating at 50% electrical efficiency. Based on a recoverable energy output of 96 MWh/year, and applying the same cost structure as the LCOH scenario, the resulting LCOE was €0.41/kWh in the base case. While this is relatively high compared to current grid prices, it provides a valuable benchmark for assessing the potential role of hydrogen as a clean, dispatchable, and locally produced energy source within airport operations.

It is important to note that the full hydrogen-to-electricity conversion process at TIA requires two distinct systems: a PEM electrolyzer for hydrogen production and a PEM fuel cell for electricity generation. While the LCOH reflects only the cost of hydrogen production, the LCOE incorporates both the cost of hydrogen and the capital and operational expenses associated with the fuel cell system. This dual-system configuration highlights the need for optimized system integration, cost-effective design, and high utilization rates to ensure the overall economic viability of hydrogen deployment within airport infrastructure.

Table 2. *Summary of Levelized Cost of Hydrogen (LCOH) under different CAPEX scenarios*

Scenario	CAPEX (€ / kW)	Annual Cost (€)	LCOH (€/kg H_2)	LCOE (€/kWh)	Hydrogen Mobility Cost (€/km)
Base Case (High CAPEX)	1,970	34,561	6.91	0.41	1.16
Optimistic Case (Lower CAPEX)	1,300	22,472	4.45	0.26	0.85

Source: Elaborated by authors

In addition to stationary applications, the study also evaluated the economic feasibility of hydrogen for mobility. Based on an average consumption of 9 kg of H_2 per 100 km and the previously calculated LCOH values, the fuel cost alone was estimated at €0.62 per km in the base case and €0.40 per km in the optimistic scenario. To provide a more comprehensive cost assessment, additional factors were considered: the capital cost of a hydrogen fuel cell bus (assumed at €650,000 in the base case and €500,000 in the optimistic case), depreciation over a 12-year operational lifespan with an annual mileage of 60,000 km, and maintenance costs estimated at approximately €0.15 per km.

When all cost components are included, the total economic cost of hydrogen mobility is estimated at €1.16 per km in the base case and €0.85 per km in the optimistic scenario. These figures underscore that hydrogen-fueled mobility remains capital-intensive, particularly during the early stages of deployment. Nevertheless, it offers significant operational benefits in airport environments, including fast refueling, zero local emissions, and low noise levels, making it an attractive option for fleet decarbonization, especially in contexts where vehicle range and operational uptime are critical.

3.4.SWOT attributes

Table 3 illustrates the strategic potential of integrating hydrogen technologies at Tirana International Airport (TIA). The integration of hydrogen technologies at Tirana International Airport (TIA) presents several notable strengths, including compatibility with solar energy, enhanced energy independence, reduced operating costs, and rapid refueling capabilities with high efficiency. The development of green aviation infrastructure promises long-term savings and delivers both environmental and public health benefits (Yusaf et al., 2022, p. 5). Hydrogen can complement solar energy systems, enabling a more sustainable energy mix for airport operations (Zhou et al., 2022, p. 7). This potential is reinforced by the recent doubling of TIA's photovoltaic (PV) system capacity from 1 MW to 2 MW, enhancing the airport's ability to support on-site green hydrogen production and reduce grid dependency. It can further reduce reliance on conventional fossil fuels, enhancing energy security. Over time, hydrogen's efficiency and scalability can lower operational expenses. Hydrogen allows for faster refueling compared to battery-electric alternatives, making it suitable for aviation needs. Refueling a hydrogen tank only takes minutes, whereas fully charging a battery may take hours, depending on the battery technology and the local electrical power limitation (Offer et al., 2010, p. 28).

Table 3. *SWOT Analysis of Hydrogen integration at Tirana International Airport (TIA)*

STRENGTHS	**WEAKNESSES**
• **Renewable Energy Integration** – On-site solar PV (1→2 MW), potential for wind energy, enabling 24/7 green hydrogen via electrolysis • **Energy Resilience** – Reduced grid dependence, hydrogen storage for backup power during outages • **Operational Advantages** – Faster refueling (3–5 min), longer range and uptime for ground support equipment, lower maintenance than diesel • **Environmental Benefits** – Zero operational emissions, noise pollution reduction, improved air quality around the airport • **Policy Alignment** – Matches EU Green Deal, supports Albania's NDC, complies with CORSIA • **Scalability** – Modular hydrogen systems allow for phased expansion as demand grows	• **Infrastructure Gaps** – No existing hydrogen production, storage or refueling systems; high capital investment required • **Regulatory Barriers** – Lack of mature hydrogen safety standards and limited regulatory experience • **Technical Expertise** – Shortage of skilled workforce for hydrogen system operation and maintenance • **Economic Feasibility** – High hydrogen cost and uncertain return on investment in current market conditions • **Limited Domestic Supply Chain** – Dependence on foreign equipment and expertise increases implementation complexity
OPPORTUNITIES	**THREATS**
• **Renewable Expansion** – Potential for hybrid solar-wind systems to power hydrogen production continuously • **Smart Energy Systems** – Implementation of energy management systems to optimize supply-demand and resilience	• **Market Uncertainty** – Slow adoption of hydrogen-powered aircraft may delay infrastructure utilization • **Safety Perceptions –** Public concerns over hydrogen safety may affect acceptance and implementation

• **Health & Community Benefits** – Reduction in NOx and particulate matter; improved health outcomes and public support • **Strategic Partnerships** – Collaborate with Airbus and EU hydrogen initiatives for co-development and visibility • **Branding & Marketing** – Position TIA as a Balkan "Green Hub" to attract green tourism and eco-conscious airlines • **Funding & Incentives** – Access to EU climate finance and support through public-private partnerships • **Technology Demonstration** – Use the airport as a showcase for clean hydrogen technologies in the region	• **Technology Competition** – Battery-electric and sustainable aviation fuel (SAF) technologies may become more dominant • **Supply Chain Risks** – Dependency on imported hydrogen tech and potential delivery delays • **Policy & Bureaucracy** – Delays or reversals in national policy, limited government support or changing priorities

Source: Elaborated by authors using

The advantages of a hydrogen economy are counterbalanced by significant weaknesses, such as high initial investment requirements, safety and security concerns, and the current absence of a hydrogen distribution network. Developing hydrogen infrastructure requires substantial upfront costs, including storage and distribution systems (Ngyon & Darekar, 2024, p.7). Hydrogen is highly flammable and requires stringent safety measures for storage and handling. Safety concerns are among the major barriers to the broad application of H2 as a fuel source (Lavanya et al., 2024, p.3). In the production of green hydrogen, one of the main challenges is reducing the number of accidents, which are mainly related to electrical risk and oxygen contamination of hydrogen (Calabrese et al., 2024, p.9). Additionally, limited expertise, lack of financial incentives, and low public awareness present further barriers. The Western Balkans, especially Albania, face a major skills gap in hydrogen technologies due to limited technical expertise, low public awareness, and inadequate VET and reskilling programs (Radovanovic and Stevanovic Carapina, 2024, p. 5).

Despite these challenges, there are multiple opportunities to strengthen the initiative, including positioning TIA as a green airport, generating new employment, reducing the airport's carbon footprint, and integrating with sustainable public transport systems. Integrating hydrogen technologies into this ongoing effort would mark a significant step forward in decarbonizing airport infrastructure. The expanded PV system also increases resilience, enabling more stable and reliable hydrogen production from renewable sources. Hydrogen can serve as a clean energy source for ground support equipment, shuttle buses, and potentially even short-haul aircraft in the future, further enhancing TIA's environmental credentials. Fuel cell electric vehicles emit only water vapor and warm air, producing no harmful tailpipe emissions. The development of hydrogen technology can also act as a powerful driver of economic growth and job creation. It opens up employment opportunities across a broad spectrum of sectors, including engineering, system design, installation, maintenance, logistics, and operations. As the hydrogen and fuel cell industries expand, a wide array of new jobs will emerge, ranging from high-tech positions to vocational and skilled trades, spanning different

skill levels, tasks, and income brackets (Bezdek, 2018, p. 9). This can support just transition strategies, particularly for workers from traditional fossil fuel industries. To help cover the substantial investment costs associated with hydrogen integration, TIA can leverage access to EU and international funding instruments, such as the European Green Deal, Horizon Europe, and the Connecting Europe Facility, all of which prioritize investments in sustainable transport and clean energy infrastructure. Additionally, the airport could benefit from the formation of Public-Private Partnerships (PPPs), which unite government agencies, private investors, and technology developers to co-finance infrastructure, share financial risks, and accelerate implementation. PPPs are increasingly recognized as crucial for fostering the development of emerging technologies, such as hydrogen applications (Pinilla-De La Cruz et al., 2023, p. 6). These funding avenues and collaborative models offer a viable path to reduce the financial burden on TIA, making the project more feasible while supporting both environmental goals and long-term economic resilience.

Nevertheless, external threats such as economic viability concerns, competition from other renewable technologies (e.g., solar + battery systems and sustainable aviation fuels), technical and regulatory challenges, public safety perceptions, and fluctuating energy markets may hinder implementation and long-term success.

4. CONCLUDING REMARKS

This study explored the feasibility of integrating hydrogen and fuel cell technologies at Tirana International Airport (TIA), with a focus on both stationary and mobility-related applications powered by rooftop photovoltaic (PV) energy. The results confirm that even partial use of available solar capacity (25%) could produce approximately 5,750 kg of hydrogen annually, enabling the generation of 96 MWh of electricity or powering more than 63,000 km of zero-emission vehicle travel. These findings align with earlier studies on hydrogen's potential in airport ecosystems (Wu et al., 2025; Rasul et al., 2015). From an environmental perspective, the analysis shows a clear advantage for mobility applications. While stationary hydrogen fuel cells offer modest emissions savings (252 kg CO_2/year), mobility uses deliver a significantly greater reduction (approximately 70,181 kg CO_2/year), primarily through diesel displacement. Even after accounting for induced emissions from PV-powered electrolysis (~11,857 kg CO_2/year), the net reduction remains substantial—58,576 kg CO_2 annually—confirming the environmental feasibility of mobility-focused hydrogen strategies. Beyond technical and environmental performance, the economic and management dimensions are critical to the real-world viability of hydrogen integration. The Levelized Cost of Hydrogen (LCOH) was calculated at €6.91/kg under current CAPEX and utilization conditions, with potential to decrease to €4.45/kg in more favorable investment scenarios. For airport operators, these values highlight the importance of system optimization, financial planning, and policy alignment to improve cost-effectiveness. Moreover, the Levelized Cost of Electricity (LCOE) for hydrogen-generated power was estimated at €0.41/kWh—relatively high, but strategically valuable for peak shaving or emergency backup applications. In the case of mobility, total cost per kilometer was estimated at €1.16 in the base scenario and €0.85 in the optimistic scenario. While hydrogen vehicles remain capital-intensive during early-stage adoption, operational advantages such as fast refueling, reduced noise, and zero local emissions

make them attractive for airport fleet management, especially for ground support equipment with high uptime requirements.

From a management perspective, this transition requires coordinated investment planning, infrastructure phasing, and workforce development. The SWOT analysis illustrates both opportunities (e.g., access to EU funding, branding as a green hub, job creation) and risks (e.g., skills shortages, regulatory gaps, and uncertain ROI). Hydrogen integration should therefore be framed not just as a technological innovation but as a strategic infrastructure investment, requiring involvement from airport leadership, public agencies, and private partners. Strategically, hydrogen deployment positions TIA within a broader enterprise innovation ecosystem (Nahara, 2024), where cross-sectoral collaboration, modular design, and flexible financing mechanisms—particularly public-private partnerships (PPPs)—are essential. This aligns with Živanović et al. (2023), who emphasize the need for innovation management structures that support business excellence and long-term sustainability goals. Additionally, evidence from the Western Balkans shows that infrastructure innovation contributes positively to economic growth (Hysaj & Sulçaj, 2024), reinforcing the strategic value of this investment for Albania's green economy transition.

In sum, while technical and environmental metrics confirm the feasibility of hydrogen systems at TIA, long-term success will depend on addressing economic barriers, leveraging funding instruments, and embedding the project within a strategic airport management framework.

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ECONOMIC BURDEN AND POLICY GAPS IN NONCOMMUNICABLE DISEASE MANAGEMENT IN GEORGIA: A HEALTH ECONOMICS PERSPECTIVE

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Abstract: *Noncommunicable diseases (NCDs) present a significant economic challenge for healthcare systems, particularly in low- and middle-income countries such as Georgia. Beyond the health sector, the escalating burden of NCDs has substantial macroeconomic implications, including long-term fiscal pressure on public healthcare budgets, diminished labor market productivity, and increased poverty due to out-of-pocket healthcare expenditures. Collectively, these effects can impede national development and economic growth potential. This study employs a health economics perspective to examine the direct and indirect costs incurred by patients and caregivers, the economic inefficiencies of the current healthcare system, and the broader implications for labor productivity and national development. Utilizing a mixed-methods approach—comprising literature review, qualitative focus group discussions, and quantitative survey—the study identifies key financial barriers, caregiving burdens, infrastructure deficiencies, and policy inadequacies.*
The findings inform economic policy recommendations, including expanded public financing, improved cost-efficiency of NCD care, and enhanced integration of NCD prevention into national development strategies. The study advocates for urgent health system reforms that not only improve health outcomes but also mitigate the long-term economic impact of NCDs.

Keywords: *Noncommunicable disease management, economic burden of NCDs, efficient management of NCDs, healthcare policy gaps in LMICs.*

INTRODUCTION

Noncommunicable diseases (NCDs), encompassing cardiovascular diseases, diabetes, cancers, and chronic respiratory conditions, constitute the predominant cause of global morbidity and mortality. As of 2023, these diseases account for 74% of global deaths (WHO, 2024). Their chronic nature, coupled with associated socio-economic burdens and pronounced disparities in healthcare access, particularly impacts low- and middle-income countries (LMICs), where premature NCD mortality rates are over three times higher than in high-income nations (Ferrana et al., 2023).

The management of NCDs necessitates substantial healthcare resources, long-term treatment plans, and significant financial expenditures, often surpassing the capacities of both patients and national health systems. In LMICs, out-of-pocket spending is a prevalent and significant concern, contributing to poverty and diminished access to essential services. Studies from global and regional contexts underscore that effective NCD strategies require not only medical but also systemic responses, emphasizing the necessity for integrated health services, early intervention, and financial risk protection (Gheorghe et al., 2018).

Mental health challenges, social stigma, and inadequate support systems exacerbate the difficulties encountered by individuals with NCDs. Stigma and social isolation can deteriorate clinical outcomes and diminish treatment adherence. Consequently, comprehensive, patient-

centered approaches that incorporate mental and social support are imperative (Patel & Chatterji, 2015). Advocacy plays a crucial role in addressing policy gaps. Effective advocacy enhances awareness, promotes equitable policies, and encourages community engagement. The 5A Model—Awareness, Acceptance, Action, Audit, and Advocacy—has been established as a framework to facilitate patient-centered reform (Kalra et al., 2023).

Globally, advocacy efforts have increasingly focused on prevention, rights-based access to care, and the meaningful inclusion of patient voices in decision-making processes (Kiknadze & Beletsky, 2013). To inform this study, advocacy agendas from India, Tanzania, Rwanda, Malaysia, the Philippines, Kenya, Ghana, Mexico, and Malawi were analyzed. Across diverse contexts, common priorities emerged: the protection of human rights and dignity of NCD patients, comprehensive preventive measures, equitable access to healthcare, and the inclusion of patients in policy-making.

Georgia bears one of the most significant burdens of NCDs within the European region, with NCDs responsible for 93–97% of all mortalities (Russell et al., 2019). According to the Institute for Health Metrics and Evaluation (IHME), the primary contributors to this burden are cardiovascular diseases, cancers, chronic respiratory diseases, and diabetes. The principal risk factors include high tobacco and alcohol consumption, inadequate diets, physical inactivity, and obesity. In 2013, Georgia introduced a universal healthcare system to enhance accessibility. Nevertheless, challenges remain, including unequal healthcare utilization, substantial out-of-pocket expenditures, underfunded outpatient care, and disparities in disease prevention. The prevalence of obesity, hypertension, and diabetes continues to escalate. As of 2015, Georgia reported 630.7 NCD-related deaths per 100,000 population annually, with an escalating public health crisis attributed to lifestyle and socioeconomic factors (Russell et al., 2019).

Persistent challenges within the country's healthcare system encompass several critical areas. Healthcare access remains limited and fragmented, particularly in rural regions (Gotsadze et al., 2017). Socioeconomic inequities are evident, with mortality rates disproportionately high among lower-income and less-educated individuals, especially women (Lomia et al., 2020). Furthermore, behavioral risks, including smoking, alcohol consumption, and poor dietary habits, are prevalent (Antia et al., 2022). There are significant implementation gaps, as health promotion programs suffer from a lack of coordination and funding. Informal caregivers, predominantly women, experience considerable stress, burnout, and income loss due to the absence of formal support structures. Despite the existence of state-run NCDs programs by the National Center for Disease Control and Public Health (NCDC), prevention efforts are under-resourced. Barriers include low public awareness, weak enforcement of health policies, inadequate screening programs, and insufficient investment in community-based interventions.

In summary, Georgia faces a multifaceted NCD crisis. Although national programs are in place, their implementation remains weak, and the economic burden continues to escalate. This study is guided by the central research question: What are the economic and systemic challenges associated with NCD management in Georgia, and how can targeted policy reforms mitigate their impact? The working hypothesis posits that individuals living with NCDs and their caregivers in Georgia encounter significant financial and access-related barriers, contributing to avoidable economic losses and systemic inefficiencies. These challenges are exacerbated by insufficient policy attention to preventive care, psychological support, and inclusive decision-making. Furthermore, the present study investigates these challenges from an economic perspective to support evidence-based reforms aimed at improving health outcomes and economic resilience.

Methodology

This study utilized a mixed-methods approach to examine the economic and systemic challenges associated with NCDs in Georgia. The research design incorporated both qualitative and quantitative methodologies to ensure a comprehensive understanding of patient and caregiver experiences, healthcare access, financial burdens, and policy gaps.

The initial phase involved an extensive review of international literature, including peer-reviewed academic publications, national health strategy documents, and advocacy reports. The countries analyzed included Armenia, Ukraine, Moldova, Estonia, as well as India, Tanzania, Rwanda, Malaysia, the Philippines, Kenya, Ghana, Mexico, and Malawi. The objective was to identify global best practices and recurring challenges in NCD management, particularly those related to healthcare financing, equity, and patient-centered advocacy.

In the subsequent phase of the research, five focus group discussions (FGDs) were conducted, encompassing 55 participants, including individuals with NCDs and their caregivers. These sessions were convened in Tbilisi and various regional locations to ensure geographical diversity. A purposive sampling method was utilized to capture variations in gender, age, disease type, and urban-rural residence. The discussions focused on economic barriers, access to healthcare services, caregiving responsibilities, discrimination, and psychological stress. Data from these discussions were recorded, transcribed, and analyzed using content analysis to identify key economic and social themes.

Subsequent to this, a quantitative survey was conducted. Building upon qualitative insights, a structured questionnaire was developed utilizing the NCD Global Alliance framework to quantify the prevalence and intensity of the identified issues. The instrument underwent pilot testing with seven respondents to ensure clarity and reliability. Data were collected from 197 participants, both online and in person. The survey gathered demographic information, disease status, healthcare access, insurance coverage, caregiving responsibilities, and indicators of financial burden.

Quantitative data were analyzed utilizing Microsoft Excel. Descriptive statistics, including frequency distributions and percentage breakdowns, were employed to elucidate patterns in economic burden, service utilization, and the impact of caregiving on employment and income. Ethical approval was secured from the institutional review board, and all participants provided written or verbal informed consent. Anonymity and confidentiality were preserved by de-identifying all personal data and securely storing the dataset.

Limitations: Although the study provides comprehensive insights, it is constrained by the modest sample size for qualitative analysis (55 participants), which may not fully represent the spectrum of NCD experiences in Georgia. The use of purposive sampling may introduce bias, and socioeconomic or ethnic diversity was not systematically assessed. While rural representation was included, it warrants further exploration given the unique challenges faced by non-urban populations.

Moreover, this study predominantly utilized self-reported data, which may introduce recall bias, as well as the potential for underreporting or exaggeration of certain experiences, such as income loss, caregiving burden, or discrimination. Respondents might also have been subject to social desirability bias when responding to sensitive inquiries. While these limitations are prevalent in survey-based research, they underscore the necessity for triangulation with administrative health records or longitudinal data in future investigations.

Table 1. Overview of the Mixed-Methods Design

Phase	Description	Key Output
Literature Review	Review of scientific articles, global and national NCD advocacy and economic impact frameworks	Identified global themes and policy benchmarks
FGDs	5 focus groups with 55 participants in Tbilisi and regional centers	Thematic insights on economic and social burden
Survey	Structured questionnaire to 197 NCD patients and caregivers (online and in-person)	Quantitative evidence on financial and labor impact

By integrating qualitative narratives and quantitative measurements, this methodology facilitated a comprehensive, multidimensional assessment of the economic and social impacts of NCDs in Georgia, thereby establishing a foundation for targeted health policy reforms.

Literature Review

According to the World Bank (2022), public health expenditure in Georgia remains below the regional average, with only approximately 2.7% of GDP allocated to healthcare, in contrast to the Eastern Europe and Central Asia regional average of 5%. The prevalence of high out-of-pocket payments, which constitute over 50% of health expenditures in Georgia, has been linked to financial hardship and decreased healthcare utilization among low-income households. The IMF (2022) underscores that underfunded health systems in LMICs frequently lead to fiscal inefficiencies and increased long-term costs due to delayed disease detection and unmanaged chronic illnesses (Cebotari et al., 2022). Moreover, investment in preventive NCD programs has demonstrated significant returns; estimates from the World Health Organization (WHO) suggest a return of USD 7 for every USD 1 invested in prevention-focused interventions.

NCDs including cardiovascular disease, cancer, diabetes, and chronic respiratory illnesses, represent an escalating health and economic challenge in Georgia and other resource-constrained countries. Evidence from Georgia indicates that the financial burden of managing chronic conditions is frequently prohibitive for individuals and places a significant strain on the healthcare system. A study on multiple sclerosis revealed that the annual direct medical costs exceeded $7,000 USD per patient receiving disease-modifying therapies, with medications constituting the primary cost driver (Gugutsidze et al., 2022).

Furthermore, in cardiovascular care, quality improvement interventions in the Imereti region of Georgia—targeting both primary and secondary prevention—led to significant improvements in treatment adherence and outcomes. For instance, use of multi-drug therapy for secondary prevention of coronary artery disease increased from 6% to 91% in outpatient settings. The intervention also led to over $600,000 in savings by reducing unnecessary treatments and diagnostics (Chitashvili, 2015).

Chronic respiratory diseases, such as COPD, are frequently underreported and likely underestimated in Georgia. A survey revealed that actual prevalence rates are five times higher than official statistics, indicating significant gaps in diagnosis and data collection (Chkhaidze et al., 2016). In resource-deficient countries, cardiovascular diseases represent one of the most substantial NCD-related costs. A global review indicated that the cost per episode of stroke or coronary heart disease can exceed $5,000, while even basic hypertension treatment averages $22 per month, which is disproportionately high relative to household incomes in many countries (Gheorghe et al., 2018).

Similarly, diabetes presents an escalating financial challenge. While specific Georgian data on diabetes costs are limited, global models estimate that diabetes treatment and

complications (e.g., kidney failure, cardiovascular events) substantially raise healthcare expenditures in LMICs. Indirect costs due to reduced productivity are often equal to or greater than direct medical costs, compounding the burden (Bloom et al., 2011). In Pakistan, for example, the economic burden of mental illness was found to be $4.3 billion annually, with 59% attributed to lost productivity—a dynamic likely mirrored in other NCDs like diabetes and heart disease (Malik & Khan, 2016).

In Georgia, the policy and legislative frameworks have encountered challenges in keeping pace with the escalating burden of NCDs. The existing health laws lack standardized definitions for essential terms such as medical malpractice and informed consent, resulting in ambiguity in the delivery of care and the protection of patient rights (Kiknadze & Beletsky, 2013). Additionally, barriers persist in health financing and workforce structure. A study on mental health services identified inadequate funding mechanisms, geographic disparities in service availability, and significant out-of-pocket expenses for medications and transportation (Sulaberidze et al., 2018). These findings align with reports from the World Health Organization and the World Economic Forum, which highlight that weak primary healthcare and fragmented systems are central policy gaps in the NCD responses of resource-constrained countries (Bloom et al., 2011).

To review comparative insights from regional Examining the management strategies for NCDs in resource-constrained countries and neighboring nations offers valuable insights into Georgia's healthcare landscape. For example, in Armenia, despite the accessibility of primary healthcare (PHC) facilities, utilization remains low, with only 4.1 visits per capita recorded in 2017. This underutilization is primarily due to concerns regarding the quality of care and associated costs. Furthermore, a substantial portion of healthcare financing is derived from out-of-pocket payments, resulting in fragmented funding and inefficiencies in service delivery (World Bank, 2024). Another country under review is Ukraine. Prior to the healthcare reforms initiated in 2017, Ukraine's system was characterized by high out-of-pocket expenses and inefficient hospital utilization. The reforms have sought to reduce dependence on hospital care, enhance PHC, and implement payment models that incentivize the effective use of resources (Swecare Foundation, 2022).

NCDs are responsible for approximately 88% of annual deaths in Moldova. Efforts to address this significant health burden have included enhancing access to quality healthcare, reforming public health and primary healthcare (PHC), and improving health system financing. Despite these initiatives, challenges remain, particularly concerning the availability and quality of NCD services at the PHC level (Leon & Xu, 2023). In contrast, Estonia has implemented a comprehensive national strategy for cardiovascular disease prevention (2005–2020), which emphasizes risk factor management, health promotion, and the strengthening of PHC. These efforts have led to a substantial reduction in preventable mortality and serve as a model for integrating public health initiatives into national health plans (European Society of Cardiology, 2020).

The regional experiences highlight the critical importance of robust primary healthcare (PHC) systems, equitable financing mechanisms, and comprehensive national strategies in the effective management of NCDs. Georgia can derive valuable insights from these countries to guide its own healthcare reforms and policy development. Georgia's experience in managing NCDs such as cardiovascular disease, diabetes, and chronic respiratory illness mirrors broader trends observed in LMICs, characterized by a significant economic burden exacerbated by fragmented services and policy inertia. Nevertheless, evidence from both Georgia and other resource-constrained countries indicates that low-cost, evidence-based interventions and integrated care models can reduce costs and improve outcomes. To address these challenges, Georgia must strengthen legal frameworks, enhance financing strategies, and expand integrated prevention and treatment programs nationwide.

Results

Qualitative Findings: Key Challenges Faced by Patients with NCDs in Georgia

Focus group discussions (FGDs) involving 55 participants elucidated a wide array of challenges encountered by individuals living with NCDs and their caregivers in Georgia. Several core themes emerged from the discussions. The foremost theme is stigma and discrimination. Participants reported pervasive stigma associated with obesity, diabetes, and cancer, manifesting in public, healthcare, and workplace environments. Notably, weight-related stigma, misinformation regarding diabetes, and discrimination against cancer survivors—such as perceptions of their incapacity to work and employers and coworkers questioning their productivity—were particularly prevalent. Elderly patients were frequently perceived as burdens within healthcare facilities, and children with type-1 diabetes experienced bullying in school settings. The resultant social exclusion and emotional distress deterred many from seeking essential medical care.

Another key challenge was - psychological and emotional burden. Patients frequently experienced emotional distress, including anxiety, depression, low motivation, and emotional eating behaviors. Cancer patients and caregivers reported limited access to mental health services and a lack of psycho-oncology support. Psychological care was virtually inaccessible in rural areas, and there was a widespread need for structured mental health integration within NCD care.

Furthermore, geographic disparities in care access were widely reported, particularly in rural areas, where patients struggled to consult specialists like endocrinologists and cardiologists. Long waiting times, absence of local rehabilitation services, and a lack of structured follow-up care for post-operative and oncology patients were noted. Rehabilitation services for stroke, bariatric surgery, or cancer were especially scarce.

Financial constraints were still another challenge regarding NCD management. Respondents frequently cited the high cost of diagnostics, medications, and rehabilitation services as barriers to continuous care. Out-of-pocket expenses for obesity, diabetes, and cancer treatments were often prohibitive. State-funded programs covered only a fraction of necessary interventions, and patients with low income were often forced to forgo treatments. Nutritional supplements, physiotherapy, and psychological support remained unaffordable for many.

Distrust in healthcare providers was underscored by the respondents. Patients expressed skepticism about the effectiveness and empathy of healthcare professionals. Many reported generic, non-individualized treatment plans and poor communication. The perception of healthcare providers as dismissive or judgmental—especially towards obese patients—contributed to a lack of engagement in care.

Moreover, Georgia lacks peer support groups or patient advocacy platforms for individuals with NCDs. Many respondents expressed the need for environments where patients could share experiences, build motivation, and advocate for tailored policies. While online platforms exist, they are often commercialized and ineffective.

One of the major problems in NCDs management in Georgia is a lack of multidisciplinary and holistic care. Respondents strongly emphasized the need for integrated care models involving nutritionists, psychologists, and physical activity experts. Patients often had to coordinate their care independently, and post-treatment rehabilitation was seldom available. School environments were reported as unsupportive of children with special dietary needs due to obesity or type-1 diabetes.

Similarly, low public awareness and a lack of accessible screenings contributed to delayed diagnoses and late-stage interventions, particularly for cancers and cardiovascular conditions. Preventive health education in schools and public campaigns were largely absent. Barriers to healthy living included the high cost of nutritious food and fitness services.

The qualitative analysis underscores the systemic, economic, and psychosocial burdens experienced by patients with NCDs in Georgia. These insights provide a foundation for evidence-based policy recommendations aimed at fostering equitable, person-centered, and economically sustainable NCD care.

Quantitative Findings:

To evaluate a degree of impact and importance of identified challenges and needs in the literature review and focus-group discussions, patients with NCDs and/or caregivers were surveyed using structured questionnaire. This article presents an analysis of survey data collected from 197 respondents, focusing on chronic diseases, healthcare challenges, and public perceptions regarding treatment accessibility and caregiving. The insights are based on demographic details, healthcare barriers, and disease types.

To review main aspects of the demographics, gender distribution shows a mix of male and female participants, where 67% of them were female and 33% - male. The median age of respondents is 59 years, indicating that a majority of participants are from middle-aged and older populations (minimum age- 22 years; Maximum age -90 years; Standard Deviation – 13.25 years). Among respondents of the survey, 75% were individuals having one or more NCD and 25% were caregivers of the chronic patients (Table 2).

Table 2. Participants' demographics table

Variable	**Category**	**Percentage (%)**
Gender	Female	67%
	Male	33%
Age (Mean: 59, SD: 13.25)	22–39	14%
	40–59	39%
	60+	47%
Residence	Tbilisi	27%
	Imereti	22%
	Shida Kartli	14%
	Samegrelo-Zemo Svaneti	10%
	Kvemo Kartli and other regions	27%
Status	Person living with NCD(s)	75%
	Caregiver of person with NCD	25%
Ethnicity	Georgian	93%
	Armenian	3%
	Azerbaijanian	3%
	Ossetian	1%

Survey participants identified several areas of health protection and promotion that receive inadequate attention from national authorities. The most commonly cited issues include:

1. Early Disease Prevention and Healthcare Access

- Limited early screening programs
- Geographic disparities in access, especially in rural areas like Javakheti
- Shortage of specialists for complex conditions
- Inadequate support for people with disabilities

2. Neglect of Healthy Lifestyle Promotion
   - Inadequate promotion of healthy diets and exercise among children
   - Widespread availability and advertising of unhealthy foods and beverages
   - Absence of structured programs for encouraging lifelong healthy behaviors
3. Poverty and Health Inequities
   - Recognition of poverty as a root cause of chronic illness
   - Lack of national strategies to mitigate the health consequences of poverty
4. Demand for Stricter Regulations
   - Public support for banning energy drinks, tobacco, and alcohol for youth
   - Calls to enhance safety and infrastructure for walking and cycling
5. Overall Neglect of Public Health
   - Respondents perceive a lack of political will and priority given to prevention
   - Infrequent or ineffective public health campaigns (Diagram #1 & Diagram #2)

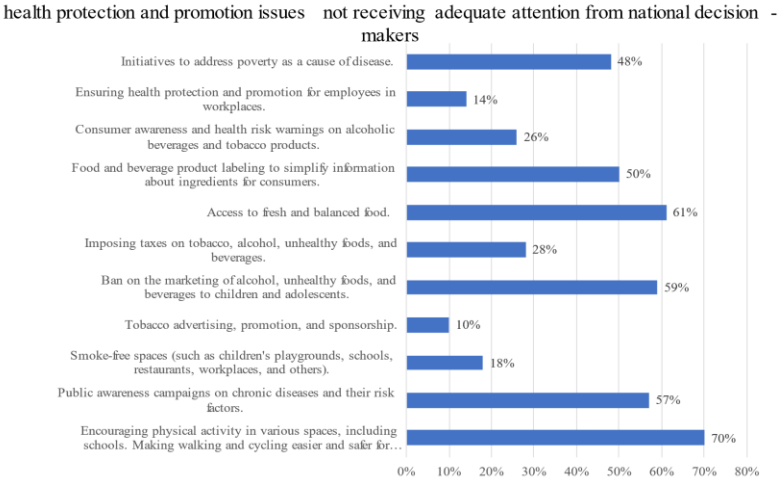


Diagram 1. Health protection and promotion issues not receiving adequate attention from national decision-makers.

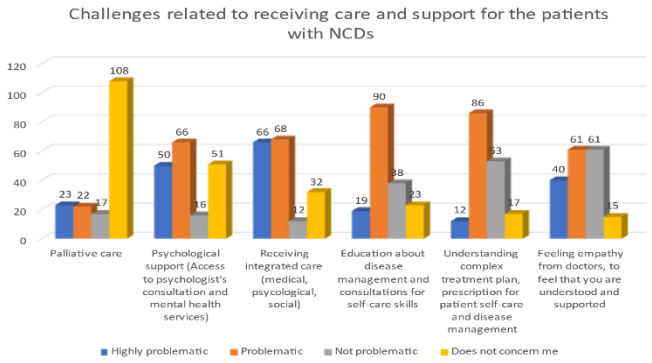


Diagram 2. Challenges related to receiving care and support for the patients with NCDs.

It needs to be emphasized, that - when asked if their NCDs could be prevented at earlier stage- 71% of respondents gave positive answer (Diagram #3).

Those participants who answered, that NCDs would have been possible to prevent, were asked further to select reason for not seeking medical care earlier. Financial difficulties, as a reason for seeking medical care late, when NCD had already worsened – was chosen by 36% of respondents; 17% selected option – "Due to travel difficulties and long distances, I sought medical care late, when my NCD had already worsened"; 15% answered – "I have little trust in my local family doctor and medical facility, so I delayed seeking medical help in other cities until my disease had already progressed" and 32% answered "Other". It should be emphasized that common topics in the comments of respondents, while explaining "other reasons" for not seeking medical care earlier were – lack of education about these conditions / low health literacy and lack of qualification of local, regional doctors (Diagram #4):

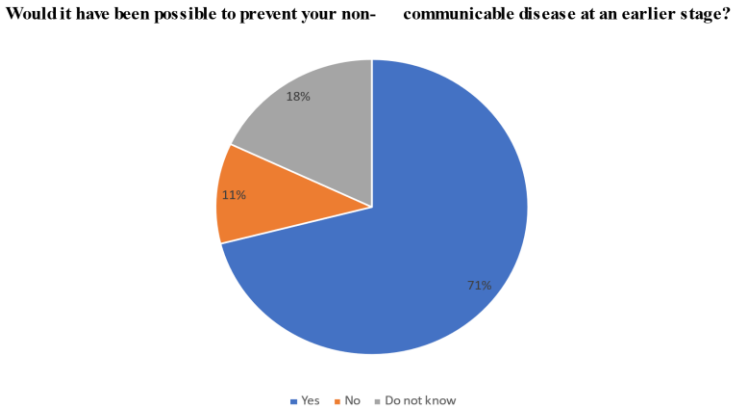


Diagram 3. Respondents' views regarding possibility of prevention of NCDs.

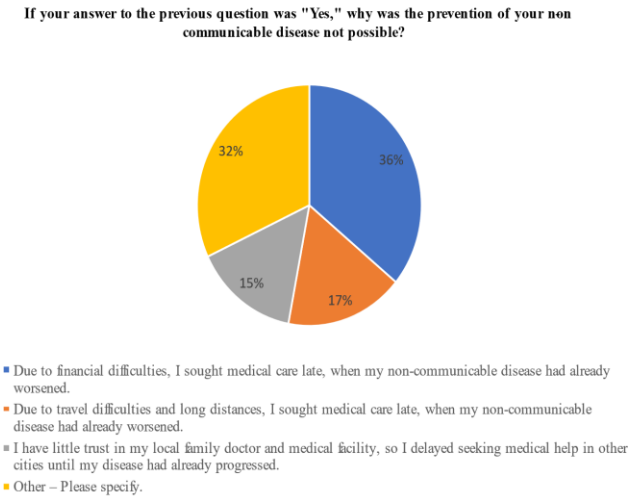


Diagram 4. Reasons why prevention of NCDs was not possible

Another topic of inquiry was public engagement in reducing NCD burden.

Participants were also asked how they would like to be involved in NCD prevention and care efforts. According to the results, 61% would share experiences with peers; 41% supported engaging in discussions with policymakers; 21% - favored contributing to awareness with healthcare providers and community organizations and 20% proposed founding new peer support networks (Diagram 5).

When asked what they needed to become more engaged in community-level NCD response, top responses included access to reliable information, support platforms, opportunities to connect with others, and structured engagement mechanisms.

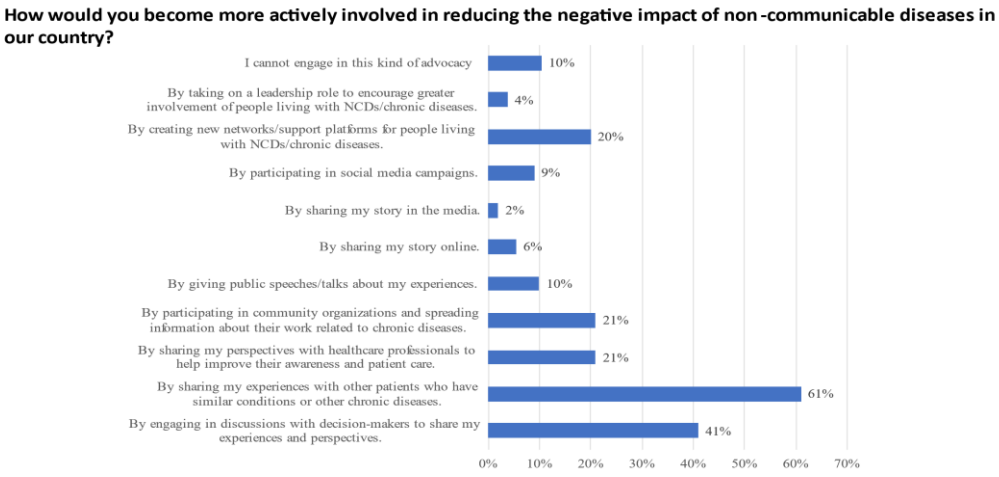


Diagram 5. Opinions of respondents how they would become more actively involved in reducing the negative impact of NCDs in the country.

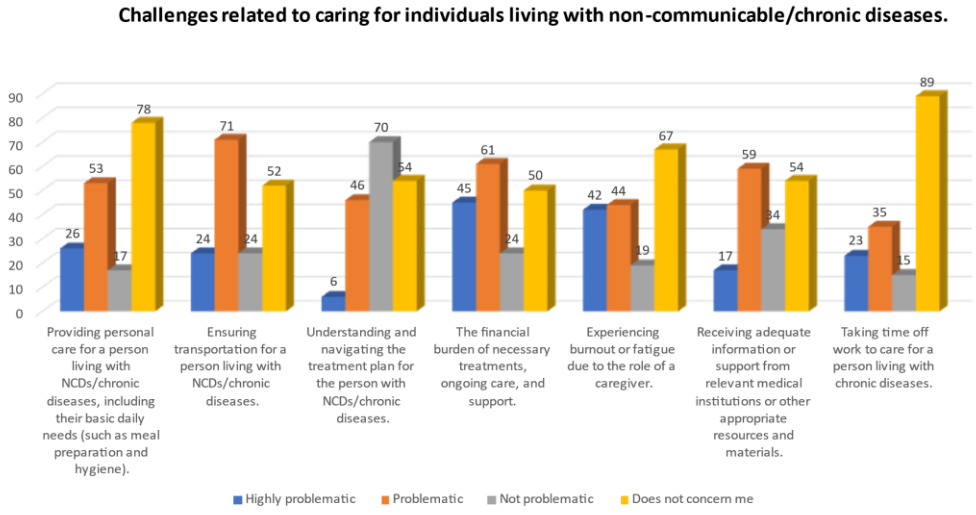


Diagram 6. Challenges related to caring for individuals living with NCDs.

To review caregiving challenges for patients with NCDs. Caregivers reported a broad array of difficulties related to providing care for individuals with NCDs.

The top-rated challenges were - financial burden, burnout, and transportation logistics. Additional concerns included:

- High cost and difficulty of hiring professional caregivers
- Inflexible workplace policies
- Caregivers quitting jobs to provide full-time support
- Lack of caregiver training and resources
- Emotional exhaustion and mental health strain
- Perceived indifference and dismissiveness from healthcare providers (Diagram 6).

Furthermore, when asked which caregiver-related issues were most neglected by government policy - 62% highlighted the lack of caregiver training, consultation, and informational support; 57% of the respondents called for better access to respite care; 42% demanded protected leave policies and 29% emphasized the need for accessible infrastructure and transport for disabled individuals (Diagram 7).

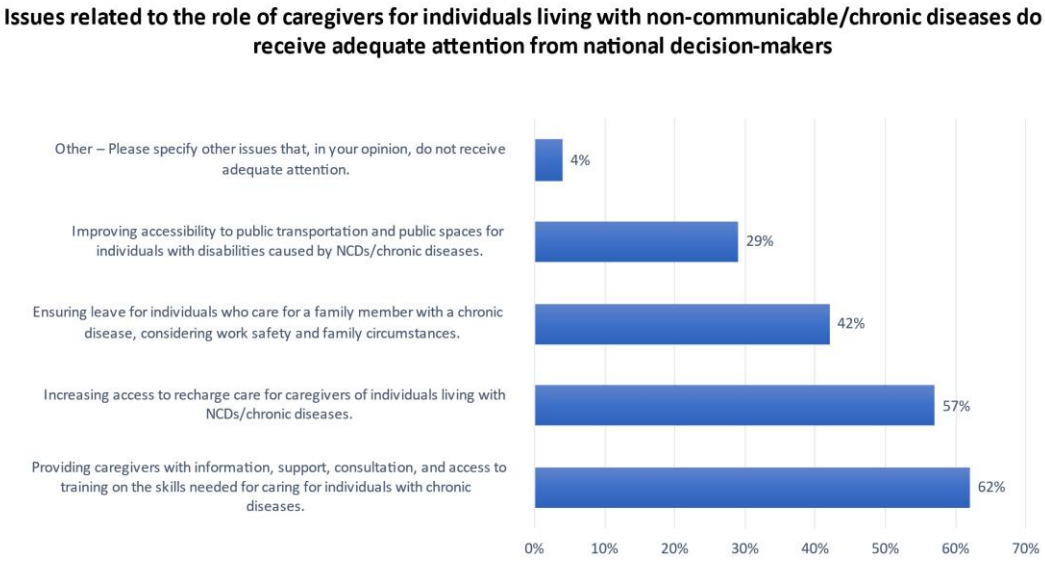


Diagram 7. Issues related to the role of caregivers for individuals with NCDs do not receiving adequate attention from national decision-makers.

These responses confirm that caregivers, like patients, face systemic, emotional, and financial burdens—and are currently underserved in Georgia's NCD response framework. Together, these findings further illustrate the broad scope of challenges faced by NCD patients and caregivers, emphasizing the urgent need for equity-based, multi-level health system reform.

Discussions

Studies in comparable resource-constrained countries have shown that investments in NCD prevention and primary care yield high returns on investment (ROI). For example, the WHO estimates that every dollar invested in strategic NCD interventions generates a return of at least seven dollars in economic benefits due to avoided treatment costs and productivity losses. A cost-effectiveness analysis from India demonstrated that community-based hypertension and diabetes screening programs saved $2–3 for every $1 spent by reducing

complications and hospitalizations. Similar outcomes were observed in Mexico and Kenya, where front-loaded investments in lifestyle interventions led to reductions in future healthcare expenditures and improved workforce stability.

In Georgia's context, delayed detection of NCDs and limited access to affordable care increase reliance on high-cost hospital services, which are financially unsustainable and less effective. This inefficiency in spending not only affects individual health outcomes but also places a long-term fiscal burden on the national healthcare budget.

From a macroeconomic perspective, failure to address NCDs effectively could have severe implications for national development. Chronic illnesses disproportionately affect working-age adults, leading to increased absenteeism, early retirement, and reduced labor market participation. This trend can undermine Georgia's human capital, decrease productivity, and reduce tax revenue, thereby slowing economic growth. Additionally, households facing catastrophic health expenditures are at greater risk of falling into poverty, further exacerbating socioeconomic disparities and weakening the consumer base needed for domestic economic resilience.

While this study does not calculate precise monetary figures for indirect costs, it does identify and contextualize them within the framework of health economics. For example, survey data revealed that many caregivers—especially women—reported job loss, reduced working hours, or inability to work due to caregiving responsibilities. These effects translate into significant productivity losses at the household and national level. Additionally, delays in seeking care due to cost or travel costs increase the long-term economic burden of NCDs through complications and hospitalizations that could have been prevented.

The findings of this study illuminate a significant economic load and structural inefficiencies within Georgia's response to NCDs, resonating with broader concerns in health economics and public finance. The combination of inadequate funding for outpatient and preventive care, inequitable access to services, and high out-of-pocket expenditures underscores the urgent need for more cost-effective health system designs. These issues directly impact economic productivity, with working-age individuals and caregivers bearing financial and psychological strain that translates to lost labor hours and reduced workforce participation.

According to World Bank data, Georgia's public expenditure on health stood at approximately 2.7% of GDP in recent years, which is below the average for Eastern Europe and Central Asia, whereas OECD countries spend an average of around 8.8% of GDP on healthcare, according to OECD Health Statistics (2022). This underinvestment is reflected in gaps in primary care, prevention, and chronic disease management—areas critical to NCD control. Additionally, over 50% of health expenditures in Georgia come from out-of-pocket payments, posing a substantial financial burden on households and leading to care delays or avoidance. The disproportionate burden on low-income and rural populations reflects not only health disparities but also economic exclusion—hindering equitable economic growth.

Investment in early detection, preventive health education, and the integration of cost-effective digital tools like telemedicine and remote monitoring are not merely health-sector improvements but economic imperatives. International evidence shows that investing in prevention and chronic care coordination can reduce long-term healthcare costs and enhance human capital outcomes. Georgia's current underinvestment in such services is a missed opportunity to mitigate future fiscal strain and social costs.

Moreover, the study's findings on the invisibility of caregivers within national policy echo economic studies highlighting unpaid labor's hidden contribution to healthcare and welfare systems. Providing financial and legal support to informal caregivers not only

addresses social justice concerns but also strengthens labor market resilience by reducing premature workforce exit, especially among women.

The observed lack of patient and caregiver inclusion in policymaking also reflects a governance deficit with economic implications. Stakeholder engagement in healthcare decision-making is associated with higher system efficiency, improved outcomes, and greater social return on investment.

Ultimately, the Georgian case demonstrates the need for a comprehensive economic strategy that integrates health sector reform with broader social protection, gender equity, and labor policy. Such an approach would move beyond siloed budgeting to a model where health investment is seen as a lever for national productivity and inclusive growth.

Conclusions and Policy Recommendations

Present study highlights the complex and interrelated challenges faced by individuals living with NCDs and their caregivers, in Georgia. Key issues identified include inadequate healthcare access, systemic inefficiencies, high financial burden, stigma and discrimination, lack of psychological support, and insufficient caregiver assistance.

Healthcare Accessibility and Infrastructure problems are one of the central findings. Patients—especially in rural areas—face prolonged waiting times and limited access to specialized care. Rehabilitation services for post-treatment recovery are underdeveloped, and the absence of a multidisciplinary approach results in fragmented and ineffective care pathways.

Financial Barriers should be emphasized as key challenge hindering seeking earlier care and prevention for the individuals living with NCDs. State health programs provide limited coverage for medications, diagnostics, and post-treatment support. Many patients face prohibitive out-of-pocket costs that delay or prevent access to timely care. Preventive services are similarly underfunded, deterring early intervention.

Widespread Social and Mental Health stigma, especially for obesity, cancer, and diabetes, impairs treatment-seeking behavior and worsens mental health outcomes. Psychological services are largely inaccessible, particularly in non-urban settings.

Lack of Prevention and Education is a common cause of delayed diagnosis. Poor public awareness and low engagement with preventive health services emerged as major barrier for the prevention and early treatment of NCDs. Schools and workplaces lack robust health promotion programs. To reduce long-term economic strain and prevent avoidable mortality, Georgia must prioritize equitable funding mechanisms and scalable preventive services at the PHC level.

Caregivers face emotional exhaustion, job loss, and lack of formal support mechanisms. Protected/paid caregiver leaves, financial aid, and respite services are currently absent from policy frameworks.

Exclusion from Policy Making. There is little to no formal involvement of patients or caregivers in the creation of health policies. Peer support networks and advocacy groups are scarce, limiting public engagement.

According to the revealed challenges and situational analysis, as well as on the basis of reviewed best practices, Policy Recommendations are as follows:

<u>In order to enhance healthcare access and infrastructure</u> - expansion of telemedicine services is highly recommended, as well as, implementing structured follow-up and rehabilitation plans.

<u>Financial Support needs to be strengthened.</u> Broadening state coverage of diagnostics, medications, and rehabilitation, provision of subsidies for lifestyle interventions and healthy food and creation of financial aid programs for low-income patients and caregivers is advised.

To Combat Stigma and Expand Mental Health Support, launching national campaigns is recommended, to normalize NCDs and reduce stigma. Moreover, it is crucial to train healthcare providers in empathy and patient-centered care and to integrate psycho-oncology and general psychological counseling into NCD programs.

For the purpose of improving Preventive Healthcare, national health education and early screening campaigns need further promotion. Furthermore, to enforce regulations on alcohol, tobacco, and unhealthy food marketing and to incorporate NCD education into school curricula should be considered.

To Support Caregivers, introducing respite care services, and policies for paid caregiver leave should be thought. Moreover, workplace flexibility and provision of caregiver training and informational support are strongly recommended.

Still another important area of focus is Facilitation of Patient Advocacy and Participation. For this purpose, creating formal mechanisms for patients and caregivers to shape policy and to support the development of peer-led support and advocacy groups should be considered, ensuring the inclusion of individuals with lived experiences in national planning.

Table 3. Summary of key challenges, impacts and recommended policy responses for NCD management in Georgia

Challenge	**Observed Impact**	**Policy Recommendation**
High out-of-pocket (OOP) expenditures	Delayed care-seeking; financial hardship; increased disease burden	Expand state insurance coverage; subsidize essential NCD medications
Rural access gaps	Inequitable access to diagnosis and treatment; geographic disparities	Strengthen PHC infrastructure in rural areas; deploy mobile/telemedicine units
Weak preventive service delivery	Late-stage disease detection; avoidable complications	Integrate NCD screening into routine PHC; fund public awareness campaigns
Caregiver burden and lack of protections	Income loss, burnout, informal/uncompensated care	Introduce caregiver leave policies and social protection mechanisms
Fragmented health information systems	Poor continuity of care; inefficiencies in tracking and planning	Implement interoperable electronic health records (EHR) systems
Low provider incentives for prevention	Overemphasis on treatment rather than prevention	Reform provider payment models to reward preventive care and early intervention

To enhance strategic planning and resource allocation, the following recommendations were analyzed and organized by timeframe and scope: short-term vs. long-term and low-cost vs. systemic reform.

Short-Term and Low-Cost Recommendations consist of:

- Launching national awareness campaigns to reduce stigma and promote early detection.
- Training healthcare providers in delivering empathetic, patient-centered care.
- Providing informational support and virtual peer platforms for patients and caregivers.
- Expansion of telemedicine services, particularly for rural communities.
- Strengthen school-based health education and prevention programs.

The following three reforms were prioritized based on their scope of feasibility and immediate impact:

1. Increasing funding for outpatient care and essential medications, particularly targeting low-income and rural populations;
2. Establishing structured caregiver support programs to address growing informal care burdens;
3. Expansion of telemedicine and digital health services to bridge access gaps and improve cost-efficiency.

Moreover, other recommendations concerning Medium to Long-Term Systemic Reforms include:

- Investing in rehabilitation services and multidisciplinary chronic disease management centers
- Formalizing patient and caregiver inclusion in policy development and health governance
- Implementing national NCD prevention and care strategy with integrated financing mechanisms
- Developing national NCD registry and digital health information system to enable better surveillance, outcome tracking, and policy evaluation. Robust data infrastructure is critical for designing effective interventions, monitoring program performance, and informing equitable health financing decisions.

By implementing these recommendations, Georgia can strengthen its response to the growing burden of NCDs, enhance system-wide efficiency, and significantly improve the health and wellbeing of patients and caregivers.

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THE ROLE OF STRATEGIC FINANCIAL MANAGEMENT IN DRIVING SUSTAINABLE GROWTH IN A GREEN ECONOMY

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Abstract: *Strategic financial management is critical in promoting sustainable economic growth and developing a green economy by integrating best financial practices with sustainable development objectives. This study analyzes the impact of strategic financial management on sustainable economic development through three case studies: Greencells in Germany, a leading and highly successful company in solar energy; the ECOPROFIT program in Slovenia, a project that aims to effectively manage the process of reducing costs and waste in enterprises, and Ujë Rugove, a Kosovar company that has received green financing to advance its production process. Through content analysis, comparative analysis, and secondary data analysis, the study examines how the financial strategies of these companies and their green projects have contributed to sustainable growth. The empirical results highlight that strategic financing and effective management of financial resources positively impact improving competitiveness and promoting environmental innovation and sustainable development projects. This study provides recommendations for all businesses, governments, and other stakeholders on effectively integrating strategic financial management into green economy projects.*
Keywords: *strategic financial management, sustainable growth, green, economy, finance.*

1. INTRODUCTION

In the era of post-modernism, in which we as a society are facing the increasingly escalating challenges of climate change and on the other hand we are trying to move towards an increase in environmental awareness (into greenish terms), without leaving aside the attempt to shift the global economy towards a green economy is no longer an option - it represents a necessity (inevitability). At the centre of this transformation is the role of strategic financial management, which goes beyond traditional financial oversight to embrace long-term planning, sustainable investments, and various risk-minimization strategies that match and adapt to environmental goals and aspirations. Moreover, organizations are constantly trying to navigate towards creating a development landscape while they are in momentum and must definitely rethink how to make financial decisions that affect not only profit but also social and ecological outcomes.

This study attempts to bring a very clear and fully meaningful approach to comparing the three case studies by providing a precise analysis of the role of several elements of the applicable green economy and their results for the economy in general. Undoubtedly, strategic financial management plays a very important role in an economy, both by the state and by businesses. Furthermore, strategic financial management is argued to be playing a pivotal role in resource mobilization, guiding responsible investment while continuously driving innovation and new developments that support sustainable development and longevity. Strategic financial management is integrating and combining a range of environmental, social, and governance (ESG) factors to inform and assist in sustainable financial planning and

decision-making, enabling economies and businesses to thrive while minimizing their environmental footprint. From green bonds and sustainable budgeting to accounting, key tools of postmodern financial strategies are being redefined to support the pillars of a green economy (verdant) (Elezaj, Morina & Dreshaj, 2025), low carbon, resource efficiency, and eco-opportunity investment, making social inclusion inevitable.

2. LITERATURE REVIEW

When we refer to the phrase "transition to a green economy," we hold for a moment to rethink the economic issues of the past, which were an integral and inseparable part of our lives. This paradigm requires a great analysis and commitment from businesses and governments to support such an approach as it is from technology to ecology. Of course, this approach requires a clear review of financial strategies to balance economic performance for environmental sustainability. The key roles in this dimension are certainly played by the field of strategic financial management, which is emerging as a critical tool in aligning corporate financial practices with long-range environmental and social goals.

Furthermore, strategic financial management is a pivotal segment that redefines the thinking of managers and leaders of various organizations regarding how they see their organizational future and reframes their orientations, especially their financial ones. In this context, Brigham & Ehrhardt (2016) argued that the inclusion of long-term financial planning and a clear decision-making process can achieve goals that meet the requirements of the owners, can create an approach to how to avoid risk, and on the other hand, can create financial consistency. Furthermore, this statement highlights an analysis and creates a communicable result that sees the security of the future of various enterprises that aim at profitability, uncertainty, risk, and, above all, longevity.

This aspect is very conscious that it requires integrated financial strategies that consider the environmental impacts that may be caused in addition to economic returns. Of course, this form will affect this segment because organizations are constantly behaving like a machine that is destroying the environment, and on the other hand, there are great calls for re-attention to these damages while on the other hand, economic returns and high interests are being realized for these destructive machines. In contrast, a green economy can be defined as an economy that demonstrates low carbon emissions, resource efficiency, and social inclusion (UNEP, 2011). Many studies conducted recently show that with the integration of these factors, which are also known as "ESG" factors, and with the embrace of many organizations that have taken into consideration the application and implementation of these factors as genuine, they are turning out to be very beneficial for the country's economy and for society in general. According to Friede, Busch, and Bassen (2015), applying these factors leads to excellent financial decision-making, thus improving their financial position in the long term. However, it also dramatically affects the organization's strategic financial management. This shows that the aforementioned factors clearly determine financial strength and position in the industry. Moreover, they create mechanisms, design entire programs, and, above all, build strategies that they translate as adaptable to increase their performability and financial viability. This can undoubtedly lead to higher firm performance regarding long-term consistency (Clark, Feiner & Viehs, 2015; Elkington, 1997).

Referring to Flammer (2021) argues that the orientation towards strategic investments in green technologies, renewable energy and sustainable infrastructure is undoubtedly an approach that may require new forms of financial innovation or green finance. This accurate orientation argues that organizations are focused on bringing their novelties toward green transformation, specifically digital ecology. Furthermore, it emphasizes a series of important

factors that play an important role in his study by listing green debts and obligations, sustainability-linked loans, and impact investing as the most appropriate examples of financial instruments that strongly support sustainable projects by providing returns.

According to the Task Force on Climate-related Financial Disclosures (2017), Strategic Financial Management is a fundamental pillar of a country's economy that plays a vital role in identifying and mitigating environmental and regulatory risks. Moreover, it is a significant segment of how to do scenario analysis, test, and detect climate risks, which are increasingly being used to make strategic plans. What is worth emphasizing is that this dimension is increasingly becoming an act that, in addition to becoming a fact in business life, is also increasing the creative logic of managers and leaders of organizations towards planning and foresight excellence.

Moreover, many studies show that this dimension embraces the economies of many developed and developing countries, which are significantly shifting towards creating ecological and digital companies so much so that organizations are very interested in each of these companies that are including climate sustainability as an element in financial planning and are much more adaptable to policy changes and resource shortages, thus promoting sustainable growth even in cases where market volatility exists (Sullivan & Mackenzie, 2017).

What can be emphasized is that organizations are looking for many ways and approaches to capture this new trend of the era of advanced modernity. This expansion of the activities of organizations is creating a critical access to build both their approaches and their benefits. The studies of Krueger, Sautner, and Starks (2020) emphasized that strategic approaches should be applied in such a way that they can create different solutions starting from financial risk management so that organizations can remain flexible even when there may be unstable, labile, and volatile situations.

The authors note that there is a vast literature on green finance, ESG (Environmental, Social, and Governance) factors and corporate sustainability. There are a limited number of cross-country comparative case studies that show how strategic financial practices differ across institutional settings and how they impact sustainable growth. Furthermore, it is emphasized that the unique role of local and international institutional support (e.g., ECOPROFIT versus EBRD-supported and Ujë Rugove) is underexplored in the existing literature. The authors emphasize conducting synthetic analyses by conducting content analysis, comparative analysis and synthesis of different cases, a study that builds a conceptual model and demonstrates how financial planning, institutional support and environmental compliance are intertwined. The study undoubtedly highlights results that clearly show the impact of strategic financial instruments (e.g., green bonds, tax incentives, soft loans). Last but not least, we identify that the original contribution of the article lies in its comparative, real-world evidence of how strategic financial management acts as inter-connectivity between the sustainability and competitiveness objectives of enterprises.

3. SCIENTIFIC RESEARCH METHODOLOGY

This research employs a qualitative and comparative research design, utilizing a case study approach to analyze the role of strategic financial management in driving the growth of the green economy. Three cases were purposively selected: Greencells GmbH from Germany, a leading player in the solar industry; the Slovenian institutional program ECOPROFIT, aimed at reducing costs and waste in enterprises; and the Kosovar firm Ujë Rugove, which has successfully modernized its production process with the support of green financing. The cases were selected purposively based on the active adoption of strategic financial management practices and sustainable development strategies.

The data were primarily collected from trusted secondary sources, including the financial and sustainability reports of the firms, program documents, the legal and institutional framework, and academic and professional literature on green finance and strategic financial management. The analysis employs three main approaches: content analysis for interpreting financial and legal documents, as well as extracting key concepts; comparative analysis to address financial and environmental strategies in three cases from different contexts; and cross-case synthesis to draw generalized conclusions regarding success factors and similar challenges.

The research also includes a qualitative conceptual model analyzing the interaction between strategic financial practices (capital deployment, cost management, and investment prioritization) and sustainable development indicators (energy efficiency, greenhouse gas emission reduction, enhancing competitiveness, and encouraging innovation). The analysis of the legal and institutional environment in Germany, Slovenia, and Kosovo is also part of the methodology, summarizing and comparing the legislation at the country level related to environmental protection, renewable energy, as well as incentive schemes for green financing, such as subsidies, tax relief, access to instruments, such as green bonds, EU funds, etc. Multiple data sources are utilized to ensure data reliability and validity, and various approaches are employed in data analysis.

Despite this, the limitations of the research stem from the use of second-level data and their limited number, resulting in reduced generalizability. Future research can be complemented with primary data and additional cases to enhance the empirical validity. This research methodology provides a detailed and professional examination of the role of strategic financial management in supporting sustainable development within the green economy. The following table shows a concise overview of the methodological approach used in this study, comparing three concrete cases across different national environments and green economy sectors. The location, primary field of activity, primary sources of secondary data, reason for analysis, qualitative methods used, primary strategic financial management elements, and applicable sustainable development targets are emphasized for each case. This arrangement enables purposeful cross-comparison of various practice regimes and different environments, to enable general conclusions regarding the role of strategic financial management on the green economy.

Table 1. *Methodological Overview of the Case Study Analysis*

Case Study	Country	Main Field	Primary Data Sources	Purpose of Analysis	Qualitative Techniques Applied	Strategic Financial Management Aspects	Sustainable Development Objectives
Greencells GmbH	Germany	Solar energy (private sector)	Financial reports, sustainability reports, national energy policies	To analyze green financing practices and their impact on long-term growth	- Content analysis - Comparative analysis - Cross-case synthesis	Investments in clean energy, financial risk management, diversification of funding sources	Emissions reduction, enhancement of global competitiveness, green growth
ECOPROFIT Program	Slovenia	Institutional program for enterprises	Program documentation, legal and regulatory acts, reports from participating companies	To assess the effects of financial mechanisms on cost and pollution reduction	- Content analysis - Comparative analysis - Cross-case synthesis	Cost planning, financial incentives, optimization of operational processes	Resource efficiency, waste management, public-private cooperation

Ujë Rugove	Kosovo	Bottled water (private sector)	Financial and investment reports, institutional documents, local legislation	To analyze the impact of green financing on technological modernization and environmental performance	- Content analysis - Comparative analysis - Cross-case synthesis	Use of funds for modernization, production cost reduction, strategic capital management	Improved energy efficiency, pollution reduction, strengthened corporate reputation.

This research aims to investigate how strategic financial management influences the promotion of sustainable growth and environmental innovation in the context of the green economy. Through analyzing three distinct cases – a top solar energy firm in Germany, a Slovenian institutional program for companies, and a manufacturing business supported by green finance in Kosovo – the research seeks to address a primary research question and examine a corresponding hypothesis.

Research Question: *How does strategic financial management contribute to sustainable growth and environmental innovation within the green economy?*
Hypothesis: *In conjunction with green finance instruments and sustainable development targets, strategic financial management systems significantly improve organizations' long-term competitiveness and environmental performance.*

The convergence of economic strategy with green objectives represents a paradigm-shifting approach to organizational growth, particularly in the green economy. Organizations and institutions can use cost management, capital planning, and environmental investment planning to reduce their environmental footprint and gain a competitive advantage. This study's use of content analysis, comparative analysis, and cross-case synthesis demonstrates that integrating financial management with green targets is a primary driver of innovativeness, efficiency, and resilience in a rapidly changing economic climate.

4. RESULTS

The results of the studies demonstrate that the mechanism plays a crucial role in promoting the objectives of a sustainable economy and its transition to a green economy by serving as an intermediary that mediates between financial, environmental, and social goals. Through three concrete cases – Greencells GmbH in Germany, the ECOPROFIT program in Slovenia, and the company in the Rugove company in Kosovo – it was found that it includes well-defined strategic assets, such as capital environment analysis, cost control, resource optimization, and access to financing of the impact on the state of operation, its effect of overall competitiveness.

Analyzed through three complementary techniques are: (1) analysis of financial documentation of accounts to break down and interpret the financial documentation, sustainability reports, and legal frameworks of each case, including the leading practices of management of financial strategies and relevant sustainability indicators; (2) comparative analysis has enabled the distinction of differences and similarities between the intermediates observed in different institutional and geographical contexts; and (3) cross-case synthesis has contributed to the formulation of general conclusions by finalizing the findings obtained from the individual analyses and by highlighting the different links of success, as well as the structural challenges that have been encountered in the application of strategic financial management in the green economy project. Combining techniques has begun to create a consolidated interpretative framework, reinforcing this study's overall theoretical and practical validity.

4.1. Results from Content Analysis

This analysis section will examine the results of three cases that illustrate the application of sustainable financial strategies across various sectors. They include Greencells (Germany), a company focused on solar energy and green financing instruments; ECOPROFIT (Slovenia), an initiative that supports cost and pollution reduction through sustainable financial mechanisms; and Ujë Rugove (Kosovo), a company engaged in equipment modernization and the use of green financing to improve efficiency and quality. Each case examines financial strategies and their impact on enhancing efficiency, promoting environmental benefits, and driving market expansion.

4.1.1. Greencells (Germany)

Greencells GmbH, a leading company in the German solar energy industry, has implemented a diverse range of financial strategies, including sustainable investments, capital structuring, and the establishment of public-private partnerships. The company's methods aim to maximize financial benefits in line with sustainable development objectives while ensuring a positive impact on the environment and the economy.

One key approach that Greencells has used is investing in energy projects with a low carbon impact. The company has continuously invested in innovative solar technologies and benefited from green financing to secure the necessary capital to expand its capacity. Utilizing green financing instruments, such as green bonds and government subsidies, has facilitated realizing sustainable investments that have enhanced financial performance and contributed to achieving emission reduction objectives.

Regarding the impact of these strategies, companies managed by Greencells have experienced a significant increase in revenue from 2019 to 2023. Revenue growth has been driven by market expansion and increased solar energy production capacity, which contribute to sustainable financial growth. Additionally, a significant reduction in CO2 emissions was achieved, meeting international environmental standards and advancing the company's transition to a green economy. The market expansion and the increase in solar installation capacity are clear indicators of the positive impact of financial management strategies (ESG Framework V1.0 - Greencells Group, 2023).

Greencells, a leader in large-scale solar energy, has developed an ESG (Environmental, Social, Governance) Framework to guide its commitment to sustainable practices and corporate responsibility. This framework outlines the company’s commitment to ensuring environmentally friendly and socially responsible operations and managing relationships with employees, suppliers, customers, and the communities in which it operates. According to the Greencells 2020/2025 Green Bond Funds Use Reports for the fiscal years 2021, 2022, and 2023, Greencells has invested over € 8 million in developing solar parks, contributing to annual CO_2 savings of approximately 1.39 million tonnes.

Table 2. *Key Findings from the ESG Framework Report of Greencells*

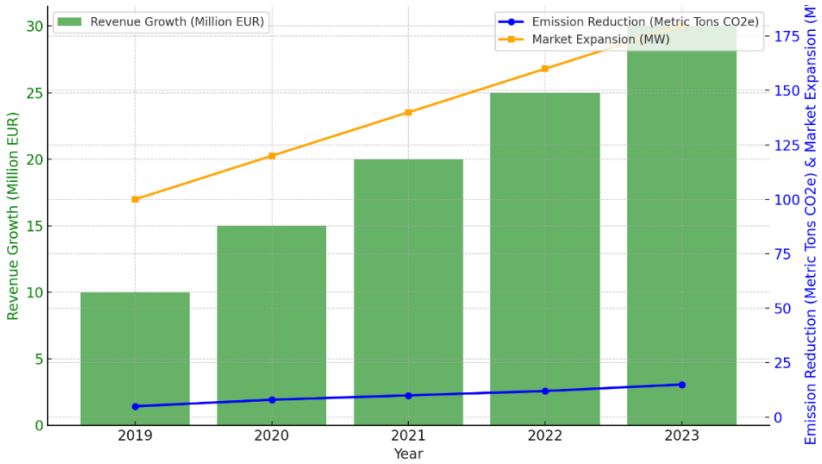
Category	***Findings***
ESG Framework	*Greencells has developed a framework for sustainable practices encompassing the environment, society, and governance (ESG).*
Environmental Commitment	*Greencells is committed to reducing CO_2 emissions and ensuring environmentally friendly operations.*

Invested Projects	*The company invested over 8 million euros in developing solar parks between 2020 and 2025.*
CO_2 Savings	*Investments have contributed to annual CO_2 savings of approximately 1.39 million tons.*
Social Commitment	*The company enhances working conditions and fosters positive relationships with its communities, employees, and suppliers.*
Governance	*Greencells implements transparent governance practices and is committed to adhering to high standards of ethics and transparency.*
Case Studies	*A specific case study is the revitalization of the St. Charles mining area, which has contributed to environmental improvement and local economic development.*

Table 1 summarizes the key findings from Greencells' ESG Framework report, highlighting the company's commitment to environmental, social, and governance sustainability. It includes significant investments of over €8 million for developing solar parks between 2020 and 2025, contributing to annual CO_2 savings of approximately 1.39 million tonnes. Greencells is strongly committed to improving working conditions and maintaining positive relationships with its communities, employees, and suppliers while focusing on transparent governance practices and high ethical standards. A unique case study is the revitalization of the St. Charles mining area, which has significantly improved the environment and local economic development. This multifaceted commitment positions Greencells as a company committed to a more sustainable future.

The diagram below illustrates the impact of Greencells' financial strategies on revenue growth, emissions reduction, and market expansion from 2019 to 2023. The values included in the diagram represent revenue growth (in EUR million), emissions reduction (in tons of CO_2), and market capacity expansion (in MW) for each year.

Figure 1. *Impact of Financial Strategies on Greencalls (Germany) Performance (2019 – 2023)*



Through these strategies, Greencells has established a sustainable model that can guide other companies in integrating financial and environmental practices to achieve sustainable growth and responsible financial development. Greencells' financial strategies have consistently driven revenue growth year after year, positively impacting market expansion and facilitating the development of additional solar parks and the integration of renewable energy sources. Greencells' environmental strategies have also contributed to reducing CO_2 emissions, demonstrating a strong commitment to combating climate change and maintaining a sustainable balance between financial growth and environmental responsibility.

4.1.2. ECOPROFIT (Slovenia)

ECOPROFIT (Environmental Cooperation for Pollution Prevention) is an international initiative that aims to create a platform for cooperation between the public and private sectors, promoting sustainable practices and reducing environmental pollution while enhancing the operational efficiency of enterprises. This program has helped many enterprises, especially small and medium-sized ones, implement environmental management strategies that align with international standards, using a practical and financially sustainable approach. Within the framework of ECOPROFIT, enterprises are assisted in identifying and implementing technologies and practices that reduce environmental impact while lowering operating costs through improved resource management, efficient energy use, waste reduction, and the adoption of greener technologies. This approach ensures sustainability at the enterprise level, enabling them to adopt new business models that are sustainable and innovative.

In particular, ECOPROFIT provides practical and financial support through grants, soft loans, and tax incentives, enabling enterprises to finance the necessary investments in clean technologies and practices. This financial support is crucial for helping the adoption of changes, particularly for companies with limited financial resources. On the public sector side, the program is supported by regulators and local authorities, who have created an appropriate legal and regulatory framework that encourages enterprises to adopt sustainable practices. This synergistic cooperation between sectors fosters an ecosystem that supports sustainable development and enterprise growth, underpinned by public policies that promote innovation and environmental sustainability.

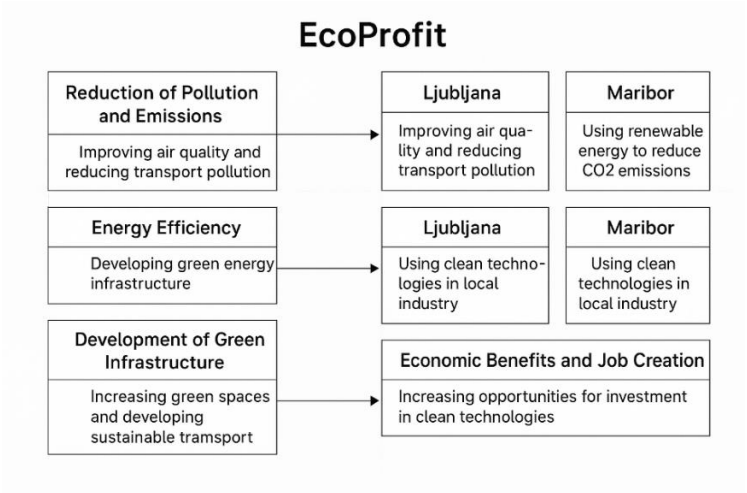
At the enterprise level, the implementation of ECOPROFIT has reduced operating costs, improved energy and natural resource utilization efficiency, and lowered waste management costs. Enterprises have also enhanced their reputation in the market, appearing as companies that respect environmental standards and contribute to sustainable development. At the local policy level, ECOPROFIT has significantly impacted the orientation of environmental policies and the development of initiatives that support the interconnection of different sectors for sustainable development. The program has established a new framework for financing and policies that help enterprises achieve sustainable goals and promote green development, ultimately improving living conditions for local communities.

In Slovenia, ECOPROFIT has used a range of financial mechanisms to encourage enterprises to invest in green technologies and environmentally efficient processes. These mechanisms include grants, tax breaks, and soft loans. Various grants have been offered to support the implementation of clean technologies, enhancing energy efficiency, and improving waste treatment. Tax breaks enable enterprises to offset some of the high initial costs associated with green investments, reducing their tax burden. Loans with lower interest rates and longer financing terms allow small and medium-sized enterprises to secure financial resources for implementing environmental projects, which in turn help mitigate their negative environmental impact. These economic incentives not only help reduce long-term operating costs but also contribute to strengthening environmental sustainability and sustainable development of the local economy, increasing the competitiveness of enterprises in the market.

The ECOPROFIT program in Slovenia has established a successful cooperation model between the public and private sectors, aiming to achieve sustainable financial management and enhance enterprises' environmental performance. This program has included several support mechanisms to facilitate enterprises' investments in clean technologies and environmentally efficient processes. In this context, the public sector has played a crucial role by providing financial and regulatory support to create favorable conditions for developing ecological projects. One instrument the public industry uses is the provision of grants and tax

incentives for environmental investments. This financial support helps enterprises cover the high initial investment costs for clean technologies and improve production processes that reduce pollution and increase energy efficiency. Furthermore, the local and regional government sectors have contributed to developing environmental policies that support enterprises in implementing sustainable practices. On the other hand, the private sector has contributed with direct investments and the application of technological innovations that reduce pollution and improve resource efficiency. Private enterprises have been motivated to invest in green projects by recognizing the potential for long-term cost savings and the benefits of an improved public image, contributing to greater market sustainability. This cooperation has led to developing projects that are not only environmentally successful but have also generated financial benefits and contributed to increased credibility and transparency within the community. Through this cooperation model, ECOPROFIT in Slovenia has helped enterprises balance economic growth and environmental protection, ensuring that these projects are financially sustainable and have a positive, long-term impact on the community.

Figure 2. *EcoProfit Benefits for Ljubljana and Maribor: A PATH to Sustainable Urban Development*



The diagram illustrates the primary benefits that Ljubljana and Maribor derive from the EcoProfit project, organized into four key categories: pollution reduction, energy efficiency, green infrastructure, and economic benefits. Ljubljana has significantly improved air quality by developing sustainable transportation, including electric buses and bicycle networks, in the context of pollution and emissions reduction. At the same time, Maribor has made significant efforts to utilize renewable energy, thereby reducing CO2 emissions in both the public and private sectors. Regarding energy efficiency, Ljubljana has invested in green energy infrastructure and low-energy public buildings. At the same time, Maribor has integrated clean technologies into the local industry to increase energy efficiency and reduce losses.

Regarding green infrastructure development, Ljubljana has expanded green spaces and promoted ecological transport, while Maribor has implemented rainwater management and biodiversity protection projects. Finally, in the category of economic benefits, Ljubljana has attracted investments in the clean technology sector and created new jobs in green areas. In contrast, Maribor has benefited economically by developing new industries and increasing employment in natural resource management and clean energy. This diagram clearly illustrates how concrete measures and well-planned environmental policies can contribute to sustainable development and improved quality of urban life.

4.1.3. Ujë Rugove (Kosovo)

In September 2023, Ujë Rugove, the largest producer of bottled water in Kosovo, secured a €6 million loan from the European Bank for Reconstruction and Development (EBRD) and the Western Balkans Enterprise Expansion Fund II (ENEF II). This innovative green financing aims to support the company in acquiring a new facility and installing advanced, high-capacity production lines for filling glass bottles, aluminum cans, cartons, and water kegs. These investments will enable Ujë Rugove to expand its product range to include sparkling water, flavored water, and tea. A key aspect of this financing is the commitment to environmental sustainability. The loan aims to reduce water losses during production, reduce packaging waste, and use recycled materials at a rate of at least 50% in packaging and labels.

Investments in modern technology have significantly increased the operational efficiency of Ujë Rugove. In 2017, the company replaced the old filling line with a new Krones/Kosme 2014 line, which could fill 12,000 0.5-liter plastic bottles or 8,000 1.5-liter bottles per hour. This investment resulted in a 30% increase in production and an average 42% increase in monthly turnover. Technological improvements have also contributed to improving product quality. However, in February 2025, the authorities in North Macedonia found a shipment of Ujë Rugove water containing coliform bacteria. The company immediately conducted additional tests, confirming the water was safe and drinkable. Ujë Rugove's commitment to environmental sustainability is evident through its participation in humanitarian and environmental projects. Since 2012, the company has been a leading partner of the "Kosova Cap Project," an initiative that collects and recycles plastic caps to provide wheelchairs for people with disabilities. These initiatives have improved the company's reputation, positioning it as a leader in social responsibility and environmental sustainability in Kosovo. The commitment to quality and innovation has also contributed to increasing consumer confidence and expanding Ujë Rugove's domestic and international market share.

Table 3 below summarizes the impact of green financing on the company Ujë Rugove, one of the largest bottled water producers in Kosovo. Drawing on official data published by the European Bank for Reconstruction and Development (EBRD), as well as reliable reporting from the company itself and media sources, this analysis aims to highlight the concrete results of investments in modern technology and environmentally sustainable practices.

Table 3. *Impact of Green Financing on Ujë Rugove – Kosovo*

Category	***Description***
Source of Financing	*EBRD and ENEF II – €6 million*
Purpose of Investment	*Technological modernization and expansion of production lines*
New Products	*Sparkling water, flavored water, tea*
Environmental Objectives	*Reduction of water losses and waste, 50% recycled materials in packaging*
Operational Improvement	*+30% productivity, +42% average monthly turnover after the 2017 investment*
Community Engagement	*"Kosova Cap Project" since 2012 – collecting bottle caps for wheelchairs*
Reputational Benefits	*Increased consumer trust and market expansion both domestically and abroad*

The summary table clearly shows that the green financing provided by the EBRD and ENEF II, worth € 6 million, has significantly impacted the operational efficiency and sustainable development of the company Ujë Rugove. This financing enabled the company to modernize its technology and expand its production lines, bringing new products such as sparkling water, flavored water, and tea. This type of investment, with a clear focus on improving processes and introducing new products, can be an opportunity to diversify its product portfolio and reach a broader audience in domestic and international markets.

Investments in technology have led to a 30% increase in productivity and a 42% increase in monthly turnover, enabling Ujë Rugove to cope with growing market demand and improve its financial performance. This shows that companies that invest in advanced technology and modernize their manufacturing processes can significantly increase efficiency and productivity. Environmental objectives, such as reducing water and waste losses and utilizing recycled materials in packaging, demonstrate a company's commitment to environmental protection. In practice, this can encourage other companies to adopt similar practices to meet regulatory requirements and attract consumers who are increasingly aware of the environmental impact of their products. The company's commitment to humanitarian and ecological projects, such as the "Kosova Cap Project," has increased consumer confidence and expanded the market. Companies with a clear commitment beyond profit, such as those implementing socially and environmentally responsible initiatives, gain reputation and credibility, leading to increased opportunities to enter new markets and retain existing customers.

In conclusion, this investment in green finance is an excellent example of how environmental practices and technological investments can be combined to achieve dual benefits: enhancing financial performance and promoting ecological sustainability. Companies following this model can experience increased efficiency, a broader product range, and social and environmental engagement benefits.

4.2. Results from Comparative Analysis

In this comparative analysis, three case studies – Greencells GmbH (Germany), ECOPROFIT (Slovenia), and Ujë Rugove (Kosovo) – are analyzed along four key dimensions: approach to strategic financial management, legal and institutional support, access to green finance, and outcomes in environmental and financial sustainability. This analysis highlights similarities and differences between the cases in different national and institutional contexts. Greencells implements a proactive approach by combining investments in clean energy with diversification of financing sources and management of financial risks. ECOPROFIT, as an institutional program, orients enterprises towards cost planning and process optimization, integrating financial incentives into the strategic approach. Meanwhile, Ujë Rugove focuses on strategic financial management in technological modernization and product diversification through investments in production efficiency and capital management.

Greencells has benefited from national renewable energy policies and instruments such as green bonds and subsidies in Germany. ECOPROFIT in Slovenia represents a model of public-private cooperation where the government provides a strong regulatory framework and direct subsidies to participating companies. In Kosovo, Ujë Rugove has benefited from support from international financial institutions (EBRD and ENEF II). However, legal and institutional support at the local level remains more limited compared to other cases. All three instances share the use of green financing but with different depths and mechanisms. Greencells intensively uses green bonds and public financing to develop solar parks. ECOPROFIT provides funding through grants, soft loans, and fiscal incentives for enterprises. Ujë Rugove has secured international financing to modernize technology and reduce environmental impact, aiming to integrate recycled materials. All three cases show significant progress but in different forms. Greencells has significantly reduced CO_2 emissions and increased revenues through market expansion and production capacities. ECOPROFIT has improved resource efficiency, waste management, and cooperation between sectors. Ujë Rugove has benefited from increased productivity (+30%) and monthly revenues (+42%) and improved corporate image through social engagement and recycled materials. The main similarity between the cases is the

integration of green finance and the orientation towards sustainability goals. However, differences stem from the nature of the institutions and the national context: Germany offers an exceptionally advanced institutional and legal framework for clean energy, and Slovenia builds on public-private partnerships to foster enterprises. At the same time, Kosovo relies mainly on international financing to overcome internal institutional challenges.

Table 4. *Comparative analysis of three case studies*

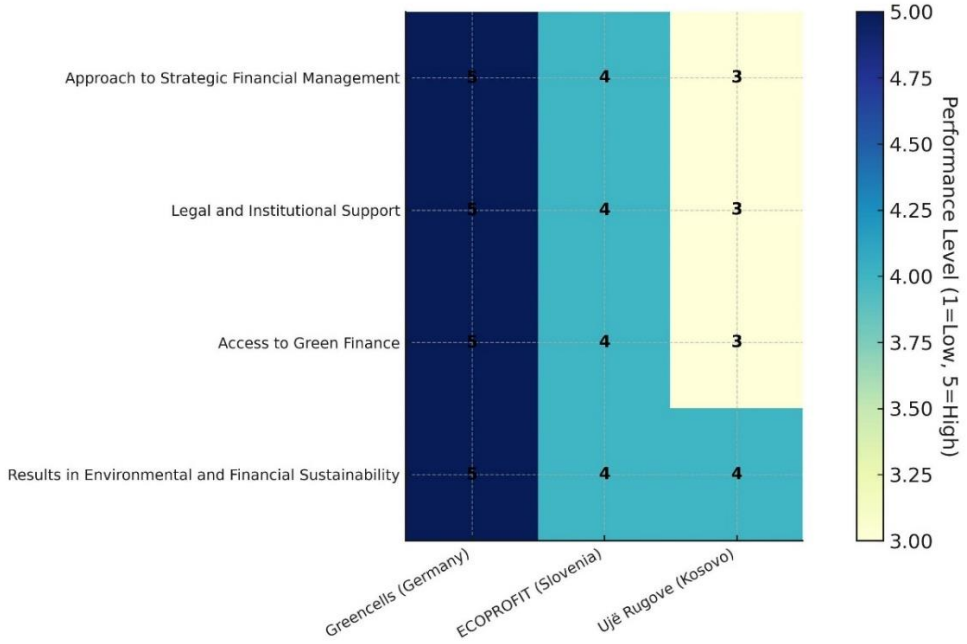
Dimensions	Greencells (Germany)	ECOPROFIT (Slovenia)	Ujë Rugove (Kosovo)
Approach to Strategic Financial Management	*Investments in clean energy, financial diversification, risk management*	*Cost planning, process optimization, financial incentives*	*Technological modernization, capital management, production cost reduction*
Legal and Institutional Support	*Advanced energy policies, green bonds, government subsidies*	*Strong regulatory framework, grants, soft loans, public sector support*	*International financing (EBRD and ENEF II), limited local institutional support*
Access to Green Finance	*Green bonds, public financing for solar energy projects*	*Grants, soft loans, fiscal incentives for enterprises*	*International dedicated funding for green technology and recycled materials*
Results in Environmental and Financial Sustainability	*CO_2 reduction (~1.39 million tons/year), increased revenues, market expansion*	*Operational cost reduction, improved energy efficiency, and waste management*	*+30% increase in productivity, +42% growth in monthly revenue, enhanced reputation, active involvement in environmental social projects*

Table 4 clearly shows that sustainability and financial performance successes come from the combination of several key factors: a strategic approach to financial management, strong institutional support, and effective access to green finance. Greencells takes maximum advantage of advanced energy policies and financing instruments, such as green bonds, ensuring sustainable growth. ECOPROFIT demonstrates the power of public-private cooperation to help small enterprises transition to sustainability. Meanwhile, Ujë Rugove emphasizes the importance of international financing and technological modernization to improve productivity and corporate image. This comparison offers practical lessons: enterprises should seek multiple financial, institutional, and technological supports to maximize sustainability benefits and ensure long-term competitiveness.

Figure 3 presents a visual summary of the performance of three case studies, Greencells (Germany), ECOPROFIT (Slovenia), and Ujë Rugove (Kosovo), across the four main dimensions of the analysis, which include access to strategic financial management, legal and institutional support, access to green finance and results in environmental and financial sustainability. In this matrix, each case is rated on a scale from 1 to 5, where 1 indicates a low level of performance and 5 represents a very high level. The colors used in the matrix help to clearly distinguish the differences between the cases and the dimensions assessed, making the figure more understandable and easier to interpret, while the numerical values placed within the cells provide a direct and precise reference to each aspect analyzed.

From the figure's visual analysis, it is clear that Greencells (Germany) presents the highest level of performance in all four dimensions, demonstrating an integrated and highly effective approach to strategic financial management for sustainability. The combination of investments in clean energy, the use of green bonds, strong institutional support, and visible results in reducing emissions and increasing revenues positions Greencells as a successful model for the green economy.

Figure 3. *Matrix Comparative Diagram: Green Strategic Financial Management*



ECOPROFIT (Slovenia) also shows a solid performance in all dimensions, especially in institutional support and access to green finance. The program successfully involves small and medium-sized enterprises through financial incentives and government support, contributing to reducing operating costs and improving energy efficiency. Meanwhile, Ujë Rugove (Kosovo) shows considerable progress, especially in sustainability results, where investments in modern technology and international financing have significantly increased productivity and revenues. However, local institutional support remains more limited compared to other cases, suggesting the need to strengthen the role of local institutions in promoting sustainable development.

4.3. Results from Synthesis Analysis

Across all three case studies, several common factors emerge as critical to success in integrating strategic financial management with sustainable development goals. Firstly, long-term financial planning is a consistent success factor. Each case demonstrates the importance of aligning financial strategies with future growth objectives, especially those oriented toward green transition and innovation. Secondly, alignment with environmental objectives has been a key driver; whether through CO_2 reduction targets (Greencells), resource efficiency and waste reduction (ECOPROFIT), or sustainable packaging and production modernization (Ujë Rugove), all initiatives are tightly connected to measurable environmental impacts. Thirdly, public policy support plays a vital role. Germany's advanced renewable energy policies, Slovenia's institutional incentives, and Kosovo's access to international financial support highlight how legal and institutional frameworks can either accelerate or limit green initiatives.

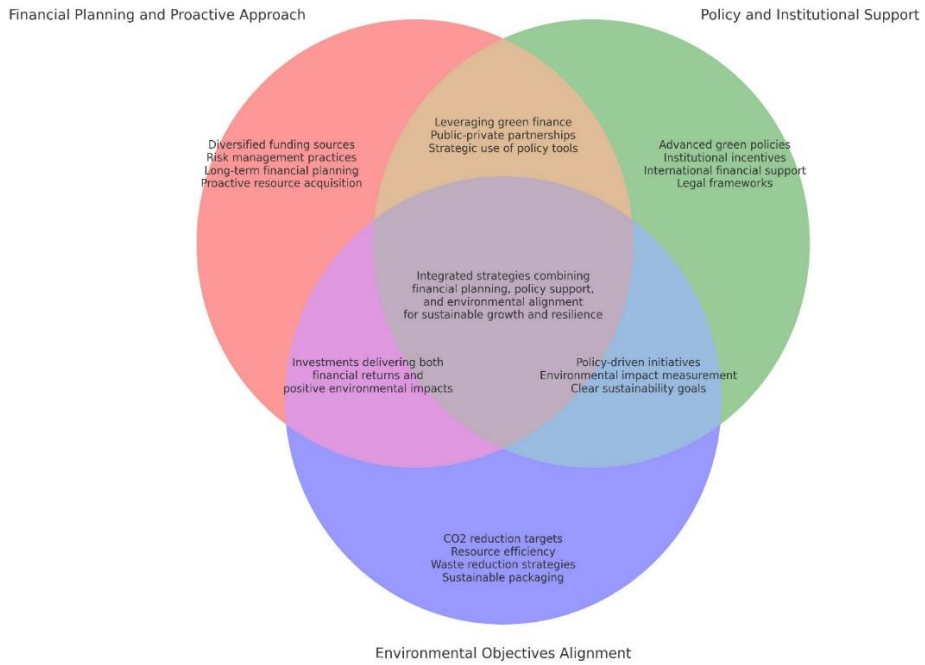
Financial instruments have been pivotal across the cases. Greencells has leveraged green bonds and subsidies to fund large-scale solar projects. ECOPROFIT utilized grants, soft loans, and tax incentives to enable SMEs to invest in cleaner technologies. Ujë Rugove accessed international green financing mechanisms, enabling technological modernization and expansion. Proactivity in securing these resources has been essential; companies and programs that actively pursued diverse funding opportunities were able to overcome financial barriers and realize ambitious sustainability goals. Moreover, proactive risk management and

diversification of funding sources strengthened financial resilience and ensured project continuity.

To build a sustainable financial strategy, businesses should integrate long-term planning with environmental targets, diversify their funding sources, and develop internal capacities for financial risk management. Emphasis should be placed on aligning internal financial goals with broader sustainability agendas, ensuring that investments generate economic returns and environmental benefits. Policymakers are recommended to strengthen legal and institutional frameworks by expanding access to green finance instruments such as grants, bonds, and fiscal incentives. Building a favorable environment for public-private partnerships can accelerate the adoption of green technologies, especially for SMEs. Further, ensuring transparency and accessibility of funding mechanisms will enhance participation and drive the green transition across different sectors.

Figure 4 presents the combination of key success factors that influenced the outcomes of three case studies: Greencells (Germany), ECOPROFIT (Slovenia), and Ujë Rugove (Kosovo). This diagram visualizes how three essential components — financial planning and proactive approach, institutional and political support, and alignment with environmental objectives — intertwine and create a strong foundation for successful strategies in financial management for sustainability. Through the overlapping areas of the diagram, we understand more clearly how these factors do not act in isolation but create a synergy that enables the transition to a green economy and environmentally and financially sustainable outcomes.

Figure 4. *Synthesis Analysis: Common Success Factors in Green Strategic Financial Management*



The diagram clearly shows that long-term financial planning and a proactive approach are fundamental elements for all case studies, highlighting the importance of businesses developing sustainable financial strategies, diversifying funding sources, and investing in risk management to meet the challenges of the green transition. Institutional support and favorable policies also appear as key pillars, as grants, soft loans, and fiscal incentives directly affect the

ability of enterprises to invest in sustainable technologies; thus, policymakers should create and expand support mechanisms for green financing, especially for small and medium-sized enterprises that often face more significant challenges in accessing finance. Compliance with environmental objectives is another defining element in all cases, where setting clear goals such as reducing emissions, increasing resource efficiency, and modernizing production processes contributes to improving the reputation of companies and increasing their attractiveness to investors oriented towards sustainability.

Most importantly, the combination of all three factors financial planning, political support, and environmental objectives creates a successful model that brings multiple benefits, such as sustainable growth, strengthened resilience to risks, and easier access to green finance. This positions the business for long-term success in an economy that increasingly demands compliance with the principles of sustainable development.

5. DISCUSSIONS

Based on the findings of this study and in comparison with the latest scientific literature, several key recommendations can be offered for businesses and policymakers aiming to integrate strategic financial management with sustainability and green economy objectives. Companies must develop financial strategies focusing on short-term benefits and integrating environmental and social objectives. Recent research by Chen, Xu, and Own (2024) shows that green finance policies and technological innovation significantly improve corporate environmental performance, contributing to the transition to sustainable energy. Public policies and institutional support are crucial in facilitating the transition to a green economy. Programs such as ECOPROFIT in Slovenia demonstrate that practical cooperation between the public and private sectors can accelerate regional decarbonization. This is consistent with the findings of Casady (2024), who emphasizes that public-private partnerships are key mechanisms for developing low-carbon and climate-resilient infrastructure.

Companies should be proactive in securing financial resources for sustainable projects. The study by Suryantini et al. (2024) highlights that green finance is essential in promoting sustainability by providing financial instruments and policies that support green development. Transparent reporting of environmental, social, and governance (ESG) performance is critical for building trust with investors and stakeholders. A recent study by Deloitte and The Fletcher School (2024) shows that improving data collection and transparency in sustainability reporting increases investor confidence and enables easier access to capital. The state must develop regulatory frameworks supporting sustainable finance to facilitate the green transition. According to the study by Gabor and Braun (2023), a new paradigm of sustainable public finance is needed to strengthen the state's role in the green transition, including direct public investment and creating favorable conditions for private investment.

To ensure a successful transition to a green economy, it is important to invest in educating and raising awareness among managers and employees about sustainability practices. This will help integrate these practices into daily business strategies and operations. Implementing sustainability performance monitoring and evaluation systems will enable enterprises to identify areas for improvement and report their progress transparently to stakeholders. These recommendations aim to guide enterprises and policymakers in integrating sustainability into financial and operational strategies, contributing to a greener and more sustainable economy.

This study provides an important contribution in both scientific and practical terms, strengthening the understanding of how companies and institutions can integrate strategic financial management with sustainability objectives. From a scientific perspective, our findings

align with current trends in the literature on green finance and sustainable management. Specifically, our study confirms the findings of Chen et al. (2024), who emphasize that green finance policies significantly improve the environmental performance of companies while also reinforcing the arguments of Casady (2024) on the strategic role of public-private partnerships in the development of low-impact infrastructure. At the same time, our study supports the findings of Suryantini et al. (2024), showing that a proactive approach to securing green finance is key for companies aiming to modernize technology and improve operational sustainability. From a practical perspective, the study provides concrete guidance for businesses and policymakers, demonstrating that effectively aligning long-term financial planning with institutional support and measurable environmental objectives can translate into tangible outcomes, such as increased revenues, improved energy efficiency, improved reputation, and broader access to green finance. Furthermore, the study highlights the importance of building integrated and sustainable strategies, making its findings highly applicable to enterprises operating in diverse geographical and institutional contexts and contributing significantly to the scientific and practical debate on the transition to a green economy.

6. CONCLUSIONS AND RECOMMENDATIONS

The results of this study confirm the validity of the hypothesis of this study, according to which the combination of strategic financial management with a proactive approach to resource provision, sustainable institutional support, and compliance with environmental objectives contributes significantly to improving the environmental and financial sustainability of enterprises. The analysis of three case studies shows that success does not lie in the isolated application of these elements but in their deliberate integration within the organization's overall strategies. This study adds a new dimension to the existing literature, emphasizing the importance of each component and especially the mutual impact that the interaction between them creates. Thus, the study contributes to the advancement of economic science by providing an integrated model, which can serve as a practical guide for enterprises that aim to overcome the challenges of the transition to a green economy.

At the same time, it is worth noting that although the study generates valuable insights, it is not without limitations. The lack of primary data and the focus on only three concrete cases limit the degree of generalizability of the results. The specific institutional and economic context of each case may have influenced the dynamics of the results, making it necessary for future studies to expand the scope of the research both geographically and sectorally. Such an approach would enable a more complete understanding of the effectiveness of integrated green finance models and help develop more comprehensive theories on sustainable finance.

From a broader systemic perspective, this study's findings raise a number of important implications for policymakers and economic institutions. The recommendations emerging from this research call for strengthening the institutional framework for green finance, increasing access to and transparency in financial instruments, and promoting effective partnerships between the public and private sectors. Furthermore, integrating sustainability criteria into overall economic and development policies can catalyze new investments and the economy's structural transformation towards a more resilient and sustainable model.

In light of these findings, future research should deepen the understanding of the interactions between public policies, financial instruments, and internal strategies of enterprises, using combined methodological approaches and direct empirical data. This will help not only to verify the findings of this study in other contexts but also to develop more effective policies to support the transition to a sustainable economy at the global level.

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KNOWLEDGE-BASED LEADERSHIP AS A KEY FACTOR IN BUSINESS SUCCESS – CASE STUDY OF MONTENEGRO

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Abstract: *In the contemporary globalized environment, effective leadership becomes a crucial factor for managing change and achieving sustainable business success. Leaders, through their knowledge, skills, and ability to manage knowledge, have a key role in shaping organizations that successfully adapt to dynamic market conditions. Continuous learning and application of knowledge enable leaders to respond to complex challenges of modern business. The aim of this research is to examine how leading principles, observed through knowledge management, influence the education of leaders in Montenegro and their readiness to face global challenges, as well as their contribution to achieving business success. The results indicate that leaders in Montenegro possess significant developmental potential, but also that, in addition, there is room for improvement, especially in the areas of leadership styles, knowledge sharing, readiness to take risks, and digital transformation. As directions for improvement, the need for adapting leadership to specific situations, greater openness and transparency, encouraging innovative thinking, development of multicultural competencies, and focus on international cooperation stand out.*
Keywords: *leadership, knowledge, globalization, transformational leadership, education*

INTRODUCTION

The contemporary business environment is characterized by accelerated technological development, omnipresent globalization, and growing complexity of market relations. In such an environment, leadership no longer implies only management of people, but requires strategic thinking, the ability of rapid adaptation, and decision-making based on knowledge. Leaders are expected to encourage innovations, develop flexible organizational structures, and effectively manage diverse teams.

However, although leaders in Montenegro show certain potential, the question arises whether they possess adequate competencies for successfully facing contemporary challenges. Although certain efforts in the direction of leadership development have been observed, there are significant discrepancies between current practices and the needs of the global market. This creates room for critical re-examination of existing approaches to leadership and emphasizes the importance of their adaptation to dynamic changes in the business environment.

Therefore, this research focuses on examining the role of knowledge management in the education and practice of leaders, with special emphasis on how through these processes their ability can be improved to act in a contemporary, competitive and dynamic business

environment. Also, the aim of the research is the identification of key areas in which it is possible to improve leadership practices, so that leaders become carriers of development and business success.

1. Leadership and modern tendencies

Defining leadership is a challenging assignment since each era brings specific demands and shapes the characteristics of leaders in accordance with social, economic and technological changes. Leadership can be viewed through different theoretical and practical approaches, which has led to a multitude of definitions and understandings of this concept. According to Stoner and Freeman (2018), leadership is the process of directing the activities of group members towards achieving common goals. This process involves the application of various forms of influence and is based on the interaction of leaders and group members (Yukl, 2012). Similarly, Northouse (2018) defines leadership as a process in which an individual exerts influence on a group in order to achieve clearly defined goals, while Singh et al. (2023) emphasizes that leadership includes processes by which organizations are shaped and adapted to changing circumstances, defining a vision of the future and directing individuals towards its realization. Regardless of the different approaches, the common basis of leadership definitions is that it is understood as a process of mutual influence between leaders and followers within a group that has a clearly defined goal. Leadership is,therefore, based on interaction that enables not only the achievement of goals, but also the continuous adaptation and improvement of organizational capacities (Northouse, 2018; Boeske,2023).

Modern tendencies of leadership are noticeable in business and social environment to which transformational leadership takes center stage. This approach implies inspiring and motivating employees through clear vision of innovative strategy and personal example of a leader (Greimel et al., 2023; Stone; Patterson, 2023). In addition, the concept of servant leadership is gaining ground importance, because it focuses on the needs of employees and their professional development, while leaders assume the role of support and guide (Benmira; Agboola, 2021; Claro; Silva,2025).

In a dynamic business environment, agile leadership is becoming essential, enabling leaders to manage change effectively, make quick decisions, and adapt strategies to keep organizations competitive. Digital transformation further redefines paradigm leadership, emphasizing the need for digital skills, innovation and technology understanding that leaders must possess in order to improve business processes and lead teams through technological changes (Delıoğlu & Uysal, 2022; Skare & Soriano, 2021).

At the same time, the leader's role of creating sustainable organizations is becoming increasingly evident. Modern leadership involves responsible management, balancing economic goals with social and environmental aspects of business. Alongside that, globalization increases the importance of leaders who are capable to successfully lead multicultural teams, understanding differences in values, norms and practices (Perez, 2017).

Key characteristics of modern leaders include flexibility, creativity, emotional intelligence, strategic thinking and open mind for innovations. According to Farrel (2017), leaders not only need to cherish creativity and support technological innovations, but also to

create an environment conducive to continuous learning and employee development. Successful leaders steer the organization towards sustainable goals, while developing the capabilities of their teams to face the challenges of the modern business world. Finally, leadership is increasingly defined as a key factor in knowledge management. Leaders are responsible for creating, transferring and applying knowledge in the organization, thereby ensuring its long-term competitiveness and success. This requires constant adaptation, innovation and reliance on teamwork, which makes leadership a central element in the development of modern organizations (Pellegrini et al., 2020).

2. Knowledge as key resource modern organization

Unlike the traditional economy, which relied on physical resources, modern organizations are based on the creation, sharing and application of knowledge as the main driver of development. In a globalized business environment, an organization's ability to effectively manage knowledge can be crucial for its survival and growth, as it enables rapid adaptation to change, increases innovation and strengthens its competitive position (Chaithanapat et al., 2022).

Knowledge in organizations is divided into explicit and implicit. Explicit knowledge is formalized, easily transferable and can be documented through procedures, databases and other records, while implicit knowledge is linked to the experiences, skills and intuition of employees. Although explicit knowledge enables process standardization and increases operational efficiency, it is precisely implicit knowledge that forms the basis of organizational intelligence, as it contributes to creativity and decision-making in complex situations. Its informal nature poses a challenge in identification and transfer, but at the same time allows organizations to develop flexibility and resilience to change (Ellis & Roever, 2021).

One of the key characteristics of knowledge, which distinguishes it from physical resources, is its ability not to be consumed by use, but to create additional value through dissemination and application. Its development depends on research, innovation and collective experiences of employees where knowledge is not only accumulated passively but is actively shaped through interaction and exchange of ideas. Since it is inextricably linked to human capital, its effective application depends on the degree of competence, creativity and engagement of employees. Organizations with highly qualified personnel not only adopt and adapt knowledge faster, but also more easily transform information into strategic resources that provide them with long-term market advantage (Haider et al., 2022).

Modern organizations must develop systematic knowledge management strategies that enable its effective integration into business processes. In this context, knowledge management is not only a technical challenge, but also an organizational and cultural process, which requires continuous collaboration, open communication and the creation of a supportive environment in which the contribution of each individual is recognized and valued. Organizations that successfully integrate knowledge into their business models not only improve operational efficiency, but also foster innovation, increase agility and build long-term sustainable business systems.

3. Synergy of knowledge and leadership in the context of globalization

Globalization, as a process of accelerated linking of markets, people and information, has created a new business environment in which competition, innovation and technological progress are constant factors shaping the market. In this context, the synergy between knowledge and leadership becomes a key factor for achieving long-term success. Leaders who understand the strategic importance of knowledge can enable organizations to quickly adapt to the dynamic changes brought about by globalization (Claro & Silva, 2025; Born et al., 2025; Jensen, 2024).

Unlike earlier management concepts, where knowledge was treated as a technical resource, today it is increasingly viewed as a strategic tool for decision-making and recognition of market opportunities. Organizations that successfully manage knowledge not only achieve greater flexibility but also ensure sustainable competitive advantage through innovation. On the other hand, organizations that neglect the development of strategies for adequate knowledge management face stagnation and loss of market position (Rupčić, 2024; Nonaka, 2009).

In such an environment, leaders not only manage organizations, but also shape a working atmosphere that encourages the development, sharing and application of knowledge. Their role is no longer just setting goals and monitoring performance - leaders today must inspire, motivate and direct teams, and encourage an open exchange of ideas. In a globalized business environment, intercultural competencies of leaders become crucial for the successful management of teams that operate in different cultural and economic contexts (Hanson et al., 2021; Carreño, 2024; Bilderback & Thompson, 2025). Therefore, the synergy of knowledge and leadership is the basis for building competitive and flexible organizations that can cope with the challenges of globalization. Effective knowledge management, combined with the ability of leaders to guide and inspire teams, enables organizations to not only survive, but also thrive in complex market conditions. To achieve long-term sustainability, organizations must continuously invest in the development of leaders and intellectual resources, thus securing their position in the global market.

4. Leadership approach to global challenges: the example of montenegro research methodology

The research was conducted between January and March 2025, on a sample of 100 respondents employed in various organizations in Montenegro. The sample includes employees of different age groups, educational profiles, job roles and genders, which allows for a representative sample for the analysis of leadership and its role in the development and application of knowledge within organizations. Given the importance of knowledge in today's business environment, the research focuses on how leaders manage, share and use knowledge to respond to the challenges of globalization and improve the competitiveness of organizations.

The respondents were selected using a random sample method, allowing for the representation of employees from different sectors. The industries covered by the research include agriculture, tourism, manufacturing and services, and the research focuses on how leaders in these sectors develop strategies for the transfer and use of knowledge in order to adapt to global trends and technological innovations. Respondents participated in surveys that covered key aspects of leadership, including:

- Democratic and authoritarian leadership styles and their ability to encourage knowledge exchange and development within organizations.
- The impact of leaders on innovation and employee motivation through strategies that incorporate knowledge as a key resource for success.
- Attitudes toward change readiness, where leaders use knowledge to help organizations adapt to new challenges.
- Managing global challenges through strategies that leverage global knowledge and technological innovations.
- Digital transformation as a key element in integrating new knowledge into business processes.
- Competitiveness in the global market, based on leaders' ability to optimize knowledge utilization within the organization.

Thematic analysis was used as a method for data analysis, as it allows identification of key themes and forms in the respondents' responses, with a particular emphasis on how leaders in Montenegro manage and develop knowledge within their organizations. This approach allows for a deeper understanding of how leaders shape organizations and how their ability to develop and apply knowledge affects the competitiveness and sustainability of organizations in a globalized business environment.

4.1. Results

The understanding of leadership throughout history has varied; in the past, it was believed that leaders are born, while today the prevailing view is that leadership depends on the development of skills through education and experience. Leaders develop through a continuous process of learning, training and experience (Jago, 1982; Northouse, 2025).

Table 1. Analysis of Leadership in Montenegro

Key Aspects of Leadership in Montenegro	**Arithmetic Mean (%)**
Leader's ability to solve problems	80
Leader's willingness to share knowledge with employees	50
Leader's responsibility for the organization's success	88
Role of the leader in organizational changes	89
Creation of knowledge within the organization	91
Communication with employees	76
Commitment to employee motivation and satisfaction	89
Managing different cultures	78
Monitoring global trends	65
Willingness to take risks	56
Recognizing the importance of digital transformation	68
Developing cooperation with international partners	74
Encouraging innovative thinking	60

Source: Own research

4.2. Discussion

The majority of respondents (80%) consider that a leader should be democratically oriented, which means that most people value openness and inclusiveness in leadership. However, 20% of respondents consider that a leader should be authoritarian, which indicates divided opinions about the leadership style. When it comes to knowledge sharing, 48% of respondents consider that the leader shares their knowledge with employees, while 52% of respondents consider that this is not the case. This may indicate the need for improvement in the area of communication and exchange of information between leaders and employees.

In terms of responsibility, 88% of respondents believe that the leader should be responsible for the success of the organization, which includes problem-solving and making key decisions. Similarly, 89% of respondents consider that the leader should be a carrier of change, because leadership largely implies the ability of the organization to adapt and develop. When it comes to knowledge creation, 91% of respondents believe that the leader plays a key role in this process, which is especially important for organizations that strive for innovations and continuous learning. Similarly, 76% of respondents consider that the leader should spend most of the time in communication with employees, because this enables better understanding and effective management of the organization.

Employee motivation and satisfaction also stand out as key factors for success, with 89% of respondents who consider that the leader should be dedicated to this. This is in accordance with modern approaches to leadership that recognize the importance of emotional intelligence and a positive work atmosphere.

In relation to the specific characteristics of leaders in Montenegro, 78% of respondents consider that leaders do not have sufficiently developed multicultural competencies, which indicates room for improvement of skills in this area. Also, 65% of respondents recognize the importance of global trends, but state limitations in the implementation of these trends in organizations. 68% of respondents consider that leaders in Montenegro recognize the importance of digital transformation, but there are challenges in the full application of these changes. Readiness for risk is somewhat lower, with 56% of respondents who consider that leaders are somewhat ready to take risks. This may indicate caution and a desire for stability, but it may also represent an obstacle for rapid adaptation and innovations. In terms of cooperation with international partners, 74% of respondents consider that leaders in Montenegro develop cooperation with foreign partners, but there is room for strengthening international networks and improving cooperation. Innovative thinking is also gradually developing, with 60% of respondents who consider that leaders are beginning to develop innovative approaches.

Previous research, including the works of Janićijević (2019), Nikčević (2016, 2023, 2024), indicate the presence of similar challenges in the domain of leadership in Montenegro. Related conclusions are also found in international studies, such as those conducted by Northouse (2018), Boeske (2023), Anderson & Crutcher (2023), Ishchuk (2024), Batsenko & Halenin (2024), where limited readiness of leaders to take risks is identified, as well as slow implementation of digital innovations in leadership practice.

Based on the results of the survey, several paradoxical situations are observed that reflect contradictory aspects of leadership in organizations in Montenegro. Although 80% of respondents consider their leader democratic, 20% see them as authoritarian. This indicates the existence of a mixed leadership style, which may cause confusion among employees, because some prefer participation, while others expect quick and clear decisions in crisis situations. The majority of respondents consider that the leader should be responsible for the success of the organization, but only 48% consider that the leader shares their knowledge with employees. This discrepancy may reduce the efficiency of the organization, because key information does not reach all members of the team, which may limit the growth of employees. Although 56% of respondents consider that leaders in Montenegro have moderate readiness for risk, there is a strong need for security and stability in organizations. Excessive security may limit innovations, because leaders, although they recognize the need for risk, avoid making decisive and strategically bold decisions that could accelerate progress. Although 60% of respondents consider that leaders are beginning to develop innovative approaches, there still exists significant resistance to new ideas, because organizational culture and traditional business practices favor old methods. This conflict between innovation and tradition may complicate the implementation of changes.

Finally, although 76% of respondents consider that communication with employees is key, digital transformation may create barriers in personal interactions. Balancing effective use of technology with the need for personal communication becomes a challenge for the leader, because excessive digitalization may reduce trust among employees and negatively affect organizational culture.

The obtained research results indicate that leaders in Montenegro possess significant potential for further development, but also that there are aspects of leadership that require additional improvement. If organizations are to become more competitive and ready for contemporary global challenges, it is necessary to invest additional efforts in the education of leaders and the application of modern business practices. In this context, adaptation of leadership styles is particularly important — leaders should skillfully balance between the democratic approach, which encourages inclusion and engagement of employees, and the authoritarian approach, which can be effective in situations that require quick decision-making. Also, it is necessary to strengthen the culture of knowledge sharing within the organization, because transparency in this regard not only contributes to the development of employees but also enables faster and more efficient response to market changes.

In addition, the results indicate the need for greater assumption of responsibility by leaders, as well as for improvement of communication with employees. This contributes to the creation of a positive organizational climate, greater trust, and more efficient decision-making.

In the contemporary business environment, additional attention must be devoted to the development of multicultural competencies, so that leaders are prepared to work in diverse teams and cooperate at the international level. Furthermore, leaders should encourage innovations and develop greater readiness for taking thoughtful risks, because precisely these qualities are key for dynamic and competitive business operations. In parallel with this, digital transformation imposes itself as an unavoidable step — leaders should lead the processes of introducing digital solutions so that organizations keep pace with contemporary trends. Finally,

the results emphasize the importance of developing international business relations, which can contribute to long-term stability and growth of organizations.

Taking into account all the above, it is clear that by strengthening the competencies of leaders and improving key areas of leadership, it is possible to significantly contribute to the development of modern and competitive organizations in Montenegro.

5. CONCLUSIONS

Leadership in the modern business environment represents key strength that enables organizations to respond to challenges of globalization. In a world that is everyday more and more connected, leaders must pay attention to understand the complexity of the global market, cultural differences and economic turbulence. Their capability to develop strategies that balances innovation, sustainability, and cultural adaptability becomes critical to success. Effective leaders not only steer organizations toward growth but also inspire teams to adapt to dynamic circumstances and recognize new opportunities. In that sense leadership is more than usual management – that is strategic response to global challenges, shaping the future of an organization and enabling it to survive and progress in an increasingly competitive global environment. This approach enables leaders to create long-term competitive advantages, making leadership not only a means of management, but also a key factor in sustainable business success.

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THE IMPORTANCE OF PROFESSIONAL ETHICS FOR ACCOUNTANTS IN THE DIGITAL AGE

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Abstract: *The digital age brings many challenges to the modern business world. Due to these significant challenges, the issue of ethics is gaining increasing attention. Ethics focuses on making moral decisions and acting upon them. Both in private and professional life, it is important to be honest, fair, and a good person. Ethics and ethical behavior are extremely important in the work of accountants, and they should apply the code of professional ethics for accountants. Proper application of professional ethics, rules, norms, laws, principles, and ethical codes significantly contributes to a positive work environment. The fundamental beliefs and value systems that accountants apply affect their work and, consequently, influence the trust in the results of their work. Financial statements provide information about an organization's operations, and accountants are responsible for ensuring that this information is accurate and reliable. Nowadays, trust in financial statements has been significantly damaged, but when ethical norms are visibly applied in the behavior of accountants, it greatly influences the trust in their work and the accuracy of the data presented in financial reports. The subject of this research is to determine how significant the application of professional ethics of accountants is in the digital age. The goal is to identify how applying the International Code of Ethics for Professional Accountants contributes to the quality of accountants' work. The paper presents the most important results of empirical research related to accountants' perceptions of the importance of applying ethical principles in the accounting profession. The results show a high level of awareness among accountants regarding the importance of applying the highest ethical standards, which is encouraging and instills confidence in strengthening the integrity of the accounting profession in the future.*
Keywords: *ethics, professional ethics of accountants, accounting profession, financial reports*

INTRODUCTION

Accountants perform their work by respecting the employer's requirements on one hand, while on the other hand, they bear the responsibility to carry out their duties professionally and to protect the reputation of the accounting profession. In the era of digitalized business, it is increasingly being discovered that financial statements do not reflect the true state of business operations, which raises the need for further consideration of business ethics. One of the measures for preventing fraud in financial statements is the establishment of internal company procedures through which internal control is implemented with the aim of identifying which actions and transactions are unethical (Osmanović & Jusupović, 2019, p. 293).

Serious disruptions in economic processes and human relations indicate the importance of applying ethics in business practices. In order to ensure dignity and restore trust in the accounting profession, accountants are required to behave in accordance with specific rules defined in codes of ethics, which primarily emphasize moral norms in behavior. In addition to professional ethics, accountants are also obligated to comply with applicable legal regulations. The Code of Ethics for Professional Accountants aims for accountants to carry out their professional duties with integrity, objectivity, professional competence and due care, confidentiality, and professional behavior. Segregation of duties is one of the fundamental control procedures that reduces the likelihood of an employee being able to commit and conceal errors, irregularities, or fraud (Osmanović & Šarić, 2024, p. 306).

This paper presents the basic characteristics and principles of professional ethics for accountants, as well as how professional ethics contribute to the reliability of financial reporting. In relation to the above, an empirical study was conducted on the impact of applying the international code of professional ethics on the quality performance of accounting work.

I. Theoretical basis of the research

I.1. The term of creative accounting

The word ethics originates from the Latin word meaning morality. Ethics is "a philosophical discipline that examines the goals and meaning of moral desires, the fundamental criteria for evaluating moral acts, as well as the basis and source of morality in general" (Sever, Tušek & Žager, 2012, p. 164). The results show that companies where organizational culture and work climate are ethically oriented, and where written codes of ethics exist, are more successful in raising employees' awareness of appropriate ethical behavior (Gibson et al., 2009, p. 467). The system of moral values of every individual is developed and acquired from early childhood within the family, but under the influence of the environment and the society in which the individual lives, changes to the acquired moral values can occur. Ethics as a scientific discipline studies the principles of proper, good, and moral action, and ethical principles determine what is acceptable and unacceptable behavior. In the digital age, ethics in business is given special importance and attention. Business ethics can be defined as 'the ability to reflect on values in the decision-making process in corporations, in order to determine how these values and decisions affect different stakeholder groups and to identify how managers can use these insights' (Certo & Certo, 2006, p. 66). Every organization strives to have employees who are professional and competent, but in addition, it is especially important that employees possess certain moral qualities and adhere to the rules and norms of ethical behavior. The application of ethical behavior in an organization depends on the individual, but it also largely depends on whether the organization has established written rules of ethical conduct. Internal control plays an increasingly important role and is reflected in the protection of assets, and in the prevention and detection of fraud and irregularities that may occur during business operations (Osmanović & Šarić, 2023, p. 95).

Business ethics is a system of business principles or values aimed at harmonizing business efficiency with the ethical dimension of operations (Hunjet & Kozina, 2014, p. 192). Business ethics represents a code of conduct accepted in the business world, which protects

both the organization and its employees, and has therefore become an integral part of the modern business environment. Accounting ethics is defined as a set of generally accepted moral norms based on ethical values required when preparing and presenting financial information related to a specific institution or company (Bedeković, 2013, p. 103).

I.2. Fundamental Principles of the Code of Ethics for Professional Accountants

The Code of Ethics for Professional Accountants, issued by the International Federation of Accountants (IFAC), is the most well-known and most widely applied code in the accounting profession. The International Federation of Accountants was founded in 1977 with the aim of serving the public interest and strengthening the accounting profession, through the adoption of various professional standards and written rules of conduct for accountants, as well as through numerous other forms of professional activity. Within IFAC, there is a special board for the development of international ethics standards for accountants (IESBA – International Ethics Standards Board for Accountants), which developed the Code of Ethics for Accountants. This code consists of three parts: the first part refers to the general section, the second part refers to accountants in public practice, and the third part refers to accountants in business.

The Code contains the following material (IESBA, 2023, p. 8–9):

- Part 1 – Complying with the Code, Fundamental Principles, and the Conceptual Framework, which includes the fundamental principles and the conceptual framework, and applies to all professional accountants.
- Part 2 – Professional Accountants in Business, which includes additional material relevant to professional accountants working in business entities while performing professional activities. Professional accountants in business include those who are employed, engaged, or contracted in executive or non-executive positions in, for example: Commerce, industry, or service sectors; Public sector; Education; Non-profit sector; Regulatory or professional bodies. Part 2 also applies to individuals who are professional accountants in public practice when performing professional activities within the context of their relationship with the firm, whether as contractors, employees, or owners.
- Part 3 – Professional Accountants in Public Practice, which includes additional material applicable to professional accountants in public practice when providing professional services.

- International Independence Standards, which contain additional material applicable to professional accountants in public practice when performing assurance services, and include:

- Part 4A – Independence for Audit and Review Engagements, which applies when conducting audit or review engagements
- Part 4B – Independence for Assurance Engagements Other than Audit and Review Engagements, which applies when performing assurance engagements that are not audits or reviews

- Glossary, which contains defined terms (along with additional explanations where appropriate) and described terms that have a specific meaning in certain parts of the Code. For example, as stated in the Glossary, in Part 4A, the term “audit engagement” applies

equally to both audit and review engagements. The Glossary also includes lists of abbreviations used in the Code and in other standards referenced by the Code.

Due to the complex political system in Bosnia and Herzegovina, there are two professional organizations whose aim is to develop the accounting profession. They are responsible for organizing the acquisition of professional titles in the field of accounting and auditing, providing education in the accounting profession, ensuring compliance with the code of ethics, translating international accounting standards, and maintaining a certain level of quality within the accounting profession (Osmanović, Šarić & Čanić, 2023, p. 18). In Bosnia and Herzegovina, the Law on Accounting and Auditing prescribes the obligation to apply accounting and ethical standards; however, practice shows non-compliance with these regulations.

II. Methodology

II.1. Population and Sample

The conducted empirical research aimed to demonstrate the importance of professional ethics for the accounting profession. The target population in this research consisted of employees in accounting and finance departments within the territory of Bosnia and Herzegovina. Scientific research on the impact of professional ethics of accountants on the accounting profession was carried out through a survey questionnaire. A total of 44 employees returned duly completed questionnaires. The objective of the research was to determine the significance of professional ethics in the field of accounting. Accordingly, the paper sets forth one main and one auxiliary scientific hypothesis:

H1: Accountants' attitudes towards ethical behavior are related to their knowledge of the Code of Ethics for Professional Accountants.

PH1: The application of the Code of Ethics for Professional Accountants in the digital age has a positive impact on reducing fraud.

II.2. Statistical Analysis

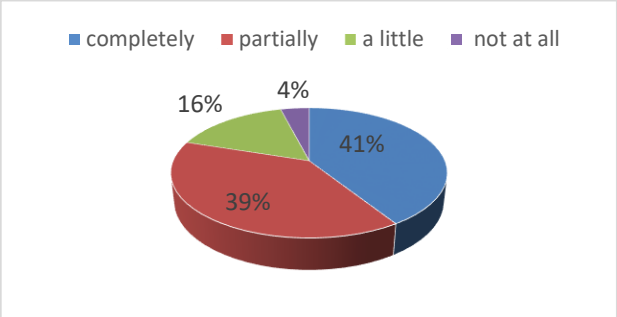
The conducted scientific research included the collection of primary data using the survey method, through a questionnaire intended for accounting employees. Out of a total of 66 questionnaires sent via email between December 1, 2024, and December 31, 2024, 44 were returned duly completed, representing a response rate of 66.66% of the total sample. This response rate is considered acceptable for this type of research. However, it should be emphasized that the results of this research do not represent a rule, but can serve as a useful guideline for future research.

III. Results

The Code of Ethics for Professional Accountants requires professional accountants to adhere to fundamental ethical principles. It also mandates the use of a conceptual framework to identify, evaluate, and address threats to compliance with those principles. This research aimed to examine whether accountants consider professional ethics to be significant for the accounting profession.

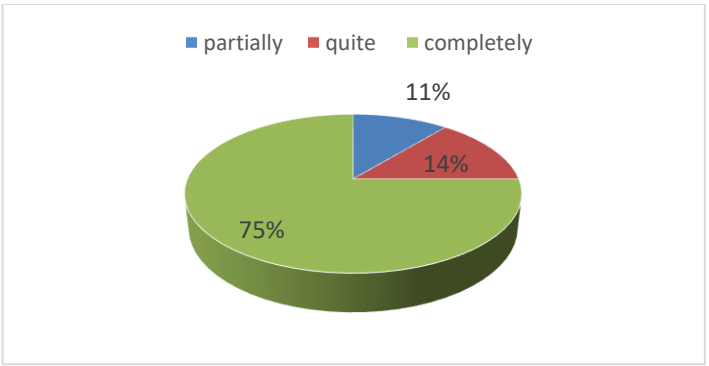
The Code of Ethics for Professional Accountants should be known and understood by every accountant in order to perform accounting activities as effectively as possible. Based on the conducted research, 41% of respondents are fully familiar with the provisions of the Code, 4% are not familiar at all, 16% are slightly familiar, while 39% are partially familiar with its provisions.

Figure 1. Familiarity of respondents with the provisions of the Code of Ethics for Professional Accountants



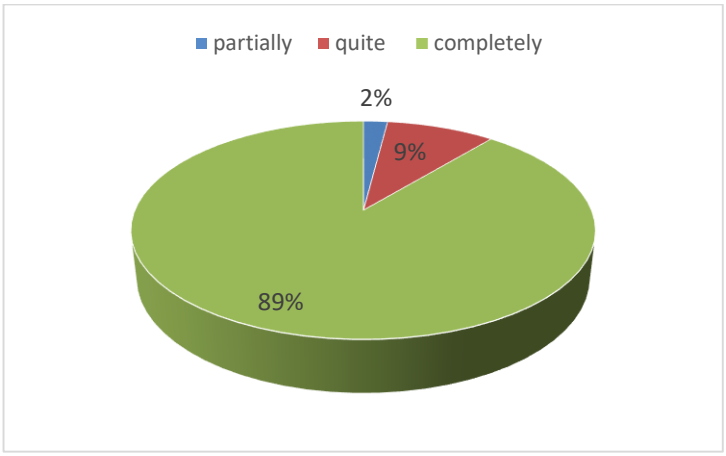
Although professional ethics implies that accountants should perform their duties objectively, the research results provide insight into how this expectation is perceived in practice. According to the data, 33 respondents (75%) believe it is fully justified to expect accountants to carry out their work objectively. An additional 6 respondents (14%) consider this expectation to be quite justified, while 5 respondents (11%) believe it is only partially justified. Notably, none of the respondents indicated that such an expectation is unjustified or only slightly justified. Based on the collected responses, it can be concluded that there is a clear understanding that accountants are expected to perform their duties with a high degree of objectivity, independence, and impartiality.

Figure 2. Respondents' perceptions of how justified it is to expect accountants to perform their work objectively



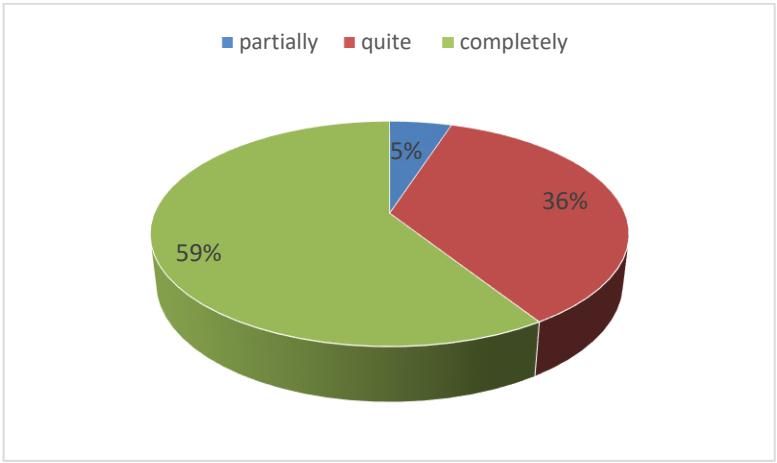
The accountant's code of ethics prescribes honesty in performing the job. The conducted scientific research led to the realization that 39 respondents (89%) believe that accountants can be expected to perform their work confidentially, 4 respondents (9%) believe it is quite justified to expect accountants to perform their work confidentially, and only 1 respondent (2%) believes it is partially reasonable to expect honest performance of accounting duties.

Figure 3. Respondents' opinions on how reasonable it is to expect accountants to perform their work confidentially



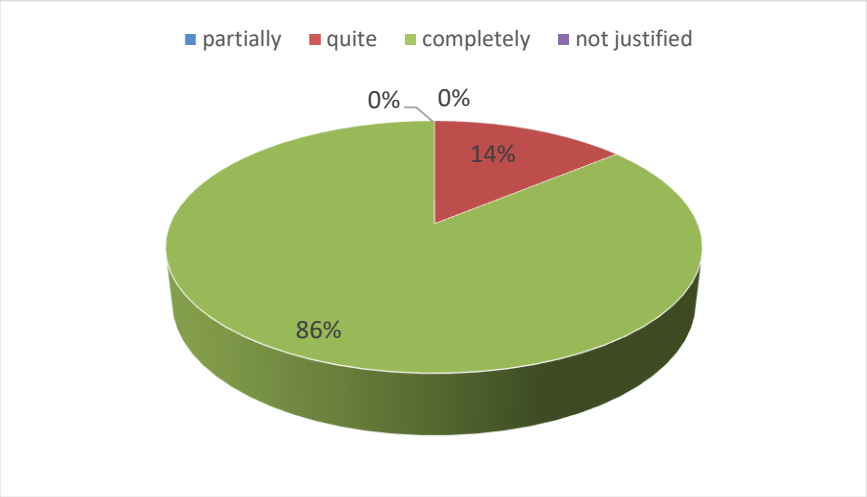
Based on the Code of Ethics for professional accountants, which requires professional competence, the research showed how many respondents believe it is reasonable to expect accountants to acquire and maintain professional competence. Out of the total number of respondents, 26 (59%) think it is completely justified to expect accountants to acquire and maintain professional competence, 16 respondents (36%) think it is quite reasonable to expect it, and 2 respondents (5%) think it is partially justified to have such an expectation, as shown in the following graph.

Figure 4. Respondents' opinions on how reasonable it is to expect accountants to acquire and maintain professional competence



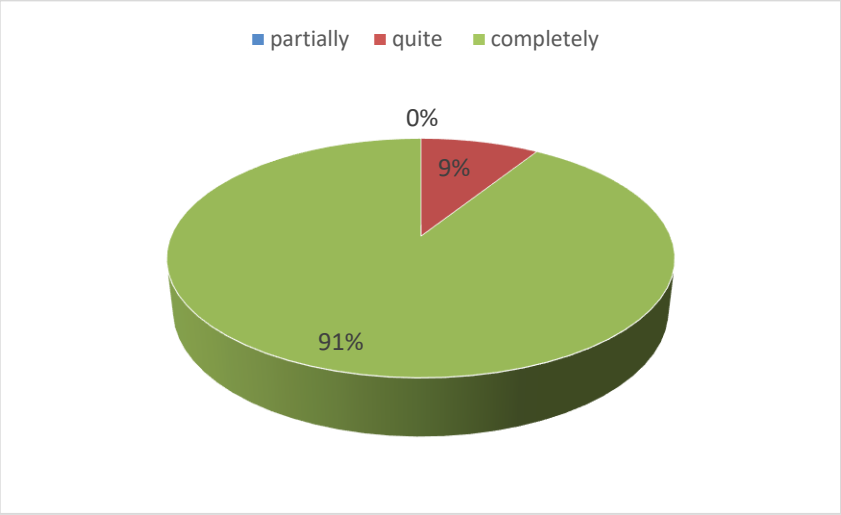
The Code of Ethics for Professional Accountants requires accountants to perform their work with due professional care, thoroughly, and in a timely manner. In Bosnia and Herzegovina, in practice, accountants, in addition to their accounting duties, often perform other tasks that are not part of their job description. Because of this, due to their workload and other tasks, the question of whether accounting tasks are being performed appropriately arises. In this regard, according to the research conducted, 86% (38 respondents) believe that it is completely justified to expect accounting tasks to be performed with due professional care, thoroughly, and on time, while 14% (6 respondents) believe that it is quite justified to expect the work to be performed carefully, thoroughly, and on time.

Figure 5. Respondents' views on how reasonable it is to expect accountants to perform their work with due diligence (thoroughly, on time)



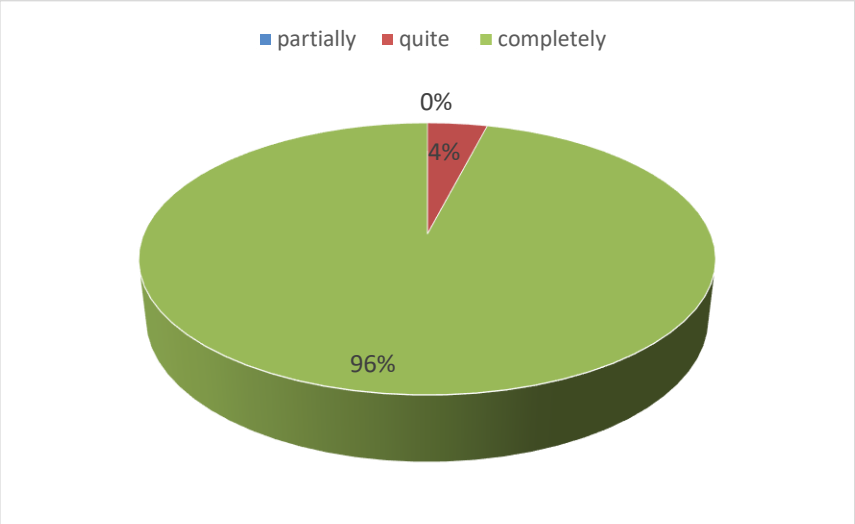
It is extremely important for accountants to maintain the confidentiality of the information they obtain while performing accounting work. The conducted research shows that 91% of the respondents believe it is fully justified to expect accountants to keep business information confidential, while 9% of the respondents believe it is quite justified to expect confidentiality.

Figure 6. Respondents' views on how reasonable it is to expect accountants to keep business information confidential



The work of an accountant is almost unimaginable without adhering to and working in accordance with legal regulations. Work in which rules and regulations are not applied leads to numerous consequences, ranging from financial to criminal. Information about accounting and financial frauds discovered by auditors and inspectors is often disclosed to the public. The opinion of respondents in the conducted survey is that 96% of them believe it is reasonable to expect accountants to act in accordance with all applicable accounting and other regulations, while only 4% of respondents believe that partial expectations are justified.

Figure 7. Respondents' views on how reasonable it is to expect accountants to act in compliance with applicable accounting and other regulations



By applying Spearman's correlation coefficient, the basic research hypothesis that accountants' attitudes towards ethical behavior are related to knowledge of the Code of Ethics for Professional Accountants was not verified in the research.

Table 1. Statistical presentation of the rank correlation coefficient between accountants' attitudes towards ethical behavior and their knowledge of the Code of Ethics for Professional Accountants

			Accountants' familiarity with the Code of Ethics for Professional Accountants	Attitudes of accountants towards ethical behavior
Spearman's	Accountants' familiarity with the Code of Ethics for Professional Accountants	Correlation Coefficient	1,000	,105
		Sig.(1-tailed)	.	,136
		N	44	44
	Attitudes of accountants towards ethical behavior	Correlation Coefficient	,105	1,000
		Sig.(1-tailed)	,136	.
		N	44	44

Spearman's rank correlation coefficient (rs) is 0.105, while the empirical significance of the correlation coefficient is 0.136, which means that $\alpha^* > 0.05$. Therefore, it can be concluded that the relationship between the movement of knowledge of the Code of Ethics for Professional Accountants and the attitudes of accountants toward ethical behavior is not statistically significant. Thus, the movement of knowledge of the Code of Ethics for

Professional Accountants is not related to the movement in the attitudes of accountants toward ethical behavior.

To test hypothesis PH1, a one-tailed test for proportion was used at the lower limit with a significance level of 95%. The proportion among the respondents is p = 0.56.

Table 2. Statistical presentation of the interval assessment

	Values
Proportion between respondents p	0,56
Sample size (n)	44
Reliability	0,95
Lower limit	0,5035

With a confidence level of 95%, it can be concluded that the proportion of accountants who believe that the implementation of the Code of Ethics for Accountants in the Digital Age has a positive impact on reducing fraud is 50.35%, which is greater than 50%, thus supporting the acceptance of hypothesis PH1.

DISCUSSIONS

The application of ethical principles in an organization depends not only on the moral values of individuals but also on written rules of conduct. These written rules define unacceptable behaviors within the organization, significantly contributing to the creation of a positive working environment for all employees. Written codes of ethics developed by international professional associations hold particular value within an organization. The environment in which accountants operate should uphold ethical values, especially today, when accountants face numerous challenges and accounting fraud is increasingly prevalent. The goal of the accounting profession is to establish high-quality work and professional behavior. If this is achieved, the profession will surely earn the respect and trust of the environment in which it works and operates.

Although international accounting standards are respected, the accounting profession in Bosnia and Herzegovina is still not fully regulated. The results of the research confirm the respondents' awareness of the importance of professional ethics for accountants and the critical role these ethics play in the business world. Accountants in Bosnia and Herzegovina are aware that they must perform their duties objectively, confidentially, and honestly, with due professional care, while acquiring and maintaining professional competence and adhering to all legal rules and regulations.

The research also revealed that accountants are familiar with the Code of Ethics for Professional Accountants, and the vast majority believe that the principles of the Code are applied by accountants. A potential limitation of this study is the relatively small sample size, so it is recommended that future researchers expand the study with a larger sample. The application of the Code of Ethics for Professional Accountants helps reduce accounting fraud, and all professional accountants should strive to apply the Code in their work. However, despite the knowledge of the Code of Ethics and awareness of professional conduct, the hypothesis

that accountants' attitudes are related to their knowledge of the Code of Ethics cannot be confirmed. One possible reason for rejecting this hypothesis could be external influences, such as profit, personal income, and intense pressure for positive business results, which may outweigh ethics and morality for accountants.

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THE DIGITAL ENVIRONMENT AND THE NEW SOCIAL SPACE

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Abstract: *Currently, the importance and essential place that digital culture occupies in the lives of Romanian adolescents is undeniable. Statistics regarding access to and use of the virtual environment and new technologies have recorded rapid increases, especially among this demographic category. Advancement and evolution in this field are expected to continue, not only by virtue of a strong and natural trend, but also as a result of the international strategies and policies that Romania has undertaken. The Internet contributes greatly to socialization processes (Institute of Education Sciences, 2017), interaction and formation of adolescents' identity. The educational process in today's society is also marked by the use of new information and communication technologies. The potential brought by them represents a permanent challenge for education, which must adapt to new realities on the fly.*

Keywords: *digital, environment, new, social, space, internet.*

1. INTRODUCTION

Although omnipresent, the digital-virtual phenomenon is not fully understood in terms of consequences and effects, and quantitative analyses on large databases provide important and relevant information regarding its scale and complexity, but elude causality and decision-making relationships. In order to understand the impact of this phenomenon, as well as the behaviors, motivations and reasoning that accompany it, the qualitative research approach is fundamental. Digital culture profoundly influences the identity and social development of adolescents, and to fully understand its impact, both quantitative analyses and qualitative research are needed to explore the complex motivations and effects of technology use. Internet communication represents a set of actions and processes mediated by computers through which interlocutors transmit information through messages that can take various forms (Fârte, 2004). Communication is an absolutely indispensable process for humanity, and over time messages have been transmitted through various means, thus taking on various forms and being used in various environments (Thurlow, 2004). Research on CMC largely focuses on the social effects of various computer-supported communication technologies. Many recent studies involve Internet-based social networks supported by social software.

"Digital media" refers to the set of technologies and platforms that enable the creation, sharing and consumption of digital content. It includes various components such as the internet,

social networks, mobile applications, streaming platforms, websites and other communication and information technologies. The digital media has transformed the way we communicate, work, learn and spend our leisure time, with a profound impact on society and the economy.

The digital media has created a new social space that is redefining the way people interact, communicate and organize themselves. This transformation has been facilitated by communication technologies and online platforms, which allow for rapid and global social interactions.

2. CHARACTERISTICS OF THE NEW SOCIAL SPACE

Global Connectivity: The digital environment allows people around the world to connect and communicate instantly, regardless of geographical distances. This facilitates the exchange of ideas and cultures and creates global communities (https://www.edu.ro).

Technologically Mediated Interactions: In the new social space, interactions are often mediated by technology, such as social networks, messaging platforms, and video conferencing applications. These technologies allow for both synchronous (real-time) and asynchronous (delayed) communication. Technology is not just a trend, it has revolutionized the way we communicate. From Skype or Twitter used on a computer or laptop to today's smartphones, technology makes communication more efficient, effective, and in some cases instantaneous (https://www.droot.ro/).

Virtual Communities: An online community is a variable group of people who communicate (maintain connections) frequently with each other through correspondence, telephone, internet network, etc., for reasons of personal, social, educational interest, etc. The term "virtual" emphasizes the fact that it is not a society with "face to face" communication, with personal contacts "in sight". There are pure virtual communities and virtual communities that nevertheless extend towards personal communication "face to/in face", that is, they activate from time to time and through direct meetings, scheduled reunions. If the communication takes place in the form of an interconnected social network that serves as a support for the mutual exchange of opinions, impressions, lived experiences, etc., then we speak of a social environment (https://creativecommons.org). Online platforms allow the formation of communities based on shared interests, hobbies, professions or social causes. These communities can be very influential and can mobilize collective action.

Digital Identity: Digital identity is an electronic means of identifying someone. It consists of a certificate containing a "public key" that can be viewed and a "private key" that must be kept secret (https://support.apple.com). Users have the ability to build and manage their digital identities, which can be different from their physical identities. This includes social media profiles, online game avatars, and personal blogs.

Participation and Civic Engagement: Civic engagement has been defined by various authors, who agree in highlighting the relationship between this concept and the way in which people, exercising their citizenship, get involved in political and apolitical issues in their environment. In this context, being a citizen means being a member of a community, with equal rights with others and with the same opportunities to influence the fate of the community (https://www.yubrain.com). The digital environment facilitates civic and political engagement through access to information, discussion platforms, and the ability to organize and participate in online petitions, protests, and campaigns.

3. THE IMPACT OF THE NEW SOCIAL SPACE

Communication Transformation:

Communication through language is essential to functioning in society, whether it is formal or informal discussions, with friends and family, negotiations at work or business meetings. Through language we incorporate information and experiences into our minds and express our ideas, thoughts, feelings and perceptions. As a result, communication is more than an exchange of information, it is an influence (https://static.wixstatic.com).

The way we communicate has been revolutionized, becoming faster and more diverse. Social platforms allow the sharing of multimedia content (images, video, audio) and create new forms of expression. Communication is a highly complex process, difficult to decipher, which requires its simplification in order to be understood. This sensitive process is carried out in two significant stages:

• the first stage is the transfer of a thought, idea or order by the sender to the receiver. This involves: expressing the idea to be transmitted; encoding it in the form of a symbol, capable of expressing a message; transmitting the encoded message from the sender to the receiver through the chosen channel (visual, auditory, tactile, electronic).

• the second stage consists of the receiver transforming the received message. This involves decoding the message, i.e. deciphering the transmitted symbol, and interpreting it, i.e. explaining its meaning (https://www.didactic.ro).

Effects on Personal Relationships: Interactions that occur since childhood and the way they are formed and evolve influence the relationships of the future adult. Attachment style is a specific behavior in relationships between people, from an emotional and psychological point of view. The attachment style that an adult has is learned in childhood, cultivated throughout life and reproduced for their own family. Interpersonal relationships are influenced by online interactions, which can strengthen or, conversely, weaken social bonds. Sometimes, digital communication can lead to feelings of isolation or a lack of authentic connection.

Social and Political Mobilization: Social media has become a powerful tool for social and political mobilization. It has played a crucial role in major social movements and election campaigns. Social mobilization is the process of bringing together all interested social partners to raise awareness of a group about a common problem, identify their needs, and provide support in identifying the resources and services needed to find ways to cope independently and take control of their own lives. “Through community mobilization, members of a community become aware of a problem, recognize that it is important to their lives, and decide together on the steps needed to solve it and take action together” (Thompson and Pertschuk 1992) (https://www.asociatianoulval.ro/).

Digital Economy: The digital economy is considered to be the fourth industrial revolution, characterized by its ability to transform economies, jobs and even society as a whole, through the introduction of new technologies and processes. It is expected that the digital economy will contribute to social and economic equalization. At the same time, technology will contribute to increasing access to education, jobs and financing, even if, in the short term, it could lead to the reduction of jobs with repetitive and non-value-added activities in almost all economic sectors, whether we are talking about industry, agriculture or services. In Romania, we estimate that approximately 60% of existing jobs could be affected by the digital economy: the main causes are the development of the concept of e-government,

robotization and automation in industrial sectors and the transfer of services from the traditional area to the digital area. If previous industrial revolutions produced changes over several generations, the digital economy produces significant effects over much shorter periods. The new social space has created economic opportunities, including for digital marketing, influencers and e-commerce. Companies can reach their target audiences more effectively and personalize user experiences.

In the digital age, data protection has become an interdisciplinary area of law, which is gradually but surely making its way into all other areas of law. If future technologies will bring new risks to human rights, society must catch the wave of digitalization without sacrificing fundamental rights. Categorically, the manipulation of digital identities determines the diversification and increase in the complexity of security risks and threats, such as hostile/influence actions carried out in the public space, disinformation, the spread of fake/fabricated news and possible, generating new security challenges.

4. CHALLENGES IN THE NEW SOCIAL SPACE - THE USE OF MASS MEDIA AS AN INSTRUMENT OF HYBRID CONFLICT

In recent years, taking as a temporary reference the referendum that took place in the United Kingdom to leave the European Union and, especially, after the presidential elections in the United States, which took place in November 2016, the media has focused a large part of its international information on warning about the danger that false news – popularized by the name of fake news – represents for Western democracies.

In recent years, especially after the Brexit referendum and the 2016 US presidential election, the phenomenon of fake news has been widely discussed as a major threat to Western democracies. Disinformation campaigns, often orchestrated through social media and supported by state or private actors, have aimed to manipulate public opinion and undermine trust in democratic institutions. A notable example is the use by the UK Leave campaign of the false claim that "£350 million a week" could be redirected to the NHS, a claim that was later debunked but which influenced public perception. Also, in the 2016 US presidential election, social bot networks amplified content with low credibility, contributing to the polarisation of the electorate. These practices have been facilitated by algorithms that create "information bubbles", in which users are predominantly exposed to information that confirms their existing beliefs, thereby reducing diversity of opinion and democratic dialogue. In this context, the European Union has recognized disinformation as a serious threat to democracy, underlining the need for concerted measures to combat it.

In its information objective, the media used all kinds of concepts, new to a large part of the public, such as cyberspace, cyberattack, cyberwarfare or hybrid warfare, to explain the events taking place through what we commonly call the internet, in which a state, in this case the Russian Federation, would use the digital sphere to interfere with the internal processes of another, with the aim of destabilizing its democratic systems.

Although Brexit is currently considered an example of Russian interference in the election campaign (BBC News UK, 2024) we found few references in the media, both during the campaign and in the post-referendum period, to accusing Vladimir Putin's government of trying to influence the referendum vote and defining these activities as hybrid warfare. For the most part, post-election analyses focused on the uncertainty generated by the United Kingdom's

exit from the European Union, the economic, political and social consequences that might follow, as well as the new role of the European Union itself at that time.

It was not until the 2016 US presidential election that the media largely reported on Moscow's alleged cyberattacks against Democratic Party candidate Hillary Clinton and orchestrated disinformation campaigns to sway public opinion. At this time, the focus was on cyberspace and the vulnerabilities it presents to Western democracies. Despite this, it was only months later that reports began to emerge of the Kremlin's possible interference in the British referendum, through the spread of fake news and the use of social media.

These events marked the role that a foreign power would have played in trying to influence a domestic electoral process. They were a warning signal to European countries that, months later, they would be organizing different electoral processes. In this context, the Guardian newspaper mentioned, in a headline, that the EU is stepping up its campaign against Russian propaganda (Adam et al., 2017) due to the fear that would have generated possible Russian influence in the US elections, as this could spread to Europe. It is worth emphasizing here that the European Union will increase its efforts to counter Russia's hybrid warfare campaign after the election of Donald Trump (Baqués, 2015:41). The news refers to the East Stratcom working group, an organization created in 2015 by the EU's European External Action Service, and therefore ahead of the processes presented here, to counter Russian disinformation campaigns during the Ukraine crisis.

In this international context of disinformation, fake news, Russian influence in electoral processes, cyberattacks and alleged hybrid warfare, Spain was plunged into a major political and social crisis due to the convening of a referendum by the regional government of Catalonia in early October 2017. The government's intention was to decide, through consultation, on the possibility of independence from the Spanish state, without the consent of the Spanish government. These activities were quickly incorporated into the information language. Thus, the concept of cyberwar was used in a generic way, regardless of its meaning and possible implications, simply because certain activities were carried out through networks.

The concept of cyberwar has been one of the most widely used in journalism to refer to activities that take place on the Internet, but it has also generated confusion. Richard A. Clarke, former National Coordinator for Security, Infrastructure Protection, and Counterterrorism of the United States and Special Advisor to the President for Cybersecurity, defines cyberwar as those actions taken by a nation-state to penetrate computers or other networks of states with the aim of causing damage or changes (Clarke et al., 2010). With the exception of the cyberattacks against the Democratic Party, for which they had access, in the campaign, to the data and information of the Party's members, the propaganda activities that took place in Brexit and the Catalan conflict cannot be described as cyberwar, according to Clarke's definition, as they would not have led to illegitimate access to the systems or networks of other states, with the aim of causing damage or changes, but, rather, would be categorized as influential and manipulative activities through networks.

This new doctrine, developed in Russia, seeks to weaken democracies by interfering in their electoral processes and fueling their internal conflicts, whether ideological or territorial, using tools such as fake news or manipulation of social media. Instead, it is only stated that we are in a conflict (hybrid warfare) promoted by a state actor (Russia), by spreading fake news via the internet and social media, with the ultimate goal of weakening Western democratic

governments. Also, the news reports regarding these activities present hybrid warfare as something new, which is part of the military doctrine of Russian origin – the Gerasimov doctrine.

The origin of the Gerasimov concept dates back to February 2013, with the publication of the article "The Value of Science in Anticipation" by the Chief of the Defense Staff of the Russian Armed Forces, General Valery Gerasimov, in the magazine Voyenno-Promyshlennyy Kuryer. For much of the Western media and analysts, the article represents the foundational document of what, in the West, is known as the Gerasimov doctrine. It is interpreted as a proposal for a new Russian way of warfare that combines conventional and unconventional warfare with aspects of national power (Gerasimov, 2013), which refers to indirect and asymmetric methods. With the events in Crimea and Ukraine, some of the elements set out in Gerasimov's 2013 document were identified and the idea spread that it set out a new way of acting. Then, hybrid crossed the border of strategic debate to become a word with common usage and was used to define the whole range of informational, destabilizing and subversive activities that the Kremlin could carry out in a covert, semi-covert or clandestine manner, below the threshold of conflict.

In short, Gerasimov refers to hybrid warfare methods because he believes that Russia should face these types of wars and therefore needs to know and adapt to them. In addition, it should be noted that Gerasimov presents it in a scenario of armed war, while disinformation campaigns and fake news in the West would take place in a context of political and social tension and confrontation, but in the absence of an armed conflict.

5. THE DIGITAL ENVIRONMENT AND THE TARGET OF A CYBER ATTACK – RUSSIAN INTERFERENCE IN THE FRENCH ELECTIONS (2017)

Every day we are exposed, both at home and at work, to threats that originate in the virtual space. In most cases we are not even aware of this, or if we do realize it, we do not react to these threats in an appropriate manner. Articles about security incidents appear daily in the media. These reported incidents are actually just the tip of the iceberg, in reality we are much more exposed than we think we are, considering that, unfortunately, the risks associated with the virtual environment are constantly increasing.

Anyone can be the target of a cyber attack. A cyber attack on an industrial control system can cause loss of control, shutdown, damage to facilities or alteration of the final product. These incidents are often accompanied by serious consequences in terms of security, economic and financial losses, and damage to the organization's image. The online environment has more and more connections with the physical space (Romanian Intelligence Services). Online identity theft is no longer an urban legend. Third-party access to confidential data creates strategic advantages, and blocking users from accessing a set of data can cause considerable financial damage.

In 2017, several European countries were due to hold elections, whether local, parliamentary or even presidential, as in the case of France. EU and NATO leaders have taken into account the possibility that Russia could intervene and manipulate the elections, in order to achieve certain strategic goals. The case of Russian interference in the presidential elections in France is one of the textbook cases both in terms of the techniques used in the attack and the response given by France.

The aim of the attack was to undermine Emmanuel Macron's candidacy in the 2017 presidential election, so there were three main dimensions of the information operation:

• disinformation campaign consisting of fake documents, rumors and fake news;

• a cyberattack on the computers of Macron's campaign organizers;

• information leak of approximately 15 GB of information extracted from campaign computers, as well as 21,075 emails.

The information was distributed on Twitter (using the hashtag #MacronLeaks) through fake accounts (bots) and an army of trolls (Russia often uses troll armies online to increase pro-Russian propaganda); these fake accounts distributed fake news branded as Sputnik, RT, NewsFront and amplified it on social networks. However, the attack was not directly attributed to Moscow, but it seems that the Russians received help in carrying out the attack from the American alt-right and the French far-right, as both factions are pro-Russian. The cyberattack was carried out using fake web domains and phishing. Trend Micro, a Japanese cybersecurity company, identified the March 15, 2017 phishing attack as being orchestrated by the APT28 group, which is known for its cyber espionage activities and is affiliated with the GRU. One of the domains had an IP address similar to another identified by the US State Department in a report on Russian malicious cyber activity in the context of the 2016 US presidential election.

Most of the IPs indicated that the attacks originated from Ukraine, which is also a buffer state for cyber operations. Facebook also said that 24 accounts were created on the platform to conduct surveillance operations on members of Macron's entourage during the election campaign; the Russian agents who created the accounts posed as friends of friends of Macron's associates; the agents' main goal was to get Macron's associates to download malicious software that could provide hackers with their login details, thus giving them access to private conversations or classified documents. The attack failed to have the desired effects, as France, expecting possible interference in the elections, took preventive measures, such as: deliberately planting false documents to create confusion among hackers; ANSSI (National Association for Information Systems Security) organized cybersecurity workshops for presidential candidates; collaborated with Facebook to automatically close the fake accounts created; limited access to Russian media in the second round of elections, etc. Consequently, preventive measures and functional administrative instruments in France on the cyber dimension, along with the existence of international cooperation in the field of Intelligence, especially between NATO members, managed to diminish the effects of the cyber attack, as well as ensure an optimal climate for the presidential elections, in the end, to take place adequately.

More specifically, in a world in the midst of globalization, cyber and communications infrastructures are developing at an accelerated pace, thus forming a dependence of state actors on digitalization; with these, both new threats and security vulnerabilities appear, thus creating a true cyber arms race. Cyberspace offers the necessary opening for both conducting physical attacks on infrastructures (kinetic military actions, electronic warfare, etc.), as well as cognitive attacks (psychological operations, disinformation, propaganda, etc.) with the aim of inoculating various ideas to the population and distorting the way people perceive certain domestic or international events, as the case may be. More simply, we can say that cyberspace does not really know borders or if it does, they are not very well delimited, the main limitation from this point of view being the lack of clear and concrete jurisprudence on this segment at the international level (https://adevarul.ro).

6. CONCLUSIONS

The new social space created by the digital environment offers significant opportunities for connection and innovation, but also brings challenges that require careful management. It is important that users, institutions and society as a whole navigate this space responsibly, promoting safe and ethical practices in the use of digital technology.

It is common to find news related to disinformation campaigns of Russian origin that claim to be recorded in a context of hybrid warfare against the West. The main problem with the journalistic information presented here is that, for the most part, the authors do not expose even a brief approximation to the concepts used, their meaning and implications, such as disinformation, fake news, cyberwar or hybrid warfare. Sometimes this leads to the use of some of these concepts as synonyms. Possibly, one of the reasons for the confusion is the mixing of the use of recent concepts, in this case, those related to cyberspace, with others, which are traditionally located in a military and academic field, in an attempt to want to inform about changes occurring on the international scene. This is also due to the spiral that the media has entered, driven by a constant demand for information from citizens, wanting to inform, almost minute by minute, about the latest news, which implies a quantity of information rather than the quality of the messages transmitted.

Undoubtedly, Russia's use of cyber and intelligence has been the focus of attention in the news about hybrid warfare. But while it is true that this country has encouraged the use of information operations and has taken advantage of the potential of the digital environment in favor of its interests, the development of disinformation campaigns and the use of information and communication technologies cannot be identified exclusively with hybrid warfare. One of the characteristics of hybrid conflicts is the combination of various conventional and asymmetric elements, but the news has focused almost exclusively on the digital element, through which disinformation campaigns, fake news and the massive use of social networks have been developed. Although they may be part of hybrid conflicts, given that, in recent years, the cyber element has gained enormous importance within conflicts, we cannot, however, say that these activities are movements of hybrid warfare. Terms such as 'disinformation', 'fake news', 'cyberwar' or 'hybrid warfare' are often used vaguely and interchangeably in the media, which can lead to confusion about the nature and implications of these phenomena in the current geopolitical context. A rigorous delineation is essential for a correct understanding and effective approach to these challenges.

Therefore, if I were to conclude that the events that took place during Brexit, the US elections and the Catalan conflict cannot be described as hybrid warfare, a meaningful analytical framework for understanding the novelties of cyberspace and its impact on international relations in these scenarios could nevertheless be developed from the concept of the grey area. The concept defines those activities below the threshold of conflict, which take place in peacetime, as opposed to hybrid warfare, and which include cyberattacks or disinformation and propaganda campaigns that would have as a common feature the difficulty of determining their attribution. This concept would therefore allow for an analysis of activities that are not specifically described as acts of war but could become as decisive as a military conflict. The concept of the 'gray zone' describes strategic actions that remain below the threshold of open conflict, being characterized by ambiguity and difficulty in attribution, and includes cyber operations and disinformation campaigns conducted in peacetime.

The analysis presented in this essay has focused on the importance of conceptualizing and contextualizing the reported facts. It is clear that the practice of journalism differs from the academic field, but it is equally true that news should convey information with the greatest possible rigor and expose the reader to what is happening in their specific context, trying to use appropriate concepts in each case. We are still at an early stage in analyzing the capabilities of cyberspace, and reducing it to the use that a single state can make for the dissemination of propaganda campaigns would be to misunderstand its potential in international relations. In the digital age, rigor in the presentation of information becomes essential to understand the complex phenomena of cyberspace, which should not be reduced solely to propaganda tools used by certain states, but analyzed in the broad context of international relations.

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TECHNOLOGICAL FINANCE (FINTECH) AND ITS PERFORMANCE IN ALBANIA

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Abstract: *The main purpose of this paper presented by the authors has to do with the realization of an analysis on the progress and level of use of Financial Technology (FinTech) with a focus on the banking sector in the state of Albania. The notion of FinTech is a dedicated term for financial technology in the digital age. The diversity of this technological solution brings with it the promise of faster, cheaper, safer and more transparent financial transactions via the internet. In the paper carried out by the authors, primary data obtained from the completion of more than 500 questionnaires by individuals located in Tirana, Elbasan and Durres districts were used. Also, in this paper, other secondary data were used, which were provided by the base data of the Central Bank of the Albanian State, from the base data of the World Bank and the International Monetary Fund. This This paper describes the implications of policies regarding the promotion of relevant institutional policies regarding the increase in the level of use of Technological Finance in the state of Albania. The continued application of innovative technologies in finance and especially in the Fintech sector is very important, this will serve as a tool to increase the level of financial economic development in Albania (Toska, 2021). The findings underscore the potential for FinTech to foster financial inclusion and economic growth in Albania, provided that regulatory frameworks and digital infrastructures are strengthened. The paper presented by the authors also discusses financial policy implications and recommends some important measures that should be considered by the Albanian government and the Central Bank of Albania. By further stimulating the adoption and development of technological Finance in Albania, and by implementing international protocols regarding cyber security.*

Keywords: *Financial Technology (FinTech), Digital Payment, Financial Banking System, Fintech and Banking.*

1. INTRODUCTION

The notion of FinTech is the combination of the words finance and technology. In various papers presented by international authors, the term BancTec is often used as a synonym for FinTech (Zavolokina, 2016). This term is essentially used to describe the application of new technologies that serve to improve and automate all processes related to various financial services. FinTech is increasing its scale of expansion in the international economy and in the near future it is thought that it will rival the banking system, as the products offered by FinTech are rapidly replacing the services offered by the Banking System and beyond with innovative products and services (Puschmann, 2017). The combination of continuous innovation with

digital technology of this spectrum, enabled the creation and development of several FinTech models that are applied in businesses (Giglio, 2021). As part of these innovations, we have a continuous increase in the convergence of the two industries, Finance and Information Technology. In the context of the implementation of financial technologies in various subjects, it is observed that the cost of transactions is decreasing, the efficiency and pace of conducting transactions has also increased. Technological Finance also includes innovations in the field of financial education, in the field of investments, the banking sector and cryptocurrencies (Gomber, 2018).

2. LITERATURE REVIEW

The emergence of FinTech has helped businesses reduce costs and increase profitability resulting in attracting investors and media (Haddad, 2019). These investors are not only interested because of the profitability, but also because it is beneficial for society. To further elaborate, FinTech has provided alternative opportunities for underserved societies where people, for example, do not have bank accounts. For example, people who don't get loans from traditional banks for home loans turn to shadow banks and FinTech shadow banks, which tend to give them loans without any calculation and bank account requirements. However, on the other hand, these loans are characterized by higher interest rates, which in turn attracts a certain segment of investors (Buchak, 2018). The reason for this is that FinTech makes it easy and low-cost to do charity work, regardless of their income level. This emerging and innovative industry has also attracted media attention due to innovative and appealing solutions to the general public. FinTech uses big data analytics to better understand consumer behaviors, needs and demands to find the best possible solutions, which was once done by big data companies and cloud technology companies (Lee, 2018). Increasingly, Financial Technology is becoming commonplace not only for consumers but also for the general public (Haddad, 2019). Innovation has its own issues such as stability, sustainability (Leong, 2017) and the safety. Technological finance should be an essential part of the overall policy solution to help identify and address the challenges in increasing finance (Loukoianova, 2024). Innovations in the industry, in which Technological Finances are a part, are making it possible to increase the degree and quality of cooperation between Fintech companies and Financial Institutions, especially in the banking spectrum. Also, these innovations are improving the quality of the realization of the whole of the transactions that develop between financial institutions and their customers (Arner, 2020). Experience gained during the period of COVID-19 highlighted the importance of promoting digital spectrum services, especially for individuals and various economic entities. The financial sector of the economy, which includes the FinTech sector, has been growing steadily, especially over the last years. During this period, it has been observed that universal banks are losing a comparative advantage that has come from more immediate access to information from entities seeking credit to expand their activity (Stulz, 2019). Fiscal policies that are applied in different countries should have a focus, more substantial investments, especially in the digital spectrum. However, innovation has the potential for consumer and reputational well-being of regulators, supervisors and the financial services industry (Anagnostopoulos, 2018).

3. METHODOLOGY

The paper presented by the authors is mainly based on primary data of both the qualitative and quantitative spectrum. Also in this paper, secondary data provided by institutions at the national and international level have been used. The research model applied by the authors is based and structured around a questionnaire that aims and aims to assess the possibility of the growth of Technological Finance in the state of Albania. Looking at and studying this approach both from the point of view of consumer demand for FinTech products and from the point of view of supply. Data collection process by the authors. The totality of primary data collected through this questionnaire is presented as follows. The questionnaires were distributed both physically and electronically using the Microsoft Forms software program. The authors considered a total of 574 valid questionnaires to be part of this study. Out of the total of 425 questionnaires that were distributed in Hard Copy format, only 260 questionnaires were fully completed and were considered valid. Meanwhile, 314 questionnaires were completed by the interviewees electronically using the Microsoft Forms program. The entire process of distributing, completing and collecting all the questionnaires was spread over a period of eight months. More specifically, the filling process started in June 2024 until January 2025. All the individuals who took part in this survey are people who live in the district of Tirana, in the district of Elbasai and in the district of Durrës. About 88% of the people who participated in this sampling are individuals who work in private economic entities, self-employed or students. While only 68 people or in other words 12% of the total sampling are individuals who are employed in public institutions. Sampling Technique. In this paper, a purposeful non-probability sampling technique was used, in relation to the persons who were selected and who have knowledge of banking services or FinTech products. The selection aimed to capture a broad demographic range to provide comprehensive insights into consumer behavior and preferences. Questionnaire Structure. The survey instrument used by the authors in this paper is divided into four main sections:

- Socio-economic profile of respondents.
- Information and usage patterns related to traditional retail banking products.
- Interaction with and use of innovative banking products, including FinTech solutions.
- Customer behavior and purchase patterns related to banking services.

The first part of the questionnaire was adapted with questions regarding the socio-economic profile of the respondents. The second section of this questionnaire, the information and use of retail banking products by the interviewees of this survey is included. The third section of this questionnaire includes information and the use of innovative banking products. The fourth section of this questionnaire includes the behavior and purchases of the bank's customers. The answers obtained from the data processing of the questionnaire were processed by the authors using the Microsoft Excel computer software. From the total of 574 completed questionnaires, looking at the gender perspective, it turns out that 330 of the respondents are women, or to say it differently, 57.49% of the total are women. While 244 questionnaires were completed by men, or in other words, 42.51% of the total number of respondents are male. The process of processing and analyzing the data of the respondents. All the data used in this paper was processed and analyzed by the authors using the Microsoft Excel software program. From the point of view of gender distribution, the summarized results show that 330 people surveyed

or otherwise 57.49 were female. While the other 244 people are male or otherwise the latter constituted 42.51 of all respondents. Also, in this paper, other secondary data were used, which were provided by the base data of the Central Bank of the Albanian State (BankofAlbania, 2025), from the base data of the World Bank (WorldBank, 2025), from the base data of Statista and the International Monetary Fund (IMF, 2025). Ethical aspect of the paper. All the individuals who participated in this survey, have completed the questionnaire with their full will and without being influenced, also all persons were informed about the purpose of this paper. Confidentiality was maintained during the entire process of collection, processing and analysis of the data collected by the authors.

4. RESULTS

4.1 FinTech users in USA and Europe.

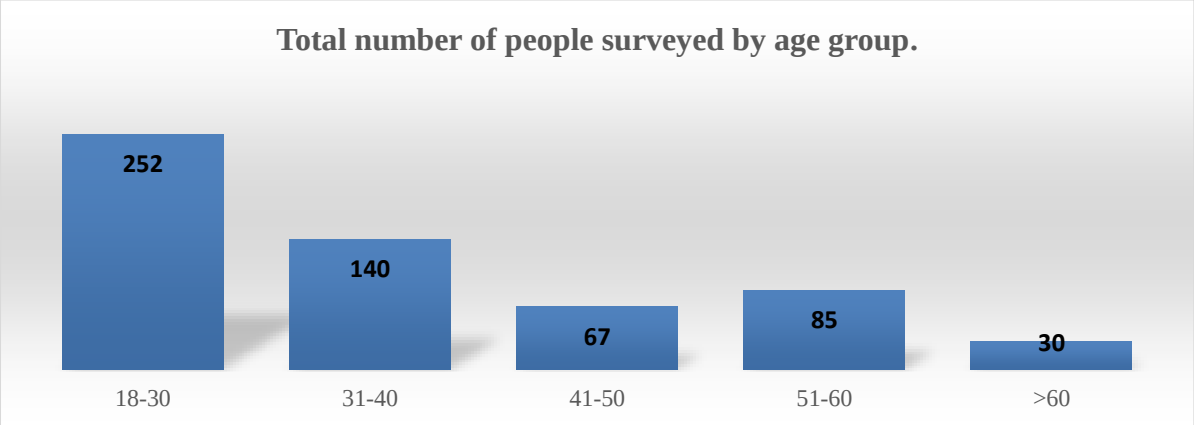
Especially during the last decade, the financial sector in which Technological Finance is a part has experienced a significant growth in different countries such as, the United States of America (USA), various countries that are part of the European Union (EU) and the Republic of Canada. The industry in which Technological Finance is part of during the year 2024 has managed to generate a value that is in the limit of 226.76 billion dollars. Based on projections calculated by different researchers, it is claimed that Technological Finance will reach the value of 917.17 billion dollars by the end of 2032, growing by a value of 16.8%. (Marketdataforecast, 2024). Based on data published by Statista, it is said that, The number of economic entities of the fintech spectrum in the European continent reached 9200 units during the year 2024 (StatistaResearchDepartment, 2025). At the same time, it is noted that fintech users are increasingly adapting to this technological innovation, especially the sector related to digital payments, where the European user base of this applied technology is expected to reach the expected level of 368 million users by the end of this year. Based on the data obtained from Statista in February 2025, it turns out that: The United Kingdom is the country with the highest number of Fin Tech companies operating in Europe. In the UK, it turns out that they extend their activity with a total of 3,300 companies in the financial technology spectrum. The country with the second highest number of companies that are part of the Fin Tech sector is Germany. While the French state is in third place with a number of 522 economic entities that are part of FinTech. In fourth place is the state of Switzerland in which 497 Fin Tech companies operate. While in the state of Spain, 463 companies in the financial technology spectrum operate during the month of February 2025 (Statista, 2025).

4.2 FinTech in Albania.

A new law on Payment Services has entered into force in Albania. The law is based on the Second European Payments Directive (PSD 2). This law, applied in the European Union countries, brought fundamental changes, especially in the payment markets, where Open Banking is at the core of the PSD 2 Directive. PSD 2 directive is that of open banking. The importance of this law is not yet very tangible, mainly due to the lack of a developed sector of financial institutions. In terms of online bill payments, online purchases and account access via e-banking, Albania ranks last in the region. In the study conducted and published during 2020, which was carried out by the World Bank in collaboration with the University of Cambridge, it is shown that only 28.8% of the total Albanians have made transactions using bank cards in

the time interval of one year. For other countries, this indicator starts from around 39% for Kosovo, up to over 66% for Serbia. In the Eurozone, an average of 92.5% of households have used digital payments at least once in the last 12 months before the survey. The published study shows that, 7.7% of all Albanians have used bank cards to make various payments. In other countries of the Balkans, such as in the state of Kosovo, it turns out that for this period of time 16.5% of the population used bank cards to make various payments, while this indicator in Serbia is at the level of 39.4%. The above data shows why Albania remains a difficult terrain for Fintech businesses; but on the other hand, they also testify to great potential for the growth of the business of payments and financial services in the field of technology. Based on data from the Bank of Albania, it results that the number of transactions through remote banking channels, through internet banking or mobile banking, for 2020 has increased by a value of 14% compared to 2019. The growth in the FinTech market is influenced by several factors summarized below. Firstly, we can say that the increasing adoption of latest generation smartphones and the internet has made digital solutions more accessible to consumers, leading to an increase in demand for fintech services. Secondly, we can say that the COVID-19 pandemic has accelerated and increased the level of digital payments and investments, as consumers have had to adapt to remote transactions. Thirdly, we can say that regulatory changes have enabled fintech companies to compete with traditional financial institutions on a more level playing field. Fourth, advances in technology, particularly in the field of Artificial Intelligence Software and the evolution of blockchain-based systems, have opened up new options for innovation in the field of FinTech. The Financial Market in which FinTech is applied has a tendency to continue to grow at a rapid pace, fueled by continuous technological advances, changing consumer behavior and support for clearer laws and regulations. It is also worth noting that the digital payment system on the part of consumers is growing more and more, as the latter are increasingly preferring SMAT devices as a means of payment. Digital investment platforms are also expected to grow in popularity as more individuals look to manage their finances online. After processing the data of the questionnaires by the authors through the computer program Microsoft Excel, the summarized findings and their interpretation are presented below.

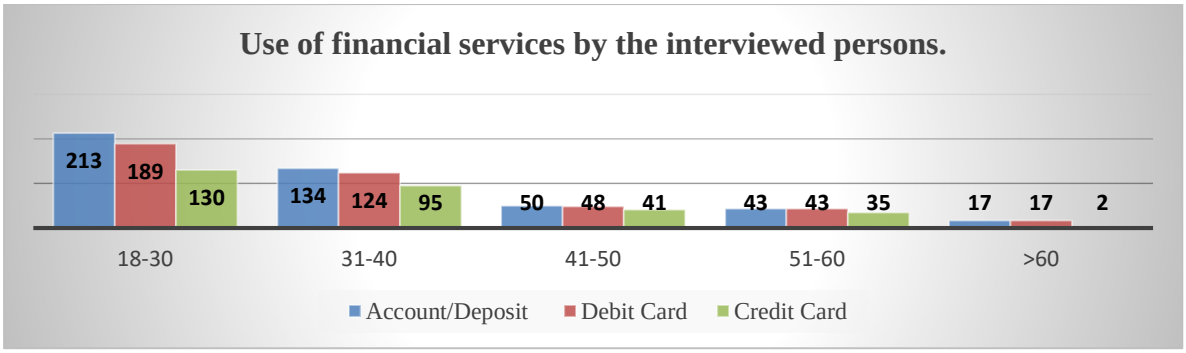
Figure1. *Total number of people surveyed by age group.*



Source: Data processed by the authors with Microsoft Excel Program (March 2025).

From the total of 574 individuals who participated in this survey, it resulted that: 252 individuals who completed the questionnaires belong to the age group between 18 and 30 years old, or in other words 44.7% of the respondents. It is noted that 140 individuals who completed the questionnaires belong to the age group between 31 and 40 years old, or in other words 24.3% of the respondents. It is noted that 67 people who completed the questionnaires belong to the age group between 41 and 50 years old, or in other words 11.67% of the respondents. It is noted that 85 people who completed the questionnaires belong to the age group between 51 and 60 years old, or in other words 10.1% of the respondents are part of this interval. And finally, 30 people who participated in the survey belong to the age group over 60, or in other words 5.2% of the total.

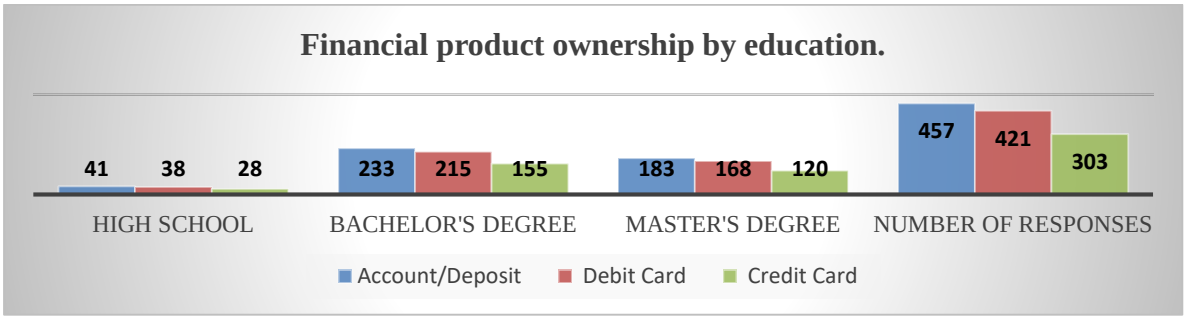
Figure 2. *Use of financial services by the interviewed persons.*



Source: Data processed by the authors with Microsoft Excel Program (March 2025).

In the above graph it is observed that: 213 individuals who are part of the age group 18 to 30 years old have a bank account. 189 individuals of this age group own a debit card and 130 of them own a credit card. In the above graph it is observed that: 134 individuals of the age group 31 to 40 years old have a bank account. 124 individuals of this age group own a debit card and 95 of them own a credit card. In the above graph it is observed that: 50 individuals of the age group 41 to 50 years old have a bank account. 48 individuals of this age group own a debit card and 41 of them own a credit card. In the above graph it is observed that: 43 individuals who are part of the age group 51 to 60 years old have a bank account. 35 people of this age group own a debit card and 35 of them own a credit card. In the above graph it is observed that: 17 people of the age group over 60 years old have a bank account. 17 individuals of this age group own a debit card and 2 of them own a credit card.

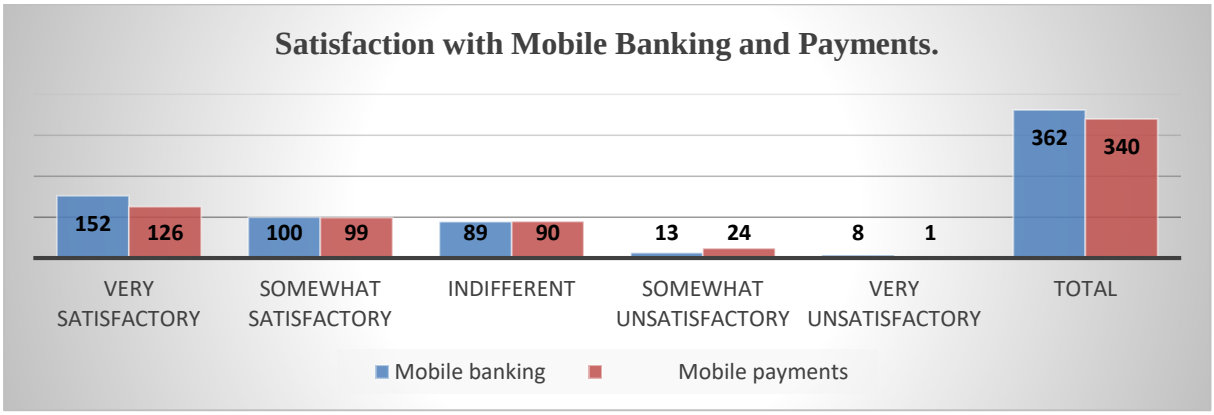
Figure 3. *Financial product ownership by education.*



Source: Data processed by the authors with Microsoft Excel Program (March 2025).

Based on the data processed by the questionnaires, we find that: Most of the interviewees who have a bank account or deposit number are people with a Bachelor's degree, specifically we find that there are 233 individuals. While 183 individuals are persons with a Master's degree and only 41 persons from all the respondents who have a bank account or deposit have a high school diploma. Based on the graph above, we can say that the higher the level of education, the higher the claim of respondents to have a bank account or deposit, on the contrary, such a percentage is low among respondents with a high school diploma.

Figure 4. *Satisfaction with Mobile Banking and Payments.*



Source: Data processed by the authors with Microsoft Excel Program (March 2025).

Based on the answers received from 362 people regarding the level of dissatisfaction they have from using Mobile Bank during the last 12 months, it turns out that 152 people are very satisfied, 100 people are somewhat satisfied, 89 people are indifferent about this question, 13 people are somewhat dissatisfied and 8 people are very dissatisfied with this service.Based on the answers received from 340 respondents, the latter claim that they have made a payment transaction via mobile phone during 12 months, it turns out that 126 people are very satisfied, 99 people are somewhat satisfied, 90 people are indifferent about this question, 24 people are somewhat dissatisfied and 1 person is very dissatisfied with this service.

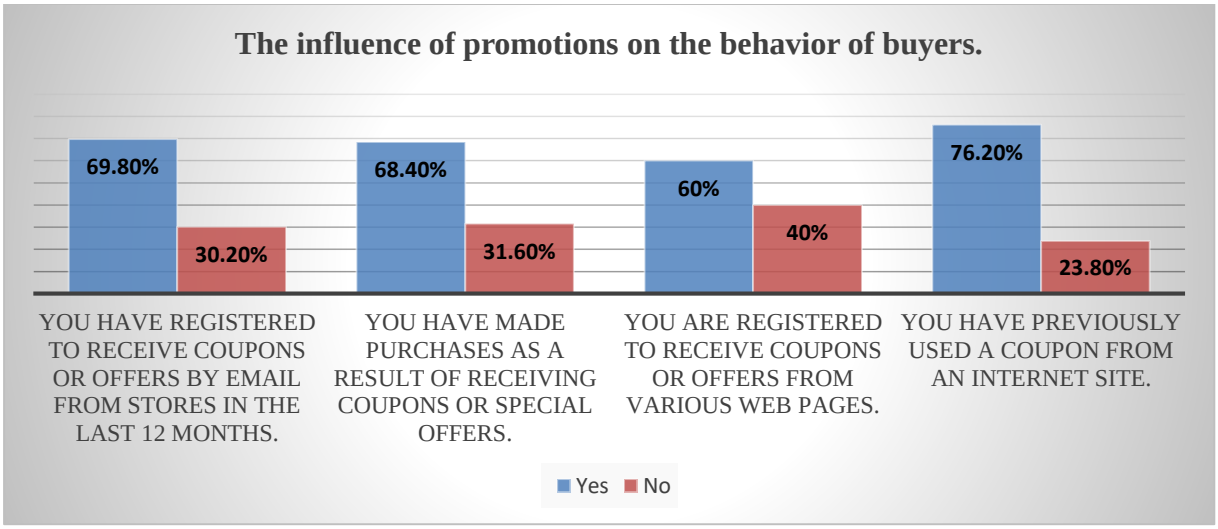
Figure 5. *Online shopping behavior.*



Source: Data processed by the authors with Microsoft Excel Program (March 2025).

The use of mobile phones to make online purchases is claimed by about 53.5% of the survey respondents. On the contrary, about 46.5% claim that they do not use online shopping. About 67.7% of respondents claim that they do online price comparisons when making large purchases, and about 65.4% of them look at online customer reviews. Despite being relatively new to Albania, around 18% of respondents claim to have used the QR barcode scanning application to compare prices to find the best deal.

Figure 6. *The influence of promotions on the behavior of buyers.*



Source: Data processed by the authors with Microsoft Excel Program (March 2025).

The increased use of the Internet and mobile phones has opened up new opportunities for retailers to advertise and reach potential customers at a limited cost. About 30.2% of respondents claim to have signed up to receive coupons or special offers via e-mail from retail stores in the past 12 months. About 31.6% of them claim to have made a purchase because of these coupons or special offers. Additionally, about 40% of respondents signed up to receive coupons or offers from the website, and about 23.8% of them took advantage of these promotions.

5. DISCUSSIONS

The market in which technological finance is a part, during these years, is expected to continue growing at an accelerated rate, influenced by continuous technological developments, consumer behavior and regulatory support (Statista, 2025). The platforms in which digital investments are made are expanding during these years, with individuals and investors who are looking for potential options to make investments at low costs. The growth of digital assets such as cryptocurrencies and NFTs has also created new opportunities for investors and traders. Advances in technology, such as AI and blockchain, have opened up new opportunities for fintech innovation, driving further growth in the market. Digital investment platforms are also expected to grow in popularity as more individuals seek to manage their finances online (Statista, 2024).

The growth of digital assets and neobanking has a tendency to continue. In general, we can say that the market in which Fintech is part, has a tendency to grow, influenced by technological developments. In Albania, there is a need for a more complete regulation in relation to legal acts and the implementation of fintech, especially in the payments sector.

In Albania, there is a need for a more complete regulation regarding legal acts and the implementation and support of fintech especially in the payments sector. This development would contribute to reducing the informal economy and opening up new opportunities, especially for the economic subjects of the innovative spectrum. Market participants can dedicate resources to improve financial education and financial inclusion and actively participate in ongoing engagements driven by national financial education policies.

More investment is needed in consumer protection, information and transparency on the conditions involved in financial products and services. The information must be processed and delivered in such a way that it is easily understood by the general public.

The Banking System in Albania, which comprises about 90% of the total Financial System of our country, should play a bigger and more important role, especially in diversifying their portfolio by increasing investments, especially in the capital markets and more widely.

The Bank of Albania in cooperation with the Albanian State and the Financial Supervisory Authority should have a higher level of focus, especially on the diversification of financial instruments present in the financial and capital markets. These interventions can attract a variety of potential investors at the international and national level who, through their investments, will affect the growth and expansion of the market. A similar situation is also presented in the work carried out by Natia Surmanidze regarding the state of Georgia (Surmanidze, 2023).

All economic entities involved in or interested in the market in Albania should focus particularly on comprehensive initiatives related to financial education. In the current reality of our country, the main FinTech products are mainly offered by the banking sector. Greater investments are needed in protecting consumer privacy, increasing the level of transparency for the public regarding the financial products offered.

In conclusion, we can say that the Industry in which Financial Technology (Fintech) is part, has a great potential for sustainable growth both at the international level and at the national level. Albania as a country of the Western Balkans that is trying to join the European Union should establish and implement a supportive regulatory framework based on the best international practices in this field.

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THE PROCESS OF FORMATION OF THE METAVERSE - A NEW STAGE IN THE CYCLICAL DEVELOPMENT OF SOCIETY

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Abstract: *The purpose of this study - to study the essence of the metaverse in the context of its role in the cyclical development of society as a new stage. This article substantiates that, in terms of dynamism and influence on societal development, the processes of metaverse formation represent a new stage of cyclical development of society. The development of metaverse has the potential to overcome the long crisis-depressive dynamics of the global economy and the deployment of an upward wave of the 6th Kondratiev cycle. It has been established that the technologies of the metaverse contribute to transhumanism, the development of the metaverse poses threats and challenges to the most important component of society's productive forces - people, as well as has eco-destructive consequences.*
It is shown that, the formation of the metaverse plays a significant role in the transformation of the geopolitical system, providing more and more advanced tools of "soft power", as well as technologies for information and cognitive warfare and technologies for the development of "military metaverses". Thus, the technologies of the metaverse radically change the technical-technological, socio-economic, institutional, military, biological components of societal development, and thus the formation of the metaverse is a new stage in the cyclical development of human civilization.
Keywords: *metaverse, "military metaverses", world-system, cyclical development, threats.*

1. INTRODUCTION

Cyclical societal development has a spiral form, which is formed on he basis of cyclic repetition of phases of formation, development and decomposition of economic systems of particular historical forms of society. Today capitalist society enters the phase of decomposition, in other words, its deep internal contradictions are aggravated and not properly resolved, so the world-system plunges into a deep crisis.

The way out of the crisis in historical retrospect was the "great transformations" forming a new techno-economic and institutional paradigms of the world being.

In modern conditions, large-scale ("great transformations") - technological and societal - can give rise to a new form of capitalism - information-network capitalism - or lead to the emergence of new forms of society - neo-feudalism or posthuman society. The scientific and technological basis of such transformations is the fourth industrial revolution; its scale, dynamism and orientation will largely determine the future path of capitalism. The development of artificial intelligence, one of the basic technologies of the metaverse, plays a leading role in the formation of the prerequisites of posthuman society.

The most relevant in terms of the degree of dynamism and impact on societal development, the emergence of the fourth industrial revolution is a metaverse - a three-dimensional virtual world in which all actions can be performed with the help of augmented and virtual reality services (Damar, 2021).

The metaverse exists and is evolving, including social networks, video game worlds, and interactive online practices, primarily through the Internet. In the course of its evolution, the metaverse creates more and more opportunities for users to actively create "information", experience it, and perhaps even live in this created reality without needing a significant physical world (Talin, 2024), which contributes to the escapism of an increasing number of people, especially in the context of the current complex crisis of capitalist society.

The development of the metaverse contributes to overcoming the protracted crisis-depressive dynamics of the global economy, which began in 2008, and also stimulates the upward wave of the new 6th Kondratiev cycle.

At the same time, the rapid development of the metaverse creates threats and challenges to the most important component of society's productive forces - people, and also has eco-destructive consequences.

The basic technologies of the metaverse are becoming a driver of transhumanist processes, and they also play a significant role in the transformation of the geopolitical system. In the cyclical development of the world-system, today there is a period of aggravation of geopolitical contradictions and their military resolution (in the form of local-global conflicts) has begun. The metaverse is also becoming a space for the resolution of geopolitical contradictions.

The purpose of this study - to study the essence of the metaverse in the context of its role in the cyclical development of society as a new stage, to identify the main challenges and threats posed by the technologies of the metaverse, to determine the main directions of overcoming these threats.

2. Literature review

The most relevant in the context of the cyclical development of the capitalist world-system today are studies devoted to global cycles, first of all, the scientific works of N. Kondratiev (Kondratieff,1926), G. Modelski (Modelski, 1995). and I. Wallerstein (Wallerstein, 1983). Today, the formation of the metaverse corresponds to the logic of the development of the sixth Kondratiev cycle, namely, its upward wave, the essence of the concept of the metaverse is revealed in scientific publications of M. Damar (Damar, 2021), B. Talin (Talin, 2024)., G. Wang (Wang G. et al., 2022).

3. Methodology

In this research we applied primarily logical and historical methods, as well as dialectical ascent from the abstract to the concrete, including general scientific methods of analysis and synthesis, induction and deduction, data from UN, UNCTAD, World Bank were used.

4. Results

The activation of the processes of metaverse formation corresponds to the logic and chronology of the deployment of large Kondratiev cycles. According to N. Kondratiev's theory, before the beginning and at the beginning of the upward wave of each major cycle, profound changes occur in the conditions of economic life of society, one of the most important manifestations of which are significant changes in technology, preceded by significant technical discoveries and inventions (Kondratieff, 1926).

The modern world-system is on the threshold of the 6th Kondratiev cycle, and metaverse technologies are one of the types of basic innovations that are necessary to start the deployment of the upward wave of the next Kondratiev cycle. The development of the upward wave of the 6th Kondratiev cycle will occur on the basis of the fourth industrial revolution - the scientific and technological basis of the coming "great transformations".

The fourth industrial revolution: began at the beginning of the 21st century, is based on the digital revolution, its main features - "ubiquitous" and mobile Internet, miniature manufacturing devices (which are constantly getting cheaper), artificial intelligence and learning machines, at the center of the fourth industrial revolution is the convergence of the physical, digital and biological worlds (Schwab, 2016).

The unfolding of the fourth industrial revolution has led to the emergence of a new form of existence - the metaverse - that combines physical and virtual realities, allowing people and their avatars to interact in an environment supported by technologies such as: high-speed Internet, virtual reality, augmented reality, mixed and augmented reality, blockchain, digital twins, and artificial intelligence (AI) (Wang G. et al., 2022). And it also led to the growth of the digital economy.

Today the digital economy is already booming, according to UNCTAD estimates:

- annual smartphone shipments have more than doubled since 2010, reaching 1.2 billion in 2023,
- the number of Internet of Things (IoT) devices is projected to grow 2.5 times from 2023 to 39 billion by 2029,
- new data from 43 countries, representing about three-quarters of global GDP, shows that business e-commerce sales grew by nearly 60% from 2016 to 2022 to reach $27 trillion (UNCTAD, (2024).

The World Bank estimates that the digital sector has been a source of innovation, economic growth, and job creation:

- value added in the IT services sector grew at 8 percent per year from 2000 to 2022, almost twice as fast as the global economy,
- IT services employment growth reached 7 percent per year, six times faster than overall employment growth,
- digital adoption accelerated after the COVID-19 pandemic, adding 1.5 billion new internet users from 2018 to 2022,
- the share of companies investing in digital solutions globally more than doubles from 2020 to 2022 (World Bank, 2024).

The UN predicts that the total artificial intelligence market will reach $4.8 trillion by 2033, making it one of the key drivers of digital transformation (UN, 2025a).

The implementation of technologies of the Fourth Industrial Revolution, including military technologies, is changing the structure of the economy, moving more and more of it

into the metaverse space, as well as radically changing the military sphere through the increasing use of artificial intelligence and strengthening the role of information-psychological warfare. Recently, leading technology corporations have intensified their activities on the development of sectoral metaverses focused on further digitalization of political and military spheres of societal life.

Distributed interactive modeling and high-level architecture have facilitated the integration of disparate training simulators, allowing the military to train in a virtual space, simulating a new concept of military operations and testing new types of AI-based weapons. The armed forces of the world's technological leaders have been using effective simulation for basic military training and the development of advanced AI-based tactical weapons for several years. Thus, AI wargames, an algorithm capable of accurately simulating real-world combat operations, have been introduced into regular military training.

The rapid and all-encompassing spread of metaverse technologies poses threats and challenges to the most important component of society's productive forces - people, and also has eco-destructive consequences. The challenges of transhumanism also deserve special attention.

Regarding the impact on humans, the major threats posed by the rapid development of the metaverse occur in three main directions: 1) influence on consciousness - threatening to destroy the integrity and identity of the individual, 2) impact on economic activity - the threat of increasing displacement of people from the process of societal reproduction, especially the loss of their ability to set goals, 3) increasing social inequality, in particular digital inequality, as a component of social inequality.

The metaverse has the potential to augment the physical world with augmented and virtual reality technologies that allow users to interact seamlessly in real and simulated environments through avatars and holograms. As the metaverse evolves, the clear boundaries between the physical and digital are likely to be somewhat blurred compared to today's perception. However, the interaction of avatars in the metaverse - even if they look real - cannot replace real human interaction (European Parliament, 2022), so the deeper immersion of humans in the metaverse space leads to deformation of their social interaction skills and an increased tendency to escapism.

According to the resolution of the Conference of the European Trade Union Committee for Education (ETUCE), AI poses a real threat to humans. From an ethical point of view, the ability of a machine to influence human choices can hinder the independence, freedom and creativity of humanity (ETUCE, 2021).

In the historical retrospective of pre-industrial, industrial and the initial stage of post-industrial epochs of societal development, the main productive force of society was a human - a carrier of knowledge, innovative ideas, skills and abilities for their realization.

The uniqueness of the modern stage of cyclic societal development lies in the fact that scientific and technological progress displaces a human from the system of societal production, and most importantly, the development of artificial intelligence creates a threat of depriving a human of an active role in goal-setting and decision-making in the most important spheres of societal existence.

The emergence of artificial superintelligence, which is developed to the point where it is able to make decisions based on its own motivation, while being qualitatively different from human intelligence, can lead to an intellectual explosion, which is closely related to the technological singularity, the essence of which is superhumanity (superhuman intelligence) (Vinge, 1993).

The benefits of automation often benefit owners of capital rather than workers, which could increase social inequality and weaken the competitive advantage of cheap labor in developing countries.

The UN predicts that artificial intelligence will affect 40 percent of jobs worldwide and help increase productivity. While the technology brings new opportunities, especially through productivity gains and new industries, it also raises serious concerns about automation and job displacement – especially in economies where low-cost labour has been a competitive advantage (UN, 2025).

The metaverse creates new employment opportunities (primarily in areas such as virtual commerce and services, content creation and curation, virtual events and entertainment). At the same time, it generates increased unemployment - routine tasks and services can be automated (Carenina, 2023).

In the context of the formation of the metaverse, such a component of social inequality as digital inequality has become relevant.

According to UN Secretary-General A. Guterres, "digital inequalities exacerbate social, economic and gender inequalities, affecting both urban and rural populations, children and the elderly, and affecting everything from education to health care" (UN, 2022).

The digital inequality manifests itself primarily at the cross-country level:

- Today, access to AI infrastructure and expertise remains concentrated in a few countries. Just 100 companies, predominantly from the US and China, account for 40 percent of global corporate R&D spending. Major tech giants such as Apple, Nvidia and Microsoft are valued at $3 trillion each - comparable to the combined GDP of the entire continent of Africa. This market dominance could deepen the technological divide, leaving many developing countries without the benefits of AI (UN, 2025a).
- Digital innovation such as artificial intelligence (AI) is accelerating in high-income countries, while low-income countries are lagging behind. While more than 90 percent of people in high-income countries were online in 2022, only one in four people in low-income countries used the Internet, and their connection speeds were typically a fraction of those in wealthier countries. The growing digital divide exacerbates the poverty and productivity gap between richer and poorer economies (World Bank, 2024).
- Artificial intelligence is emerging as a critical driver of the economic future, yet according to UNCTAD, 118 countries, mostly from the Global South, remain outside key international discussions on its regulation (UN, 2025a).
- Many developing countries face digital infrastructure deficits, data shortages and skills shortages (UN, 2025a).
- UNCTAD has developed the Advanced Technology Readiness Index, which takes into account ICT penetration, skills, R&D activity, industrial capacity and access to finance. The leading positions in the ranking are occupied by developed countries of Europe and North

America, as well as Singapore. Among the BRICS countries, China (21st), Russia (33rd), India (36th), Brazil (38th) and South Africa (52nd) have high positions.

- Only a limited number of developing countries, including Brazil, China, India and Russia, have supercomputers and large data centers. In terms of data, China stands out in terms of both quantity and availability. In addition, countries such as Germany, the UK, Russia, the US and Hong Kong, China have significant data sets that can be used for AI development (UN, 2025a). As the digital economy grows, its eco-destructive effects and resource intensity increase.

Digital technologies and infrastructure are highly dependent on raw materials, and the production and disposal of more and more devices, along with growing water and energy demands, are increasingly damaging to the planet. The production and use of digital devices, data centers and information and communication technology (ICT) networks account for between 6% and 12% of global electricity consumption. This growth is taking an increasingly heavy toll on the environment.

Environmental damage occurs throughout the lifecycle of ICT devices and infrastructure, including through e-commerce.

Digital waste is growing faster than the rate of collection. Waste from screens and small IT equipment grew 30% between 2010 and 2022, reaching 10.5 million tons

The growing demand for data transmission, processing and storage for new technologies such as blockchain, artificial intelligence, fifth-generation (5G) mobile networks and the Internet of Things is increasing emissions. For example, the ICT sector emitted between 0.69 and 1.6 gigatonnes of CO2 equivalent in 2020, corresponding to 1.5% to 3.2% of global greenhouse gas emissions (UNCTAD, 2024).

As digital devices become more sophisticated, they require more mineral resources. In 1960, phones used 10 elements from the periodic table, in 1990 they used 27, and in 2021 they will use 63. As a result, the demand for critical minerals needed for both digital and low-carbon technologies is rising sharply. For example, according to the World Bank, demand for cobalt, graphite and lithium is expected to increase by 500% by 2050.

The access to critical minerals is becoming an increasingly strategic priority for many countries, increasing global competition and the risk of geopolitical challenges (UNCTAD, 2024).

The main difference between the current stage of the cyclical development of the capitalist world-system and all previous stages is that scientific and technological progress influences man not only through the transformation of the material conditions of life, but is increasingly acquiring the ability to radically transform the biological body of man, his cognitive abilities.

Transhumanism - in the simplest sense - is the process of improving the cognitive and physical abilities of a man by integrating technology into the human body. Transhumanism and the metaverse are closely connected, because on the one hand the technologies of the metaverse are able to provide opportunities for human improvement, on the other hand the metaverse needs a cyborgized person, a person maximally immersed in the space of the metaverse (in work, recreation, hobbies, communication), in other words, a person for whom virtual reality becomes equivalent or even more important than material reality.

The Fourth Industrial Revolution envisages the mass introduction of cyber-physical systems into production and servicing of everyday human needs. The development of "web 4.0" (predicted to replace "web 3.0" in the 2040s), "university 4.0" (digital university), the Internet of Things, Big Data, artificial intelligence, global robotization are radically changing the living space and a human himself/herself, bringing closer the posthuman existence, in which there will be a comprehensive fusion of a human with new technologies.

Three main model variants of posthumanity can be distinguished: 1) Homo genetically transformed, 2) Nano-cybernetic homo organism, 3) Homo Virtualis (Belyaev, 2017).

Transhumanist technologies are one of the components of the technological basis of the fourth industrial revolution and, consequently, of the metaverse. Their development generates threats of destroying the integrity of the biosocial essence of a human and establishing such a form of social inequality as biosocial inequality, in other words, the inequality of "improved" and "unimproved" people.

5. Discussions

In order to overcome the threats posed by the rapid development of the metaverse, it is necessary to:

1. To neutralize the threat of destruction of the integrity and identity of the individual:
- development and implementation of ethical norms in the practice of institutional regulation of public life, which should be followed by all developers of technologies that form the metaverse and users of these technologies,
- reaching an institutional consensus between corporations, governments and civil society on the need to adhere to ethical norms that should regulate the development of metaverse technologies in order to prevent destructive effects on human consciousness
- pausing the training of artificial intelligence systems more powerful than ChatGPT 4 for at least six months to develop appropriate security protocols during this time, as suggested by scientists and representatives of the IT industry (Future of Life Institute, 2023),
- the creation of special agencies for licensing metaverse technologies, especially artificial intelligence.

2. To neutralize the threat of human displacement from societal reproduction:
- development of skills relevant to the digital sphere, including virtual collaboration, digital marketing and content creation;
- retraining and professional development;
- cooperation between sectors: governments, educational institutions and industries should collaborate to develop effective training programs and policies (Carenina, 2023).
- transitioning to a circular and inclusive digital economy that promotes economic opportunity and job creation while addressing environmental challenges (UNCTAD, 2024).

3. To neutralize the threat of growing digital inequality:
- ensuring opportunities for developing countries to participate in shaping norms to regulate the development of meta-intelligence technologies, especially artificial intelligence, so that technologies serve the interests of all humanity and not just a narrow circle of states (strengthening international cooperation will create a global regulatory system based on the principles of fairness, transparency and universal benefit) (UN, 2025a),

- the signing of a global societal contract on digital technologies, which includes the principles of avoiding digital colonization (when residents of less developed countries are able to connect, but only as participants providing data to monopolies located in other countries, and never as entities able to independently derive economic and social benefits) and inequality (Mulligan, 2025), developing public-private cooperation to reduce the digital divide,
- increasing public investment in digital literacy,
- private companies introducing digital literacy programs for their employees,
- making digital literacy programs accessible to all segments of society, including users from rural areas, from marginalized communities, from countries where access to the Internet is difficult.

Bioethics is becoming increasingly important to prevent threats associated with the use of transhumanist technologies. The development of bioethics contributes to the formation of institutional foundations for preserving the integrity of the biosocial essence of the human being, as well as guarantees of the rights and freedoms of an "unimproved" human being in a possible posthuman future.

Widely recognized are the principles of biomedical ethics developed by T. Beauchamp and J. Childress, namely: respect for autonomy; nonmaleficence; beneficence; justice. Complementing these principles are veracity, privacy, confidentiality, and fidelity (Beauchamp & Childress, 2019).

The implementation of these principles is aimed at avoiding interventions that harm the individual patient. Many modern transhumanists avoid radical approaches, take into account the risks generated by human enhancement technologies, and move from the concept of "posthumanity" to the idea of "humanity+".

The application of human enhancement technologies should take place within the limits delineated by the norms of bioethics. Bioethics itself is in urgent need of normative support and the development of bioethics law.

To reduce the eco-destructive impact and resource intensity of the digital economy, it is necessary to:
- implementing sustainable practices throughout the entire digitalization lifecycle - from design and production to use and recycling,
- encouraging the development of a circular economy (one of the components of the Fourth Industrial Revolution) that minimizes waste and maximizes resource use through reuse, recovery, recycling and product life extension (Only 7.2% of today's global economy is circular, and this share is declining due to increased extraction and use of materials, however, the global electronics recycling market is expected to grow from USD 37 billion in 2022 to approximately USD 108 billion by 2030, led by the U.S. and China) (UNCTAD, 2024),
- improving data collection and transparency of ICT companies' energy consumption
- implementing energy efficiency policies in data networks,
- offering companies tools for customers to measure, report and reduce greenhouse gas emissions from their cloud services,
- encouragement of companies developing devices using environmentally friendly materials, promoting longer product life cycles and supporting the "right to repair" by providing third parties with access to spare parts and repair information,

- using environmentally friendly or reusable packaging materials and automated packaging systems to adapt box sizes to the contents,
- improving supply chains and delivery logistics and promoting cycling (UNCTAD, 2023).

6. CONCLUSIONS

In the cyclical development of human civilization today, the prerequisites for the transition from a deep complex crisis to a phase of comprehensive transformations of the world-system have matured. The fourth industrial revolution and the development of the network economy are one of the most important foundations of such transformations. These processes form a new component of existence - the metauniverse, which inevitably affects production relations and productive forces of society, primarily people as the main productive force.

The uniqueness of the modern stage of societal development lies in the fact that scientific and technological progress is displacing man from the system of societal production, and most importantly, the development of artificial intelligence creates the threat of depriving man of an active role in goal-setting and decision-making in the most important spheres of public life.

The expansion of the metaverse creates such threats - the threat of destruction of the integrity and identity of the individual, the displacement of the individual from the process of societal reproduction, the increasing scale of social, in particular digital inequality, the emergence of bio- inequality due to the use of transhumanist technologies, and has eco-destructive consequences.

Today, the growing instability in the capitalist world-system due to the aggravation of geopolitical contradictions indicates the beginning of crisis-militaristic phases of global cycles (long cycles of world politics, cycles of hegemony, Kondratiev cycles). The unfolding of such forms of global cycles as long cycles of world politics, substantiated by G. Modelski and W. Thompson (Modelski, 1995), cycles of hegemony, proved by I. Wallerstein (Wallerstein, 1983), are cyclical processes of struggle of the leading actors of geopolitics for the status of hegemon.

The unfolding of the crisis-militaristic stage of the cyclical development of the world system has accelerated the formation of military metaverses and the use of new types of weapons based on the use of artificial intelligence and advanced VR-technologies; competition between leading states in the development and application of information and cognitive practices in the military sphere has intensified.

Certain areas of application of artificial intelligence in military operations are of concern from a humanitarian point of view. According to the position of the International Committee of the Red Cross, these are, first of all: the integration of artificial intelligence into weapons systems, in particular, into autonomous weapons systems; the use of artificial intelligence in cyber and information operations; military systems for supporting the decision-making process based on artificial intelligence (ICRC, 2023). The current geopolitical situation prevents full and effective institutional regulation of the development of the metaverse, primarily the regulation of the use of artificial intelligence for military purposes. Therefore, all constructive societal forces, primarily the scientific community, should direct their efforts to create institutional practices for regulating the development of the metaverse.

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THE IMPACT OF DIGITAL TRANSFORMATION ON ENTERPRISES' RESILIENCE: EVIDENCE FROM UKRAINE

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Abstract: *The research focuses on determining the impact of digitalization factors on the resilience of Ukraine's entrepreneurial sector. The main aim is to determine whether digitalization has a positive impact on the resilience of enterprises. The factors under research include the following: the availability of Internet access at Ukrainian enterprises, their e-commerce, the number of employees involved in research and development, and the share of enterprises that employ ICT specialists. The research methodology has two components: the use of a multifactor nonlinear regression model and the calculation of the proposed Index of Digital Penetration in the Ukrainian business sector. The results show that the most influential factors of digitalization are: the presence of employees specializing in ICT and e-commerce. Both factors make Ukrainian enterprises more resilient and adaptive to shocks. However, the results of the Digital Penetration Index emphasize the low level of digital transformation in Ukrainian enterprises, particularly limited automation and insufficient use of cloud computing and artificial intelligence technologies. The results of the study confirm that digitalization does enhance the resilience of Ukraine's entrepreneurial sector, but the low level of digital transformation underscores the need for legislative action to accelerate the development of advanced digital technologies. In order to benchmark the experience, the authors compare the use of digital technologies in Ukrainian and EU enterprises. The results of the research can be used to deepen the study of sectoral resilience, the experience of EU countries, and to provide recommendations for digital development of Ukraine.*

Keywords: *digital transformation, economic resilience, enterprises' resilience, digitalization*

INTRODUCTION

Enterprise resilience in the context of digitalization refers to the ability of businesses to integrate digital technologies to maintain competitiveness, ensure the continuity of business processes, and absorb shocks of various kinds. Two positive effects of digital technology adoption by the entrepreneurial sector can be identified. First, at the micro-level, it directly improves enterprise efficiency (positive correlation may result from process automation, better data management, and enhanced communication capabilities (Wang et al., 2023)). Summarizing existing theoretical research (Caputo et al., 2020; Bican & Brem, 2020; Legner et al., 2017), digitalization affects enterprise productivity through operational efficiency improvement, market expansion, better communication between business and household sectors, product diversification, and adaptability to a changing business environment. In addition, according to recent research, the development of a digital culture has a beneficial impact on the sustainable development of enterprises (Serafimova & Vasilev, 2024). Such

positive correlations contribute to enterprise resilience, as these conditions enable faster recovery following shock events.

The second assertion logically follows: digital technology adoption by the entrepreneurial sector enhances the resilience of the entire economic system. This can be attributed to the transformation of business models and the creation of new products (which increase economic diversification and, hence, adaptability); global market entry and revenue source diversification (which improve competitiveness and recovery capacity); and cost reduction through digitalization (which enhances the system's absorption capacity).

This paper aims to assess the impact of digitalization factors on the resilience of Ukraine's entrepreneurial sector. Research on the digitalization impact on enterprise resilience in Ukraine remains limited. While significant attention has been paid to economic security (Zinenko & Kobielieva, 2022; Hrinkevich et al., 2023; Ohrenych & Dibrova, 2023), innovation development, digitalization, and their implications for enterprise security (Popelo et al., 2023; Zubko et al., 2021; Kuzior et al., 2022; Dubyna et al., 2023), the concept of resilience and the direct impact of digital technologies are mostly explored theoretically. Therefore, expanding the research focus is appropriate.

This research addresses the following questions: (1) Can digitalization factors influence the resilience of Ukrainian enterprises? (2) If so, which factors have greater or lesser impacts? (3) If digital technologies affect enterprise resilience, what is the current level of digital technology penetration in Ukraine's entrepreneurial sector?

METHODS

The research consists of two quantitative components: (1) the application of a nonlinear regression model to assess the impact of digitalization on enterprise resilience and (2) the calculation of the Digital Technology Penetration Index for Ukraine's entrepreneurial sector.

The assessment of the impact of digitalization factors on enterprise resilience was conducted using mathematical modeling, particularly a multifactor nonlinear regression model. This method is widely employed by both Ukrainian (for assessing the impact of digitalization on economic security (Zubko et al., 2021)) and international researchers (for assessing the impact of digital technologies on urban resilience (Shi et al., 2023), the influence of digital transformation on SME resilience (Omoush et al., 2023), and the effect of innovation on urban disaster resilience (Samarakkody et al., 2023)). Several key theoretical and methodological considerations justify the choice of a nonlinear regression model: the influence of digitalization factors is often nonlinear due to varying intensities and speeds of enterprise adaptation to digital changes, and complementary or substitution effects are better evaluated through nonlinear models.

The calculation of the Index involves the following steps:

1. Selection of indicators and data collection. Indicators were chosen to reflect the level of digital technology adoption and use by national economy enterprises (Table 4).

2. Definition of threshold values. Thresholds were developed considering Ukraine's economic specifics (size, development dynamics, historical context, strategic digitalization goals), as well as the experience of EU countries.
3. Data normalization according to threshold values. If an indicator value exceeds the threshold, it is normalized to 1; otherwise, it is normalized to 0.
4. Calculation of digital technology penetration:

$$I_m = \frac{\Sigma N = 1}{\Sigma N_x} \times 100\%$$

where I_m is an integral indicator of the m-th sector of the economy, where m = (1, 2, 3)
Nx=1 — is the number of indicators whose normalized value is 1;
Nx — number of indicators.

DATA

The research process and results depend entirely on the availability of statistical data. The assessment of Ukraine's digital environment used data from the State Statistics Service of Ukraine and official EU statistics, as well as international indices (Global Innovation Index and Frontier Technology Readiness Index). Due to the ongoing war initiated by Russia, data collection has been suspended or restricted, limiting the research scope. The quantitative assessment took into account only those time periods that had the most complete statistical data. For missing indicators, the latest available data were used.

RESULTS

To build this model, it is necessary to define the dependent variable (Y) and independent variables (X) (Table 1). Accordingly, within the model, the dependent variable will be an indicator that assesses the economic resilience of the entrepreneurial sector. The independent variables are indicators that will reflect the factors of digitalization's impact on resilience.

As a dependent variable, the indicator of value added by production costs of economic entities was chosen. We believe that the selected indicator successfully demonstrates the resilience of the sector: value added by production costs actually means the ability of enterprises to create new economic value. Even in the face of shocks, enterprises with a stable level of value added are better able to maintain their operations and ensure financial independence.

The indicators that will serve as independent variables and reflect the impact of digitalization on economic resilience are: the number of enterprises with access to the Internet; the volume of products (goods, services) sold by enterprises derived from e-commerce; the number of employees involved in research and development; and the share of enterprises with ICT specialists.

In addition, we believe that it would be appropriate to assess the use of CRM systems by enterprises of the national economy (as this is a direct reflection of automation processes) and the state of cybersecurity, but currently there is no statistical data for the period under research. It should also be noted that due to the lack of statistical data for the share of the

number of enterprises that employ ICT specialists (statistical data are not available for 2020 and 2022), the model may contain a certain percentage of uncertainty - for the purpose of the assessment, the indicators for 2020 and 2022 were projected based on the growth (decline) rates of previous years.

Table 1. *Initial data for assessing the impact of digitalization on value added by economic entities' expenditures*

	Value added by production costs of economic entities	The number of employees involved in research and development	The number of enterprises with access to the Internet	The volume of products (goods, services) sold by enterprises derived from e-commerce	The share of enterprises with ICT specialists
Year	Y	X1	X2	X3	X4
2018	**2640886379,2**	88128	43303	228 035 634,70	22,3
2019	**3121256476,2**	79262	43785	292 731 939,10	21,6
2020	**3294768464,7**	78860	44271	364 571 488,00	20,9
2021	**4594232280,4**	68808	44508	435 909 793,90	21,7
2022	**3947735837,3**	53221	42785	465 316 898,70	17,7
2023	**4838907049,6**	58567	34204	547 590 249,30	17,7

Source: Website of the State Statistics Service of Ukraine, 2022

Calculations and model building were based on a regression model in Excel. The level of reliability is defined as 0.95 - the boundaries of the confidence interval for each regression coefficient cover the true value with a probability of 95%. Considering the upper limit of the confidence interval for each of the coefficients, the model is as follows:

$$\check{Y} = -49274{,}9X_1 - 72464{,}9X_2 + 6{,}5X_3 + 433463774{,}7X_4 - 1029872880$$

The coefficient of determination R^2 is quite high and amounts to 0.999. Thus, the variation of value added by the costs of economic entities is 99% determined by the variation of the proposed factors, but there are 0.1% that are unaccounted for.

These results allow us to assess the adequacy of the model. According to the Fisher's test of adequacy, the obtained F-value (0.02) is lower than the significance level (0.05), so since $F < a$, we can say that the model is generally statistically significant and adequate. We can assess the adequacy and statistical significance of each coefficient separately by using the critical t value from the Student's statistical table. If the critical significance level is $\alpha = 0.05$ and the degree of freedom is n-m=2, the critical value is 2.920. As can be seen from the results of the t-test (Table 2), all available coefficients are greater than the critical value. This indicates that they are not statistically significant. Therefore, we consider it necessary to use a different type of model to evaluate the selected indicators.

Table 2. *Calculations of a multifactor linear model*

	Coefficients	**t-statistics**	**p-value**	**R-square**	**The significance of F**
Y	-1029872879,60175	-2,33445888668255	0,257650973	0,999	0,0240
X1	-49274,90302	-10,8441748720604	0,058540589		
X2	-72464,89698	-10,5163655881444	0,060354627		
X3	6,54706318666723	17,1301999848115	0,037121463		
X4	433463774,656223	19,6914621593524	0,032301987		

Source: compiled by the authors

From now on, we will use a power function with its transformation to a linear form as a result of logarithmizing. The function will have the following form:

$$lnY = lnA + \alpha \times lnX_1 + \beta \times lnX_2 + \gamma \times lnX_3 + \delta \times lnX_4$$

The calculations were performed by building a regression model in Excel, and the results are as follows: $\grave{A} = 10.33$, $\alpha = -1{,}02$, $\beta = -0{,}9$, $\gamma = 0{,}61$, $\delta = 2{,}39$.

Accordingly, taking into account the logarithmization of the coefficients, we have the following form of the function:

$$Y_{calc} = \exp(10{,}33) \times X_1^{-1{,}02} \times X_2^{-0{,}9} \times X_3^{0{,}61} \times X_4^{2{,}39}$$

The final result after calculating the exponential function:

$$Y_{calc} = 30{,}638.1 \times X_1^{-1{,}02} \times X_2^{-0{,}9} \times X_3^{0{,}61} \times X_4^{2{,}39}$$

The coefficient of determination R^2 of the newly created model remained at the same level - 0.99, which still indicates a high influence of the factors considered. We can also assess the adequacy of the model, in particular, using Fisher's criteria. For this purpose, we will use the result of the F-value for the built model and the tabulated F-value for the significance level of 0.05. To select the correct table value, we also took into account the number of independent variables (4) and the total number of observations (6) minus the number of parameters. Accordingly, $F_{table} = 7.7$, $F_{calc} = 3354{,}08$; $F_{calc} > F_{table}$. We can conclude that the model is reliable, all factors have an impact on the dependent variable (p-value in Table 3).

Table 3. *Results of calculations using a power function with logarithmization*

	Coefficients	**t-statistics**	**p-value**	**R-square**	**The significance of F**
Y	10,32814803	28,62656837	0,022229734	0,999	0,012949335
X1	-1,015903715	-24,22316748	0,026266527		
X2	-0,903507143	-26,19640569	0,024290005		
X3	0,607733673	39,84619939	0,015973573		
X4	2,392693185	35,46667481	0,017945047		

Source: compiled by the authors

Thus, according to the results of the calculations, the factor of the availability of ICT employees at enterprises has the greatest impact on the entrepreneurial sector's resilience. There are several reasons for this: first of all, enterprises with ICT specialists are able to demonstrate

greater preparedness for digital threats (cyberattacks or NDA data leaks), which directly affects their ability to maintain functionality during economic shocks. In addition, there is a possibility of greater flexibility and technical competitiveness of the enterprise: the presence of ICT specialists in the enterprise allows for the introduction of modern digital technologies, and thus, increases the efficiency of operational processes.

The results also show that e-commerce has a significant impact, which can be explained accordingly:

1. E-commerce actually eliminates most of the barriers to doing business: physical interaction between consumer and seller is replaced by digital communication (which is faster and more affordable), and it is easier to expand the market - it becomes possible to compete not only in the national but also in the international market, with a positive result of diversifying the customer base.
2. Another positive effect of e-commerce is the reduction of transaction costs: enterprises can increase their profitability by reducing the cost of renting premises, logistics, etc. However, of course, there is also the possibility that costs will be incurred for maintaining a website, CRM systems to automate customer interaction, and the development of digital marketing campaigns.

The impact of Internet access at the enterprise and the number of employees involved in R&D is also statistically significant. However, it should be noted that the effectiveness of these two factors is difficult to assess in the short term (which is why their impact is negative in the current situation, see Table 3). For example, the effect of R&D can be traced conditionally in 5-10 years, and the effect of using the Internet connection is also not immediately noticeable (or its significance is not so great). In order to comprehensively assess the level of digital transformation of Ukraine's entrepreneurial sector, we propose to consider the developed Digital Penetration Index (Table 4).

Table 4. *Input data for the calculation of the Digital Penetration Index in the entrepreneurial sector of Ukraine*

№	Indicator	Threshold value	2022
1	Share of enterprises engaged in e-commerce in the total number of enterprises, %.	≥ 22	6.1
2	Share of the number of enterprises using fixed Internet access in the total number of enterprises, %.	≥ 90	61.8
3	Share of the number of enterprises applying ICT security measures in the enterprise's information and communication systems in the total number of enterprises, %.	≥ 90	73.2*
4	Share of enterprises purchasing cloud computing services in the total number of enterprises, %.	≥ 40	9,8
5	Exports of ICT services, USD billion	≥ 6.5	7.52

6	Share of the number of enterprises that faced problems due to ICT security incidents in the total number of enterprises, %.	≥ 15	24.7
7	Share of the employed population in the ICT sector in the total number of employed people, %	≥ 4	1.9**
8	Share of the number of enterprises using artificial intelligence technologies in the total number of enterprises, %.	≥ 6	5.4
9	Global Innovation Index	≥ 30	32,3
10	Frontier Technology Readiness Index	≥ 0.61	0.59

Source: Website of the State Statistics Service of Ukraine, Global Innovation Index (GII), Frontier technology readiness index

** — statistical data for 2023;*

*** — statistical data for 2021;*

After analyzing the available statistics, we can calculate the level of digital penetration in Ukraine's entrepreneurial sector using the following formula:

$$I_m = \frac{\Sigma N = 1}{\Sigma N_x} \times 100\%$$

Thus, the calculation is as follows:

$$I_1 = \frac{3}{10} \times 100\% = 30\%$$

The level of digital technology penetration in Ukraine's business sector is 30%. According to the proposed assessment scale (Table 5), this level is low, which means minimal adoption of digital technologies. Business processes are mostly performed manually, but there is a small percentage of automation. The level of digital skills of employees is also low and needs to be significantly improved.

Table 5

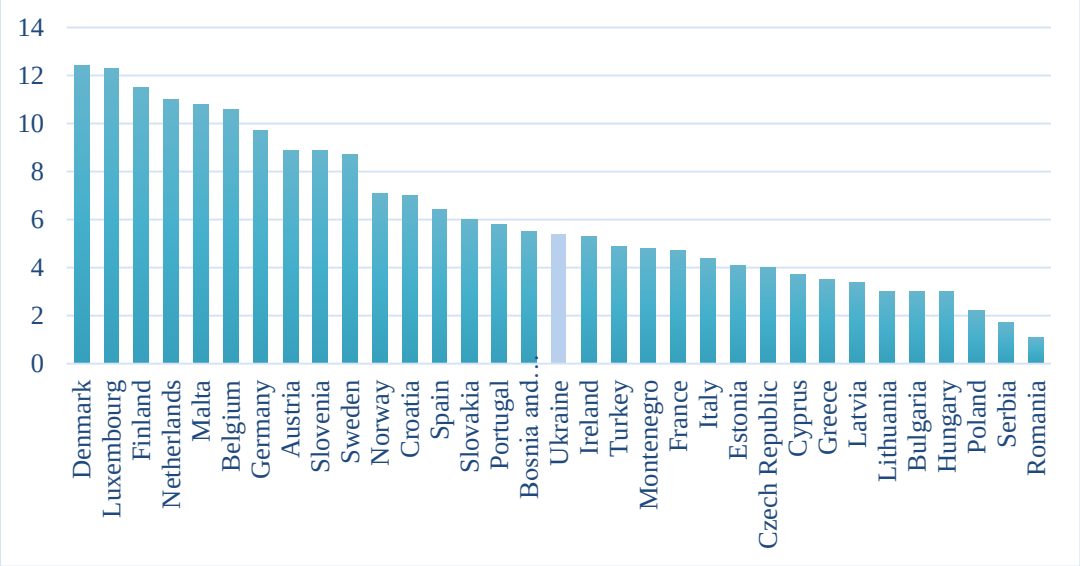
Digital penetration scale	Penetration level	Meaning
100-80%	High	Business operations are fully dependent on digital technologies. Business processes are automated, artificial intelligence, cloud computing, and IoT are used. Employees' digital skills are at a high level.
80-60%	Sufficient	Digital technologies are actively used in operations, but not to the fullest extent. Thus, business process automation is selective and digital tools are partially used. The level of digital skills of employees is average.
60-40%	Moderate	Digital technologies are used only for certain business processes, automation is fragmented, with limited use of digital tools. There is a need to improve the digital skills of employees.

40-20%	Low	Digital technologies are implemented at a minimal level. Business processes are mostly performed manually, but there is a small percentage of automation and use of digital tools. Low level of digital skills of employees.
20-0%	Extremely low	Digital technologies are hardly used, and enterprises are dominated by "traditional" approaches to doing business, without significant automation. The level of digital skills among employees is too low.

Source: compiled by the authors

Statistical analysis shows that the weakest points of Ukraine's entrepreneurial sector are indicators related to automation (in particular, the use of AI and cloud computing in enterprises). Compared to EU countries, the share of enterprises using AI technologies in Ukraine is not very high - 5.4% (statistical data of enterprises with 10 to 49 employees) (Website of the State Statistics Service of Ukraine, 2022), while the average value in EU countries is 6.2% (Eurostat, 2022). It is also worth noting that a characteristic feature of the national economy is the invariance of this indicator depending on the size of the enterprise: the share of large enterprises using AI technologies in Ukraine is 5.2% (which is 0.2% less than the same share in the context of small enterprises). On the contrary, compared to small enterprises, large enterprises in the EU use AI technologies more often - 14.5% (Eurostat, 2022) across the EU. Obviously, the conditions of a full-scale war somewhat limit the introduction of innovative technologies in enterprises, but as a rule, large enterprises are more resilient and adaptive to shocks, so it is surprising that they fund AI technologies less.

Figure 1. *Share of enterprises using AI technologies in Ukraine and EU countries*



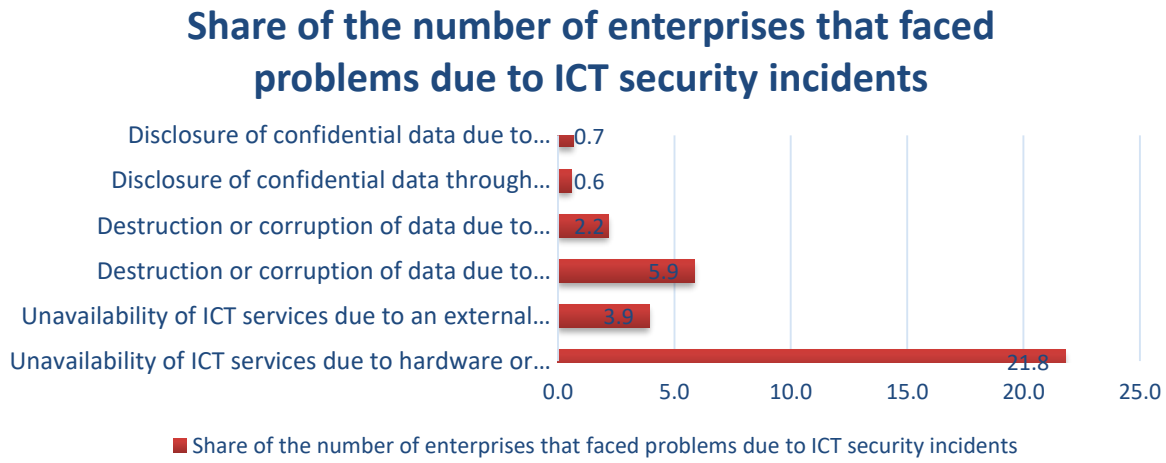
*Source: compiled on the basis of (*Eurostat, 2022; Website of the State Statistics Service of Ukraine, 2022)

The share of the number of enterprises that purchase and use cloud computing services is also low compared to EU enterprises. While the average value for the EU countries is 42.5% (2023), only 9.8% of Ukrainian enterprises take advantage of cloud computing.

Internet access also needs to be improved. In 2023, 80.8% of Ukrainian enterprises had access to a fixed-line Internet connection, which is 19% more than in 2022. However, under ideal conditions, this figure should reach at least 90%, as the experience of EU countries shows. We assume that this may be due to infrastructure constraints: areas with low population density have a lower number of fixed Internet access lines, where providers are not economically interested in laying fixed networks. In addition, damage to or destruction of infrastructure as a result of hostilities, especially in frontline areas, significantly complicates access to the fixed Internet. It should not be forgotten that enterprises with unstable income tend to use an alternative network - the mobile Internet.

The level of digital security in the business sector can be indicated by the share of enterprises that use ICT security measures. According to statistics, in 2023, there were not too many ICT incidents among Ukrainian enterprises - the share of the number of enterprises that faced problems was 24.7% (in the total number of enterprises) (Website of the State Statistics Service of Ukraine, 2022). The most vulnerable economic activities are: manufacturing (production of coke and petroleum products, basic pharmaceutical products and pharmaceuticals); wholesale and retail trade; computer programming, consulting and related activities; provision of information services; travel agencies, travel operators, provision of other reservation services and related activities.

Figure 2. *Types of ICT incidents among Ukrainian enterprises*



Source: compiled on the basis of (Eurostat, 2022; Website of the State Statistics Service of Ukraine, 2022)

At the same time, security measures are used by the vast majority of enterprises in the national economy - 73.2% in 2023. The most commonly used security measures include strong password authentication (66.3%) (unfortunately, more secure authentication methods, such as biometric methods or a combination of two authentication methods, are used much less frequently), backing up data to a secure location (52.7%), controlling network access (44.6%), encrypting data, documents, or email (23%), and VPN (21.4%). However, these figures are

significantly lower than in the EU, where 92% of businesses use at least one security measure on average. The most popular in the EU are password authentication (82%), backups (78%), and network access control (65%).

The strength of the digital transformation process of Ukraine's business sector is the size of ICT exports and the resilience of the IT sector as a whole. Even though the national economy's ICT services exports have a positive upward trend, 2023 was the first year when the value of this indicator decreased. According to the World Bank, in 2023, Ukraine's ICT services exports amounted to USD 6.8 billion. USD (for comparison, in 2022, the value of the indicator was 7.52 billion USD, which is 0.72 billion USD less. USD, which is 0.72 billion more). It is noted that the reason for this may be a slowdown in economic growth in global markets. The countries from which the revenue from ICT exports comes are: USA (USD 2,667 million), Malta (USD 567 million), Great Britain (USD 535 million), Cyprus (USD 362 million), Israel (USD 293 million), Germany (USD 275 million), and Switzerland (USD 274 million). All of these countries are currently experiencing a recession, and the demand for ICT services is not as high as it was during COVID-19. Local reasons are also worth highlighting: increased investment risks due to a full-scale invasion and the mobilization process, which affects the number of IT professionals.

DISCUSSIONS

Thus, the use of a quantitative approach, specifically building a nonlinear regression model, enabled the identification of the impact of digitalization factors on the resilience of Ukraine’s entrepreneurial sector. According to the results, the most significant influence on value added by production costs of economic entities stems from the presence of ICT specialists in enterprises and the adoption of e-commerce. The presence of ICT specialists directly affects economic resilience by ensuring productivity and adaptability. Employees with ICT skills and, accordingly, a high level of digital culture, increase resilience, strengthening the enterprise's innovation potential, flexibility to change and competitiveness (Serafimova & Vasilev, 2024). E-commerce, in turn, is no less important for enterprise resilience. Enterprises that use e-commerce as a sales channel can respond more swiftly to demand fluctuations, scale sales, and optimize transaction costs. These factors most significantly contribute to enhancing: (1) economic efficiency, (2) digital adaptability, and (3) resilience to external shocks.

However, the results of the Digital Technology Penetration Index for Ukraine's entrepreneurial sector indicate that processes related to e-commerce and the employment of ICT specialists remain among the weak points of the national economy, as their values fall below threshold levels. This undoubtedly limits the resilience of Ukraine’s entrepreneurial sector. Firstly, there is a substantial negative impact on adaptability—in the case of macroeconomic or geopolitical shocks (such as the onset of the full-scale invasion), enterprises lacking digital sales channels or automated processes are less able to adapt to changes. Secondly, this contributes to reduced competitiveness across the economy, as a low percentage of ICT specialists constrains the adoption of advanced digital technologies.

Despite the comprehensive analysis, the research has certain limitations. The most significant limitation relates to the use of statistical data. It would have been preferable to analyze a longer time period, thereby obtaining more regression observations, which would have greatly increased the accuracy of the results. However, official data for some selected indicators were unavailable. This affected both the time frame for the regression model and the calculation of the Digital Technology Penetration Index. As noted, the Index was calculated only for 2022, which considerably limits the ability to draw precise conclusions. Nevertheless, this period provided the most comprehensive set of statistical data for the selected indicators.

The choice of threshold values for the Index indicators is also a matter of discussion. In most cases, their development is based on a quantitative method, i.e., calculating the median value among the results of the European Union countries, but certain qualitative characteristics were also taken into account (such as the historical context of Ukraine's economic development, the pace of digitalization and its strategic vision in the country, current shocks, etc.), which indicates a degree of subjectivity in this approach.

Considering the results and limitations, the study has the potential for further development. The publication of official statistics for more specific indicators (e.g., cybersecurity, cloud computing, and AI) is becoming regular, so it is expected that it will be possible to assess longer time periods in the future and expand the analysis of the Index indicators, which will make the analysis more accurate and comprehensive. Additionally, sectoral analysis warrants attention. Understanding that digitalization factors do have a positive impact on the resilience of enterprises, the question arises as to which industries are more affected and whether digitalization is a key factor for all industries. In this regard, it would be valuable to compare the most significant sectors contributing to Ukraine’s GDP and assess the impact of digitalization factors on them.

Also, since the research is partly based on a comparison of Ukraine's experience with the EU countries, there is a need for a broader analysis: a comparison of regression analysis of the impact of digitalization on EU and Ukrainian enterprises, and a study of the experience of European countries. Although the results of the study and the developed Index are adapted to the economic conditions of Ukraine and there is no direct generalization of the study, it is possible to adapt the methodology and structure of the research to other countries.

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UNDERSTANDING STEM EMPLOYMENT CHALLENGES IN GEORGIA: A QUALITATIVE ANALYSIS OF EMPLOYER PERSPECTIVES

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Abstract: *This paper explores the challenges and opportunities within Georgia's STEM (Science, Technology, Engineering, and Mathematics) labor market from the perspective of employers. Drawing on qualitative data from in-depth interviews and focus group discussions with representatives from key sectors—including ICT, healthcare, engineering, and research—the study examines structural issues hindering STEM workforce development. The analysis identifies six major challenges: talent drain, low salaries and limited career growth, mismatch between education and labor market demands, limited STEM awareness, gender disparities, and regional inequalities. Findings show that employers face persistent difficulty in attracting and retaining qualified professionals, largely due to inadequate training systems, underfunded research infrastructure, and limited career incentives. The study concludes that improved collaboration between academia, industry, and government is essential for enhancing workforce preparedness and promoting sustainable economic growth. Policy recommendations include aligning academic programs with labor market needs, investing in regional infrastructure and promoting inclusive STEM participation through early engagement and targeted reforms.*

Keywords: *STEM, labor market, skills mismatch, talent drain.*

1. INTRODUCTION

Science, Technology, Engineering, and Mathematics (STEM) fields are fundamental to economic growth, technological advancement, and national competitiveness. Countries that successfully develop and sustain a skilled STEM workforce benefit from increased productivity, innovation, and long-term economic resilience. In Georgia, as in many other countries, STEM employment plays a crucial role in shaping industrial and technological progress. However, despite the growing demand for STEM professionals, various structural and systemic challenges hinder workforce development and retention. Following the collapse of the Soviet Union, many post-Soviet states, including Georgia experienced the dismantling of their once-robust research and development (R&D) sectors. During the Soviet era, R&D institutions were heavily funded and integrated into industrial and technological development strategies. However, the transition to a market economy led to severe funding cuts, brain drain, and the fragmentation of research infrastructure, leaving STEM fields struggling to recover.

Currently, approximately 10.5% of employees in Georgia work in STEM-related professions (source: authors' calculation based on Labour Force Survey). However, STEM employment is highly gender-segregated, with men dominating ICT and engineering fields, while women are more represented in healthcare and certain science disciplines.

Through qualitative data from in-depth interviews and focus group discussions with employers and industry representatives, the research will evaluate challenges based on the employer's perspective regarding STEM employment. By analyzing them, the research aims to identify structural gaps and propose policy recommendations to enhance STEM workforce retention, strengthen R&D capabilities, and foster innovation-driven economic growth in Georgia and other developing nations facing similar obstacles.

2. Literature Review

The growing discourse around the mismatch between STEM (Science, Technology, Engineering, and Mathematics) education and industry demand highlights challenges in workforce development. While STEM education is promoted as a pathway to innovation and economic growth, the actual employment landscape presents discrepancies between the skills students acquire and those employers seek. This literature review aims to identify the main challenges, and their extent related to STEM employment which will be discussed in the practical research from the employers' perspective.

One of the main challenges on a labor market with regard to STEM professions is **talent drain**. The exodus of skilled professionals in STEM fields, commonly referred to as "brain drain," poses a significant threat to economic development, technological advancement, and workforce stability. Various factors contribute to the migration of STEM experts, including financial incentives, restricted career growth, and suboptimal work environments. Salary differences play a crucial role in this mobility, with higher-paying sectors like finance drawing STEM graduates away from traditional scientific and technical roles (Marin & Vona, 2017). Moreover, the scarcity of career progression opportunities and inadequate research funding compel professionals to seek better prospects in other countries (Schwager & Gates, 2024). Inferior working conditions, especially in less developed areas, further amplify this trend by pushing talent towards nations with superior research facilities (Yu, Piew, & Fai, 2014). Political unrest and administrative inefficiencies also contribute to the outflow of skilled workers (Zwetsloot, 2021). The effects of this talent drain are debatable, with some researchers suggesting that global redistribution of talent can enhance labor market efficiency (Horton et al., 2017), while others emphasize the detrimental impact on economic productivity and innovation in the countries of origin (Auriol, 2010). To counter this trend, governments can bolster STEM education, enhance workplace conditions, and implement programs that incentivize expatriates to return (Chen & Tan, 2024; Duran & Lopez, 2019). Fostering stronger ties between industry and academia can also play a crucial role in retaining skilled professionals by promoting domestic career advancement (Schwager & Gates, 2024).

The STEM workforce plays a crucial role in driving economic growth and innovation, but professionals in this field encounter persistent challenges related to **insufficient pay and limited career growth opportunities**. Career stagnation in STEM fields is exacerbated by the lack of structured promotion pathways, particularly in academia and research, where professionals often struggle to advance due to unclear career trajectories and limited leadership opportunities (Saras, 2024; Xue & Larson, 2015). Additionally, public sector STEM wages remain uncompetitive compared to private sector opportunities, making it difficult to attract and retain skilled professionals in government-funded research and technical roles (Edwards, McCollester, & Phillips, 2021). Rapid technological advancements also contribute to career instability, as evolving industry demands frequently render certain skills obsolete, requiring continuous retraining to remain relevant (Deming & Noray, 2018). Compounding these challenges, market saturation in STEM fields has led to wage stagnation, particularly in

academia and research, where an oversupply of highly educated professionals has outpaced the availability of well-paying jobs (Delavallade et al., 2024; Salzman, 2013; Xue & Larson, 2015).

Furthermore, the **mismatch between STEM education and industry demand** has been widely discussed in the literature (Biagi & Castaño Muñoz, 2020; Smith & White, 2022; Pater et al., 2022; Ghaffarzadegan et al., 2017; Ngo et al., 2025; Srivastava, 2025; Ali & Bangalore, 2025). The disconnect between STEM education and industry needs leads to underemployment, as employers seek practical skills often absent from traditional STEM degree programs (Delavallade et al., 2024; Rodríguez et al., 2025), especially STEM curricula lag behind emerging technologies (Tajudeen et al. 2025, Zhou et al., 2025, Gao, et al., 2025; Wu & Zhou, 2025). Researchers also highlight the lack of industry-specific skills among STEM graduates (Kersanszki & Nadai, 2020; Teshome & Oumer, 2024; Morris et al., 2024).

The growing skills gap in the labor market, especially among women and minorities, is largely attributed to **insufficient STEM awareness and engagement**. Research indicates that the absence of early STEM exposure and traditional teaching methods that lack interdisciplinary integration contribute to this issue (Owens et al., 2012). Moreover, employers report that graduates often fall short in both technical proficiency and crucial problem-solving and communication abilities needed for contemporary STEM positions (Karimi & Pina, 2021, Hora et al. 2016; Jiang et al., 2024). While programs to boost STEM participation exist, many are found to be temporary and fail to provide lasting solutions to workforce deficits (Hodgson et al., 2024). Introducing STEM education in early years increases interest and career aspirations in STEM fields. Without structured interventions, disengagement occurs (Siregar et al. 2023).

Current research indicates ongoing **gender inequalities in STEM education and careers**, despite initiatives to enhance diversity. Reviewed literature demonstrates that gender disparities in STEM emerge early, influenced by societal expectations, unconscious biases, and a scarcity of female exemplars (Martínez-Gómez et al., 2024; Jimenez, Santiago, & Couvertier, 2024; Burgos-Lopez et al., 2024). Female professionals in STEM often encounter pay inequities and obstacles to professional growth, compounded by job segregation and workplace bias (Ruiz, Ganuza, & García, 2024; Dolgikh & Potanin, 2025). Sector-specific inequalities are particularly evident in aerospace, AI, and green technology industries, where systemic obstacles further restrict women's involvement (Costa et.al, 2024; Conde-Ruiz et al., 2024; Moso-Diez & Mondaca-Soto, 2025). Policy measures have shown varied outcomes, with certain studies recommending more equitable recruitment practices, mentoring initiatives, and educational reforms to tackle ingrained biases (El Khawand, 2025; Lucietto & Peters, 2024).

Still another challenge with regard to STEM professions is the **uneven distribution of STEM careers across regions**. This is influenced by a combination of economic, educational, and demographic elements that result in unequal access to opportunities in different geographical areas. Studies show that urban centers with robust STEM industries provide enhanced job prospects and salary levels, while rural and economically challenged areas struggle with ongoing issues due to scarce educational resources and industrial concentration (Wright, Ellis, & Townley, 2017; Lysenko & Wang, 2020). These regional imbalances are further intensified by gender and racial disparities, as women and minority groups are often underrepresented in lucrative STEM positions due to systemic and cultural obstacles (White & Smith, 2024). Economic strategies and workforce development initiatives are instrumental in shaping these disparities, with regions that actively invest in STEM education and innovation centers typically demonstrating stronger labor market results (Gregory, 2015; López-Bazo, Monastiriotis, & Motellón, 2017).

Table 1. *Predefined STEM Employment Broad Challenges based on Literature Review*

Challenge	Academic Literature
Talent Drain	Auriol, 2010; Horton et al., 2017; Marin & Vona, 2017; Yu, Piew, & Fai, 2014; Zwetsloot, 2021; Schwager & Gates, 2024; Chen & Tan, 2024; Duran & Lopez, 2019
Low Salaries and Limited Career Growth	Salzman, 2013; Xue & Larson, 2015; Deming & Noray, 2018; Edwards, McCollester, & Phillips, 2021; Saras, 2024; Delavallade et al., 2024
Mismatch Between Industry Demand and Workforce Skills	Ghaffarzadegan et al., 2017; Smith & White, 2022; Biagi & Castaño Muñoz, 2020; Kersanszki & Nadai, 2020; Pater et al., 2022; Teshome & Oumer, 2024; Morris et al., 2024; Delavallade et al., 2024; Ngo et al., 2025; Srivastava, 2025; Tajudeen et al., 2025; Zhou et al., 2025; Gao, et al., 2025; Rodríguez et al., 2025; Wu & Zhou, 2025
Limited STEM Awareness and Engagement	Owens et al., 2012, Hora et al., 2016; Karimi & Pina, 2021; Siregar et al., 2023; Hodgson et al., 2024, Jiang et al., 2024; Ali & Bangalore (2025)
Gender Disparities in STEM	Jimenez, Santiago, & Couvertier, 2024; Lucietto & Peters, 2024; Martínez-Gómez et al., 2024; Ruiz, Ganuza, & García, 2024; White & Smith, 2024; Dolgikh & Potanin, 2025; Costa et. al, 2024; Conde-Ruiz et al., 2024; Burgos-Lopez et al., 2024; El Khawand, 2025; Moso-Diez & Mondaca-Soto, 2025
Regional Disparities in STEM	Gregory, 2015; Wright, Ellis, & Townley, 2017; López-Bazo, Monastiriotis, & Motellón, 2017; Lysenko & Wang, 2020

Source: Developed by authors.

3. Methodology

3.1 Research Materials

This academic research is based on transcripts and qualitative data from the 2024 practical research project- "STEM OPPORTUNITIES AND CHALLENGES IN GEORGIA: Analysis of the Education System, Labor Market, and Legislative Framework" which examined the challenges, needs, and opportunities faced by employers in STEM fields within Georgia's labor market. The transcripts include interviews and focus group discussions conducted as part of the mentioned research project, providing a rich dataset for analysis. Rather than collecting new primary data, this study utilizes those existing transcripts to examine key labor market trends, skill shortages, and employer perspectives in greater depth.

The research respondents represent major sectors and organizations that employ STEM professionals, ensuring a comprehensive understanding of workforce challenges and opportunities. STEM professionals in this research are defined based on the ILO 2024 classification, which categorizes occupations relevant to science, technology, engineering, and mathematics. According to this classification, STEM professions include engineering and science specialists (ISCO-08: 21, 31), IT professionals (ISCO-08: 25, 35), and healthcare specialists (ISCO-08: 22, 32) involved in scientific and technological work. Additionally, business and administrative roles (ISCO-08: 12, 13, 24) are included only when employees work in specific industries. ISCO-08: 12 (Administrative and commercial managers) is considered STEM if employed in NACE 72 (scientific research and development). ISCO-08: 13 (Production and specialized services managers) qualifies if employed in NACE 62 (computer programming, consultancy, and related activities). ISCO-08: 24 (Business and

administration professionals) is included if working in NACE 62, 63 (information service activities), or 72.

In total, transcripts are available for thirteen in-depth interviews and six focus group discussions, involving 43 participants. These transcripts form the foundation of this study, allowing for an in-depth examination of employer challenges and expectations. The list of respondents is displayed in Table 2.

Table 2. *Overview of Interview and Focus Group Participants*

In-depth Interview	Focus Group Discussion
Research Institutes ▪ R. Agladze Institute of Inorganic Chemistry and Electrochemistry ▪ Ilia Vekua Sukhumi Institute of Physics and Technology ▪ Institute of Earth Sciences and National Seismic Monitoring Center ▪ G. Eliava Institute of Bacteriophages, Microbiology, and Virology ▪ A. Razmadze Mathematical Institute Government & Innovation Agencies ▪ Agency "Produce in Georgia" ▪ Georgia's Innovation and Technology Agency Industry Associations & NGOs ▪ ICT Association of Georgia ▪ Georgian Association of Artificial Intelligence ▪ Georgian Renewable Energy Development Association ▪ Georgian Farmers' Association ▪ N(N)LE "Healthcare Association" ▪ StrategEast	▪ Managers of Clinics and Hospitals ▪ Representatives of Sectoral Skills Organizations ▪ Board Members of the Georgian Laboratory Association ▪ Representatives of ICT Companies ▪ Managers of Energy Sector Companies ▪ Representatives of Technology Startup Companies

Source: Developed by authors.

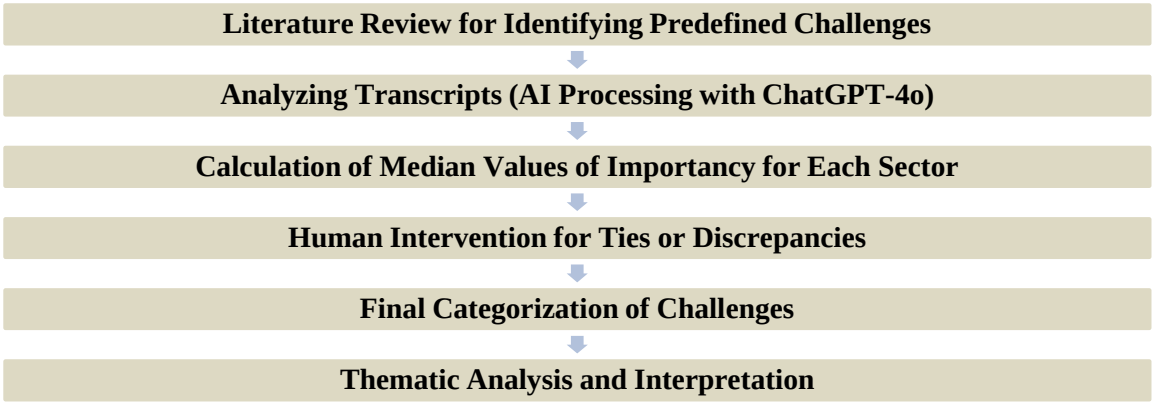
3.2 Data Analysis Process

The qualitative data analysis in this study was used to identify the importance and context of key challenges based on findings from the literature review. The predefined challenge categories were collected based on academic literature review and included following factors: Talent Drain, Low Salaries and Limited Career Growth, Mismatch Between Industry Demand and Workforce Skills, Limited STEM Awareness and Engagement, Gender Disparities in STEM, and Regional Disparities in STEM (see the Table 1 in previous chapter).

To systematically analyze the transcripts, we applied a structured classification approach using AI-assisted content analysis. Each transcript was assessed based on how prominently each challenge was discussed and the sentiment expressed by the respondents. The classification system used four categories**: Important** (discussed in-depth with strong negative sentiment), **Somewhat Important** (mentioned but without strong emphasis), **Not Important** (rarely mentioned or explicitly dismissed), and **Not Mentioned** (not referenced at all).

The analysis was conducted in several steps. First, AI tools (ChatGPT-4o) processed the transcripts, categorized discussions, and assessed sentiment based on the predefined classification criteria. After this initial analysis, we reviewed the results and calculated **combined values for each sector** by determining the **median value of the transcript analysis for each respondent within that sector**. If the responses were tied or varied significantly, **human intervention was used to determine the final category** based on contextual interpretation and industry-specific insights.

Figure 1. *Qualitative Data Analysis Process*



Source: Developed by authors.

During the sectoral analysis, we manually grouped the findings into **four broad categories**: ICT, Science, Engineering, and Health. These categories align with common international classifications used in STEM workforce analysis, particularly those based on ISCO-08 and NACE Rev.2 standards, ensuring consistency with global research frameworks. Additionally, they were identified as broad and easily understandable sectoral divisions that best represent the distribution of STEM employment and challenges across industries.

3.3 Research Limitations

This study examines STEM employment challenges exclusively from the perspective of employers.

This approach was chosen for two main reasons. First, the dataset consists solely of qualitative data from employers, making it the primary lens through which challenges are assessed. Second, the challenges faced by employees represent a distinct research question requiring different research methods. Employee perspectives tend to focus on more specific, personal-level concerns, whereas employers provide insight into systemic labor market issues. As a result, a separate study would be needed to properly capture the challenges from the employee's viewpoint.

Additionally, this study **does not compare employer perceptions of challenges to general labor market data**. There are two reasons for this. First, reliable statistics on STEM employment in Georgia remain limited, making direct comparisons difficult. Second, the study seeks to understand employer perceptions rather than objective market trends. Employer sentiment does not always align with statistical realities; for example, while salaries in certain STEM sectors may be high compared to other fields, employers may still perceive them as insufficient to attract or retain talent. Understanding these perceptions is critical, as they influence hiring decisions and workforce strategies.

Furthermore, **the dataset is limited to transcripts from STEM-related organizations and companies,** excluding non-STEM industries that may also employ STEM professionals. While this study captures insights from core STEM sectors, it does not account for the demand for STEM professionals in industries such as finance, consulting, and public administration, where technical expertise is increasingly valuable. Future research could expand the scope to include perspectives from non-STEM sectors to provide a more comprehensive picture of STEM employment opportunities and challenges.

4. Results and Discussion

4.1 General Overview of Findings

The analysis is systematically structured, beginning with an examination of each challenge identified through the literature review. This approach ensures a comprehensive assessment of the predefined issues, grounding the findings in established academic discourse. Subsequently, each challenge is analyzed within the context of the studied sectors, providing a sector-specific perspective on the identified challenges. The main results for each sector are presented in Table 3, indicating the significance of each challenge as follows: **Important** (discussed in-depth with strong negative sentiment), **Somewhat Important** (mentioned but without strong emphasis), and **Not Important** (rarely mentioned or explicitly dismissed).

Challenge	ICT	Health Sector	Science	Engineering
Talent Drain	Important	Important	Important	Somewhat Important
Low Salaries and Limited Career Growth	Important	Important	Important	Important
Mismatch Between Industry Demand and Workforce Skills	Important	Important	Important	Somewhat Important
Limited STEM Awareness and Engagement	Not Important	Somewhat Important	Somewhat Important	Important
Gender Disparities in STEM	Important	Somewhat Important	Not Important	Important
Regional Disparities in STEM	Somewhat Important	Somewhat Important	Important	Important

Table 3. *Sector-Specific Importance of Identified STEM Challenges in Georgia*
Source: Developed by authors.

4.2 Discussion of Key Challenges in STEM Employment

Talent Drain - Talent drain remains a critical challenge across STEM fields in Georgia, with many professionals choosing to work abroad or remotely for international companies. Respondents highlight that this issue is particularly severe in healthcare, IT, and research, where skilled professionals have access to significantly higher salaries and better working conditions outside Georgia. For some fields, such as nursing, the migration trend is largely due to structured pathways leading to European jobs, where wages can be three to four times higher than in Georgia. In other sectors, such as IT and AI, the trend is different: while professionals remain in Georgia physically, they work exclusively for foreign employers, bypassing the local job market and contributing to a shortage of senior professionals in Georgian companies.

The lack of career progression and research funding further fuels the brain drain. Many researchers and engineers leave the country for doctoral programs and specialized training, often choosing to remain abroad due to better infrastructure, access to modern technology, and financial incentives. Respondents also highlight the failure to retain international specialists who arrived in Georgia during geopolitical shifts, particularly after the Russia-Ukraine war. Bureaucratic hurdles and lack of targeted policies meant that many skilled foreign professionals ultimately moved on to European countries instead of staying in Georgia. Without long-term investment in local career opportunities, salaries, and research infrastructure, talent drain will likely continue to be a major obstacle for Georgia's STEM workforce.

Low Salaries and Limited Career Growth - Respondents overwhelmingly agree that low wages and a lack of structured career growth are among the biggest obstacles to talent retention in STEM fields. In many cases, salaries are not only non-competitive internationally

but also insufficient for professionals to remain in their fields domestically. The problem is most pronounced in healthcare, research, and engineering, where wages often do not match the skills, education, or workload required for the roles.

For example, young researchers in physics, microbiology, and chemistry frequently leave academia because entry-level salaries are so low that continuing research is financially unsustainable. Healthcare professionals, particularly nurses and therapeutic specialists, also cite salary stagnation as a key reason for leaving their fields or switching to higher-paying specialties like plastic surgery. In IT and AI, while salaries are relatively higher, they still cannot compete with international companies, leading to a steady outflow of mid-to-senior level professionals.

Respondents also emphasize the lack of structured career progression pathways in many industries. Young professionals often see few opportunities for promotions, professional training, or leadership roles, making long-term career growth in Georgia unattractive. Engineering and energy sector professionals specifically mention that public sector jobs fail to attract young talent, as salaries remain unchanged for years, and career development programs are either nonexistent or poorly implemented. Without policy interventions that increase salaries and create clear career advancement structures, Georgia risks continued workforce attrition in critical STEM sectors.

Mismatch Between Industry Demand and Workforce Skills - Respondents identify a serious gap between STEM education and actual industry needs, with many graduates entering the job market without the necessary practical skills. Across multiple sectors, employers report having to invest heavily in additional training, as many university graduates lack real-world experience and technical expertise required for their roles.

In IT, this issue is particularly visible in AI, data science, and cybersecurity, where university curricula have not kept pace with technological advancements. Many graduates struggle with hands-on problem-solving, forcing companies to spend significant resources on internal training programs. Similarly, engineering and energy sector respondents highlight that technical education is outdated, and many professionals graduate without exposure to modern industrial equipment, hydropower infrastructure, or automation technologies.

Healthcare professionals note that the medical specialization system does not align with sector demands, leading to shortages in therapeutic medicine and general practitioners, while oversaturation exists in certain high-paying specialties. Laboratory professionals also emphasize that many graduates lack fundamental laboratory skills, requiring additional in-house training. Without curriculum modernization, better industry-university collaboration, and improved certification processes, Georgia's STEM graduates will continue to face challenges in meeting labor market demands.

Limited STEM Awareness and Engagement - While awareness of STEM careers has improved, respondents indicate that many young people still lack proper career guidance, leading to imbalances in sector growth. Certain fields, such as IT, have benefited from strong marketing and educational programs, leading to an influx of students. However, other critical STEM fields—such as renewable energy, microbiology, and industrial engineering—struggle to attract young talent due to a lack of visibility and outreach efforts.

Respondents stress that many students choose quick certification programs instead of building a strong foundation in STEM education, often entering the workforce with insufficient skills for long-term career success. This creates an oversupply of junior professionals in some areas while leaving critical gaps in others. Some professionals argue that early engagement programs in schools, industry partnerships, and better career guidance could help direct students toward sustainable career paths in underrepresented STEM fields.

Gender Disparities in STEM - It manifest differently across industries, but respondents agree that structural barriers still limit gender equality in leadership roles. In some fields, such as healthcare and laboratory sciences, women make up the majority of entry-level positions, but men dominate leadership roles, creating barriers to career progression. Respondents in laboratory sciences emphasize that despite women being well-represented in technical roles, decision-making positions in research institutions remain largely male-dominated.

In IT and engineering, the underrepresentation of women in technical roles is more pronounced. Despite ongoing efforts to increase female participation in software development, AI, and hydropower engineering, respondents state that cultural perceptions and a lack of mentorship opportunities still discourage many women from pursuing STEM careers. The healthcare sector presents an interesting contrast: while nursing is a female-dominated field, men are significantly underrepresented due to social stigma and traditional gender roles. Addressing these disparities requires structural policy changes, mentorship programs, and targeted initiatives to promote greater gender diversity in STEM careers.

Regional Disparities in STEM - Access to STEM education and career opportunities remains highly concentrated in urban centers, with respondents highlighting severe workforce shortages in rural areas. Schools outside major cities often lack high-speed internet, laboratory facilities, and trained educators, making it difficult for students to pursue STEM careers outside of Tbilisi and major regional hubs.

In the energy and engineering sectors, respondents stress that the absence of regional training centers has created critical skill shortages, making it difficult to implement infrastructure projects in rural areas. IT professionals note that rural students lack access to proper digital education, limiting their ability to enter high-demand fields like software engineering and cybersecurity. Additionally, healthcare respondents point out that regional hospitals struggle to attract and retain skilled medical professionals, worsening the gap between urban and rural healthcare services.

Without targeted investment in regional education programs, workforce incentives, and infrastructure development, these disparities will continue to hinder economic growth and STEM sector expansion outside major cities.

Table 4. *Key Research Findings for Each Challenge*

Talent Drain	- IT and AI professionals remain in Georgia but work remotely for international companies, bypassing local employers. - Healthcare and nursing professionals migrate to Europe due to significantly higher salaries. - Research talent leaves due to lack of funding and career opportunities. - Georgia failed to retain international specialists who arrived during geopolitical shifts.
Low Salaries and Limited Career Growth	- Salaries are not competitive with international markets, leading to workforce attrition. - Career progression pathways are unclear in engineering, healthcare, and research. - Public sector jobs fail to attract young professionals due to stagnant wages.
Mismatch Between Industry Demand and Workforce Skills	- Graduates often lack hands-on experience and require additional training. - University curricula in IT, AI, and engineering are outdated. - Specialization choices in healthcare do not align with labor market needs.

Limited STEM Awareness and Engagement	- Certain STEM fields, like renewable energy and microbiology, struggle to attract students. - Quick certification programs are leading to skill imbalances in the workforce. - Early engagement initiatives could improve career planning.
Gender Disparities in STEM	- Women dominate lower-level laboratory and healthcare roles but are underrepresented in leadership. - IT and engineering have a significant gender gap, particularly in technical positions. - Nursing remains female-dominated, with few men entering the field due to societal perceptions.
Regional Disparities in STEM	- Rural areas lack access to STEM education, limiting career opportunities. - Engineering and healthcare sectors struggle to retain professionals outside major cities. - Limited digital infrastructure prevents rural students from entering IT careers.

Source: Developed by authors.

4.3 Discussion of Sector-Specific Trends and Insights

We also analyzed sector-specific findings to better understand the challenges and opportunities within different industries:

ICT Sector - According to IT sector respondents, the industry faces a unique form of talent drain, where professionals remain in Georgia but work exclusively for foreign companies, bypassing local employers. While there is a steady influx of new entrants into the field, mid-to-senior level professionals are in short supply. Many respondents highlight that university graduates often lack practical experience, forcing companies to invest heavily in training. Additionally, salary disparities between local and international employers make retention difficult. The gender gap in IT remains another issue raised by respondents, with women being underrepresented in software development and technical roles, despite growing awareness initiatives.

Engineering & Energy - Respondents in the engineering and energy sectors highlight that workforce shortages are one of the biggest challenges, primarily due to the lack of technical training programs and weak career incentives. While the demand for specialists continues to grow, many professionals either seek opportunities abroad or transition to better-paying fields. Hydropower and infrastructure projects, in particular, face a shortage of skilled workers, especially in rural areas where training facilities are limited. Public sector engineering jobs, according to respondents, fail to attract young professionals due to low wages and limited career development pathways. The gender gap remains particularly wide in this sector, with few women pursuing technical engineering roles.

Healthcare & Life Sciences - Respondents highlight severe talent shortages in the healthcare sector, particularly in nursing, where many professionals migrate to Europe due to significantly higher salaries. While medical careers remain attractive, specialization choices do not always align with industry needs, leading to shortages in critical areas such as therapeutic medicine. Some respondents note that financial considerations often dictate career paths, with professionals transitioning into more lucrative fields such as plastic surgery rather than remaining in essential medical specialties. Additionally, urban-rural disparities in healthcare are a major concern, as regional hospitals and clinics struggle to retain qualified personnel due to low wages and limited access to professional development. From a gender perspective, nursing remains a female-dominated profession, with very few men entering the field.

Respondents suggest that societal perceptions and stereotypes discourage men from pursuing careers in nursing, despite increasing demand for professionals in the sector. Conversely, leadership roles in healthcare institutions remain male-dominated, with fewer women advancing into senior decision-making positions.

Science & Research - The science and research sector, including microbiology, physics, and laboratory sciences, faces major workforce challenges due to underfunding, outdated equipment, and low salaries. Respondents emphasize that talented researchers in physics, microbiology, and industrial laboratory work frequently leave Georgia due to a lack of career growth opportunities and poor research infrastructure. The disconnect between university curricula and practical industry needs is another key issue, as new graduates often require extensive additional training before becoming job-ready. Laboratories, in particular, face a shortage of well-trained specialists, and employers note that many graduates lack hands-on experience with modern laboratory equipment. Women are well-represented in laboratory roles at the entry level, but leadership positions are still dominated by men. Respondents also highlight that rural areas lack access to modern research and laboratory facilities, limiting opportunities outside major cities.

5. Conclusions and Recommendations

The study reveals several structural challenges in the STEM labor market in Georgia:

- Due to low income levels and limited prospects for career advancement, STEM professionals show low engagement in scientific and research activities, particularly in natural and exact sciences. This creates a significant barrier to retaining qualified STEM talent within the academic sector, which in turn hinders knowledge generation and the potential for research commercialization.
- Brain drain remains a persistent issue across multiple sectors, including ICT, medicine, and engineering. Notably, tech startups, which already face difficulties in attracting qualified personnel due to relatively low salaries, are further challenged by the high turnover of re-trained staff, resulting in resource losses after initial investments in skill development.
- Employers across all STEM sectors report that the knowledge and competencies of job seekers often fail to meet market demands. This mismatch is particularly evident in the lack of practical skills and the limited applicability of theoretical knowledge. Although the issue is widespread, IT employers perceive it as a comparatively less critical concern.
- There is a lack of sufficient efforts to promote STEM education and career pathways across all STEM fields, which undermines labor market readiness and long-term workforce planning.
- Gender stereotypes negatively influence hiring practices and educational choices. For example, women remain underrepresented in engineering and ICT sectors, while men are underrepresented in nursing professions. These stereotypes, embedded in societal attitudes, discourage individuals from pursuing education and careers in certain STEM fields, exacerbating existing labor shortages.
- STEM education and career opportunities are heavily concentrated in urban areas, especially Tbilisi, leading to severe workforce shortages in rural regions. Limited infrastructure and training centers outside cities create critical skill gaps and deepen regional inequalities.

The recommendations are based solely on the perspectives of employers and are intended for key stakeholders in higher education, government, and the private sector. Insights

from students, educators, or policymakers may lead to different or additional recommendations.

- Universities are encouraged to strengthen cooperation with employers to enhance students' practical training and improve their transition into the workforce. This includes aligning academic programs more closely with current labor market demands.
- To foster innovation, it is recommended to promote the commercialization of research through the establishment and integration of R&D centers within universities.
- At the policy level, setting a progressively increasing national target for R&D expenditure as a share of GDP, along with regular monitoring, would help support sustainable scientific and technological development.
- A STEM employer working group, composed of private sector stakeholders, could regularly inform universities about evolving labor market needs and collaborate with public institutions to attract further investment into the STEM sector.

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EXCHANGE-TRADED FUNDS (ETFS) OPTIMIZATION WITH RISK PARITY STRATEGIES

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Abstract: *This paper explores the application of the Risk Parity methodology to portfolios constructed using Exchange-Traded Funds (ETFs). In the world where the market is becoming more and more global, it is becoming more dynamic in terms of portoflio recalibrations, bringing resilience in terms of values. In other words, is it important to consider only a short holding period, and adapt the asset allocationn. In opposition to typical capital-weighted techniques, risk parity reallocates portfolio weights to ensure that each asset contributes an equal amount of risk. The study builds and assesses risk parity portfolios using ten assets that comprise the majority of the EA Bridgeway Blue Chip ETF (BBLU). The process entails assessing the volatilities and correlations of specific ETFs, adjusting portfolio weights to balance risk contributions, and back testing performance under different market scenarios. Empirical data shows that risk parity portfolios outperform standard allocation approaches in terms of diversification, drawdowns, and the stability of risk-adjusted returns. This research illustrates Risk Parity's potential as a strong framework for managing ETF portfolios in both institutional and individual investing settings.*

Keywords: *Risk Parity, ETF, Portfolio Optimization, Asset allocation, Risk.*

Introduction

Modern finance focuses on risk management and portfolio development. Traditional portfolio allocation approaches, such as the 60/40 equity-bond split, prioritize capital allocation, which frequently results in an imbalance in risk contributions across asset classes (Maillard et al., 2010, pp.2). This strategy can lead to an overreliance on more volatile assets, such as stocks, while undervaluing the potential diversification benefits of less volatile asset classes, such as bonds or commodities. Risk Parity (RP) provides an alternative paradigm that reallocates weights to ensure that each asset contributes equally to overall portfolio risk, resulting in a more balanced and diversified portfolio structure (Qian, 2011, pp.2).

The application of Risk Parity to portfolios built with Exchange-Traded Funds (ETFs) is a significant step toward implementing advanced portfolio methods. ETFs are well-known for their cost-effectiveness, liquidity, and accessibility, making them an excellent vehicle for adopting systematic approaches such as Risk Parity. ETFs also give exposure to a diverse variety of asset classes, such as stocks, bonds, commodities, and real estate, which is critical for attaining broad diversification (Hill et al., 2015, pp.6).

This article brings at the practical use of the Risk Parity technique using ETFs.It focus es on creating portfolios that balance risk contributions across specific ETFs while taking into

account real world restrictions such as transaction costs and leverage requirements. The Conditional Value at Risk (Rockfellar & Uryasev, 2000), or the Expected Shortfall (Artzner & Delbaen, 1999) and the traditional mean-variance (Markowitz, 1952), will result in a strong concentration on a limited number of assets and poor performance during the out-of-sample period. These models also rely on predicted returns (Markowitz, 1978, pp.2), which are usually calculated using financial models or historical data. These projections are not without uncertainty, though, and can be impacted by a number of variables, including shifts in investor mood, market circumstances, and economic developments. Suboptimal portfolio allocations and performance may result if the predicted returns utilized in the portfolio model prove to be incorrect. According to Merton (1980, pp.2), portfolio models that mainly depend on expected returns may be extremely vulnerable to shifts in those assumptions.

The ten biggest blue chip stock part of EA Bridgeway Blue Chip ETF (BBLU) are selected and optimized in the Risk Parity model using $CVaR_{\alpha}(x)$ as a risk measure. The partial derivatives of the Conditional Value at Risk can be calculated using approximation techniques (Tasche, 2000, pp.3). The comparison using Risk Parity methods is made with several risk measurements (Conditional Value at Risk and standard deviation) in order to obtain a comprehensive pattern. Although the findings are quite similar, it takes a lot less time to calculate Risk Parity with Conditional Value at Risk.

Research methodology

This section outlines the empirical framework for evaluating the six portfolio strategies for the ten biggest blue-chip stocks comprising the EA Bridgeway Blue Chip ETF (BBLU). The goal is to compare their risk-adjusted performance, diversification benefits, and robustness. To provide a complete framework for the portfolio models, the following are considered:

1. 1/N Naïve Portfolio with the same weight for each asset (10% of each asset);
2. Mean variance without the expected return constrain (MV);
3. Minimum CVaR (Andersson et al., 2000) without the expected return constrain;
4. Risk Parity with standard deviation (RP-std);
5. Risk Parity with Expected shortfall or CVaR (RP-CVaR);
6. Worst case Risk Parity CVaR (RP-CVaR Naïve);

The last one is a special case for the worst-case scenario (highest CVaR), useful as an upper bound (Colucci, 2013). A similar study was conducted with cryptocurrencies (Veliu & Aranitasi, 2024).

In all these models, the constraint of expected returns is removed, so the minimum variance MV and minimum CVaR are at the smallest possible value of the risk measure.
For a portfolio with n assets, each weight x_i and $\mathcal{R}(x)$ as a risk measure for the portfolio, the vector of the weights is given by:

$$x = (x_1, x_2, ..., x_n).$$

In the literature (Maillard et al., 2010 p.1), the use of Risk Parity is the case with the standard deviation as risk measure. For a portfolio with n assets and weights $x = (x_1, x_2, ..., x_n)$, the standard deviation is:

$$\mathcal{R}(x) = \sigma_P(x) = \sqrt{\sum_{i=1}^{n}\sum_{j=1}^{n} x_i x_j \sigma_{ij}} = \sqrt{x'\Omega x}$$

where Ω is the covariance matrix. The marginal risk contribution of the *i* asset:

$$MRC_i(x) = \frac{\partial \sigma_P(x)}{\partial x_i} = \frac{\partial \sigma_i^2 + \sum_{j=1}^{n} x_i \sigma_{ij}}{\sigma_P(x)} = \frac{(\Omega x)_i}{\sqrt{x'\Omega x}}$$

and the total risk contribution:

$$TRC_i(x) = x_i \frac{\partial \sigma_P(x)}{\partial x_i} = x_i \frac{\partial \sigma_i^2 + \sum_{j=1}^{n} x_i \sigma_{ij}}{\sigma_P(x)} = x_i \frac{(\Omega x)_i}{\sqrt{x'\Omega x}}$$

The following optimization problem can be used to construct the Risk Parity model:

$$x^* = \arg\min \sum_{i=1}^{n}\sum_{j=1}^{n} \left(TRC_i(x) - TRC_j(x)\right)^2$$

$$\sum_{i=1}^{n} x_i = 1$$

$$x \geq 0$$

To guarantee the existence of the partial derivatives of $CVaR_\alpha(x)$ some assumptions are needed on the distribution of the random vector $R = (r_1, r_2, \ldots, r_n)$.

The conditions for quantile of the portfolio return $X = R'x = \sum_{i=1}^{n} x_i r_i$ should be differentiable respect to the weights x_i. These *i*-th asset return r_i given the others is measured as follow:

$$r_{i,t+1} = \frac{P_{i,t+1} - P_{i,t}}{P_{i,t}}$$

From the definition of $CVaR_\alpha(x)$ (Rockfellar & Uryasev, 2000, pp.2) is as follow:

$$CVaR_\alpha(x) = \frac{1}{\alpha}\int_0^\alpha VaR_v(x)\mathrm{d}v$$

Thus, partial derivatives are calculated as follow:

$$\frac{\partial CVaR_\alpha(x)}{\partial x_i} = \frac{1}{\alpha}\int_0^\alpha \frac{\partial CVaR_\alpha(x)}{\partial x_i}\mathrm{d}v = -\frac{1}{\alpha}\int_0^\alpha E[r_i | -R'x = VaR_\alpha(x)]\mathrm{d}v =$$

$$-\frac{1}{\alpha}\int_0^\alpha E[r_i | X = q_\alpha(X)]\mathrm{d}v = -\ E[r_i | X \leq -VaR_\alpha(x)]$$

The Total Risk contribution for each asset *i* of a portfolio is given from the following expression:

$$TRC_i^{CVaR_\alpha(x)}(x) = x_i \frac{\partial CVaR_\alpha(x)}{\partial x_i}$$

The expression in case of continuous returns distribution is the following:

$$TRC_i^{CVaR_\alpha(x)}(x) = -x_i E[r_i | X \leq -VaR_\alpha(x)]$$

$$CVaR_\alpha(x) = \sum_{i=1}^{n} TRC_i^{CVaR_\alpha(x)}(x) = -\sum_{i=1}^{n} x_i E[r_i | X \leq -VaR_\alpha(x)]$$

Numerical approximation for estimating $VaR_\alpha(x)$ and $CVaR_\alpha(x)$ Risk Parity using historical data the following assumption are neccessary.

The calculation of $VaR_\alpha(x)$ and $CVaR_\alpha(x)$ of portfolio returns as follows:

$$VaR_\alpha(x) \approx -r^{\text{sorted}}_{\text{p}\lfloor\alpha\text{T}\rfloor}$$

$$CVaR_\alpha(x) \approx -\frac{1}{\alpha\text{T}}\sum_{\text{j}=1}^{\lfloor\alpha\text{T}\rfloor} r^{\text{sorted}}_{\text{p j}}$$

where the *i*-th asset return r_i consist of *T* number outcomes r_{ji} with *i*=1,.....,*n* and *j*=1,...,T.

The vector of the observed portfolio returns is $R_P = (r_{p1}, \ldots\ldots, r_{pT})$ where:

$r_{pj} = x' r^j$ with j=1,....,T where $r^j = (r_{j1}, \ldots\ldots, r_{jT})$.

where α is level of significance and $\text{r}^{\text{sorted}}_{\text{p j}}$ are the sorted portfolio returns such as

$$r^{sorted}_{p\,1} \leq r^{sorted}_{p\,2} \leq \cdots r^{sorted}_{p\,j} \leq \cdots \leq r^{sorted}_{p\,j}$$

With the time series observation, the approximation of the partial derivatives $CVaR_\alpha(x)$ for each asst *i* becomes:

$\frac{\partial CVaR_\alpha(x)}{\partial x_i} \approx -\frac{1}{\alpha\text{T}}\sum_{\text{k}=1}^{\lfloor\alpha\text{T}\rfloor} r^{\text{sorted}}_{\text{k i}}\ \forall\ i$=1,...,*n*

and then the total risk contribution of asset *i* is

$$TRC_i^{CVaR_\alpha(x)}(x) = x_i\frac{\partial CVaR_\alpha(x)}{\partial x_i} \approx -\frac{1}{\lfloor\alpha\text{T}\rfloor}x_i\sum_{\text{k}=1}^{\lfloor\alpha\text{T}\rfloor} r^{\text{sorted}}_{\text{k i}}$$

where $r^{\text{sorted}}_{\text{k i}}$ are the corresponding returns of asset *i* to the sorted portfolio returns.

In the rolling windows, in order to the measure the performance the following calculation $\mu_T^c(R_P)$ is the compounded return over the whole period (terminal compound return) (Bacon, 2008, pp.130).

$$\mu_k^c(R_P) = \prod_{j=1}^{k}\left(1 + r_{pj}\right) - 1$$

To check if the portfolios are well diversified, three diversification measures are considered (Caporin et al., 2012).

If the allocation is as follows, $x = (x_1, x_2,.....,x_n)$ with the constraint $\sum_{i=1}^n x_i = 1$ in case short sales not allowed ($x_i \geq 0$) . The diversification measure is the Herfindal index:

$$D_{Her} = 1 - xx'$$

In the same way, the diversification measure is given by (Bera & Park, 2004 p.2).

$$D_{BP} = -\sum_{i=1}^{n} x_i\log(x_i) = \sum_{i=1}^{n} x_i\log(\frac{1}{x_i})$$

The D_{BP} takes value between 0 (fully concentrated in one asset) and log(*n*) for the Naïve portfolio.

Another important aspect is the consideration of the transaction costs, and for that, the estimation of the turnover of the portfolio:

$$TO = \sum_{i=1}^{n} |x_i^{t+1} - x_i^t|,$$

where x_i^t denotes the weight of asset *i* at time *t*.

Results

In this study, the dataset covers the period from January 9, 2024 to January 8, 2025 with daily frequency. The data is available at nasdaq.com.

Table 1. *Top EA Bridgeway Blue Chip ETF (BBLU)*

1	Meta Platforms, Inc. Class A Common Stock (META)
2	NVIDIA Corporation Common Stock (NVDA)
3	JP Morgan Chase & Co. Common Stock (JPM)
4	Broadcom Inc. Common Stock (AVGO)
5	Tesla, Inc. Common Stock (TSLA)
6	Apple Inc. Common Stock (AAPL)
7	Visa Inc. (V)
8	Microsoft Corporation Common Stock (MSFT)
9	Eli Lilly and Company Common Stock (LLY)
10	Wells Fargo & Company Common Stock (WFC)

Source: nasdaq.com

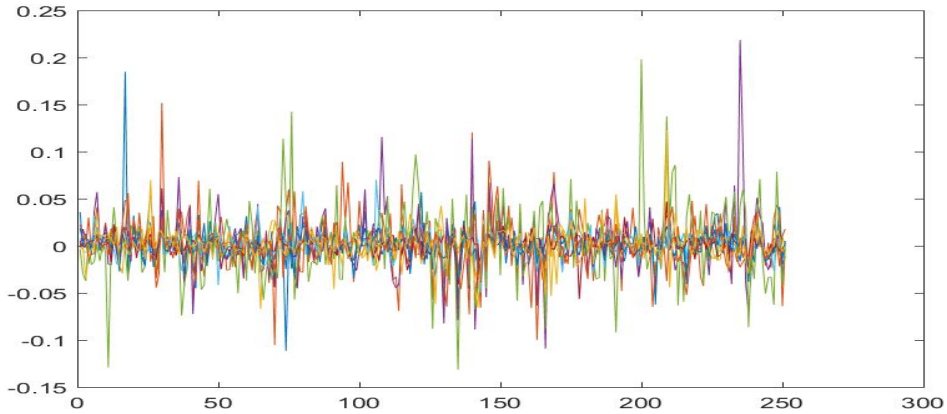
The reason these stocks are selected is because they comprise the top components of the EA Bridgeway Blue Chip ETF (BBLU). In this way, it will be interesting to allocate the optimal weights using different strategies and compare their performance among them.

Figure 1. *The Heatmap of the correlation matrix*

	META	*NVIDIA*	*JPM*	*AVGO*	*TESLA*	*APPLE*	*VISA*	*Micro*	*ELI*	*WFC*
META	100.0%									
NVIDIA	83.9%	100.0%								
JPM	84.7%	88.8%	100.0%							
AVGO	81.8%	82.1%	80.0%	100.0%						
TESLA	68.7%	62.3%	79.3%	81.5%	100.0%					
APPLE	71.7%	83.5%	81.6%	85.7%	78.7%	100.0%				
VISA	67.6%	48.8%	71.0%	60.9%	80.0%	47.5%	100.0%			
Micro	50.1%	61.3%	43.7%	56.2%	36.8%	50.2%	22.0%	100.0%		
ELI	50.3%	66.1%	41.7%	44.1%	4.1%	53.3%	-12.8%	53.2%	100.0%	
WFC	71.9%	73.7%	87.9%	65.7%	73.3%	56.2%	78.8%	39.8%	11.1%	100.0%

Figure 1 presents a heatmap-style correlation matrix where each cell contains a numerical value representing the correlation between two variables. All diagonal values are 100% (in red), which reflects perfect correlation of each variable with itself. Red: Represents the highest positive correlation (close to 100%). Green: Represents weaker or negative correlations. Yellow/Orange: Represents moderate positive correlations. The heatmap suggests a symmetric matrix (correlation matrices are symmetric by definition). The variables are represented both horizontally and vertically, indicating the relationship between the same set of items. Many variables exhibit strong positive correlations (>80%) as indicated by the red and orange cells. Clusters of high correlation suggest that certain variables behave similarly or share strong linear relationships. Yellow cells indicate moderate correlations (40%–70%). These relationships are still positive but weaker than the stronger clusters. Moderate correlations could imply indirect relationships or shared dependence on other factors. The -12.8% correlation stands out as a clear example of an inverse relationship between two variables. This suggests that as one variable increases, the other tends to decrease. Negative correlations, though rare in this matrix, might signal opposing behavior or complementary roles like in the case of ELI with VISA.

Figure 2. *The graph of the returns of the ten assets*



The Figure 2 represents the daily returns of 10 assets plotted over a time period of approximately 251 days. The daily returns fluctuate around zero, with the majority of returns falling within the range of -0.15 to 0.25. The spikes indicate days with significant movements in returns, likely driven by market events. From a visual inspection, there are some similar patterns across the lines, suggesting potential correlation between certain assets.

Before creating a rolling window, in Table 2 are showed the first iteration using 125 observations:

Table 2. *The allocation in % in of each of assets*

Optimization Model	META	NVIDIA	JPM	AVGO	TESLA	APPLE	VISA	Micro	ELI	WFC	TOTAL
R.P. with std	6.17%	5.17%	13.93%	5.27%	5.83%	12.19%	13.36%	11.39%	12.45%	14.24%	1
Minimum Variance	0.00%	0.06%	14.35%	0.02%	0.07%	14.41%	31.43%	10.41%	15.48%	13.78%	1
R.P. with CVaR	7.62%	5.65%	12.04%	6.60%	4.92%	11.63%	16.18%	11.68%	10.69%	12.98%	1
Minimum CVaR	0.65%	4.44%	3.41%	0.00%	0.00%	15.25%	27.27%	9.06%	14.71%	25.20%	1
Naïve	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	1
R.P. CVaR naïve	7.94%	4.19%	13.70%	4.29%	6.06%	13.29%	13.75%	10.49%	13.49%	12.81%	1

Table 2 represents the portfolio weights for 10 assets under different optimization models. The Risk Parity (R.P. with std) with Standard Deviation, which aims to balance risk contribution across assets using standard deviation as the risk metric, is Heavily weighted on JPM (13.93%), Apple (13.36%), and ELI (12.45%). Minimum Variance focuses heavily on Apple (31.43%) and JPM (14.35%), with near-zero weights for META and others. Risk Parity with CVaR (Conditional Value-at-Risk) is similar to R.P. but uses CVaR to account for tail risk. JPM (12.04%) and VISA (16.18%) have higher weights, reflecting their perceived stability under extreme conditions.

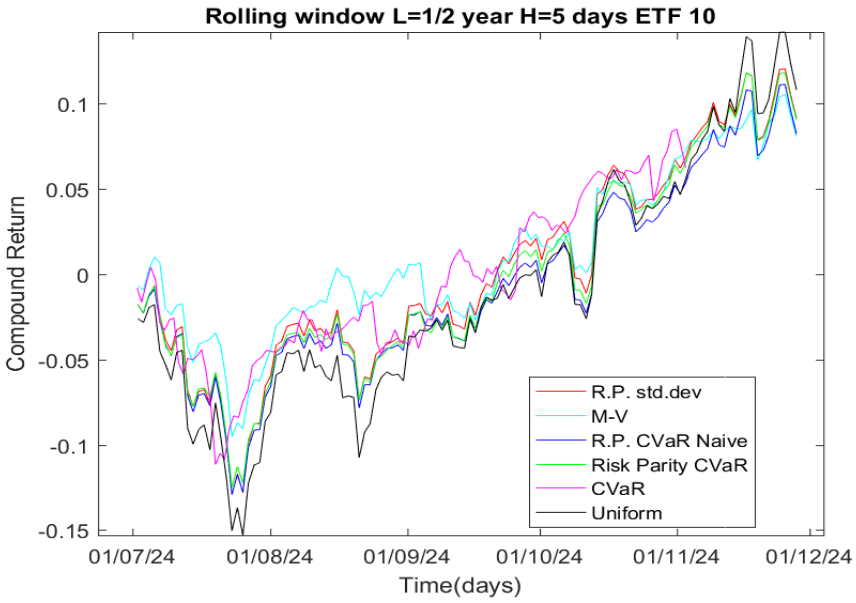
Minimum CVaR minimizes portfolio tail risk. VISA (27.27%) and WFC (25.20%) dominate the allocation, likely reflecting their low downside risk. Naïve (Equal Allocation) assigns an equal 10% weight to all assets, disregarding risk or return considerations.

R.P. CVaR Naïve is a special case in which has the worst-case scenario (highest CVaR, useful as an upper bound (Colucci, 2013). JPM (13.7%) and VISA (13.75%) maintain higher weights but are more evenly distributed compared to other R.P. models.

Naïve allocation provides the most diversified portfolio, while others heavily concentrate on specific assets. Minimum Variance and Minimum CVaR models allocate significant weights to assets with perceived lower risk. The JPM & VISA Dominance consistently receives higher weights in most models, indicating their importance in minimizing risk or balancing contributions. Tesla and AVGO tend to receive lower weights, likely due to higher volatility or correlation with other assets.

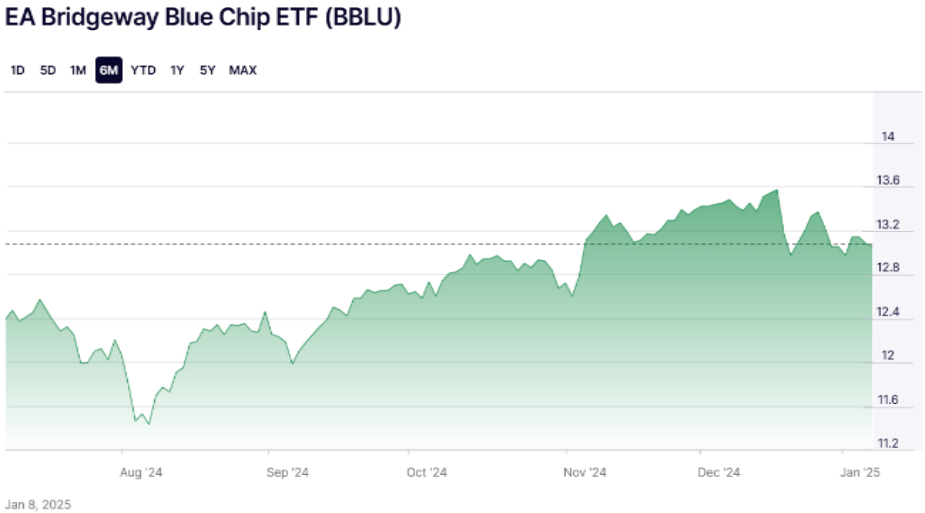
In order to keep the portfolio updated, the calculation is made each week, based on the past 25 weeks, the asset allocation. The rolling window is made with L=125 days (6 months) and H=5 days, where L are the daily observations used to estimate the weights and H is the holding period for the performance of the portfolio using the compound return. The performance is given by the following graph 1.

Graph 1. *The performance of the portfolios in ETF fund using the compound return***.**



Source: Computed with Matlab

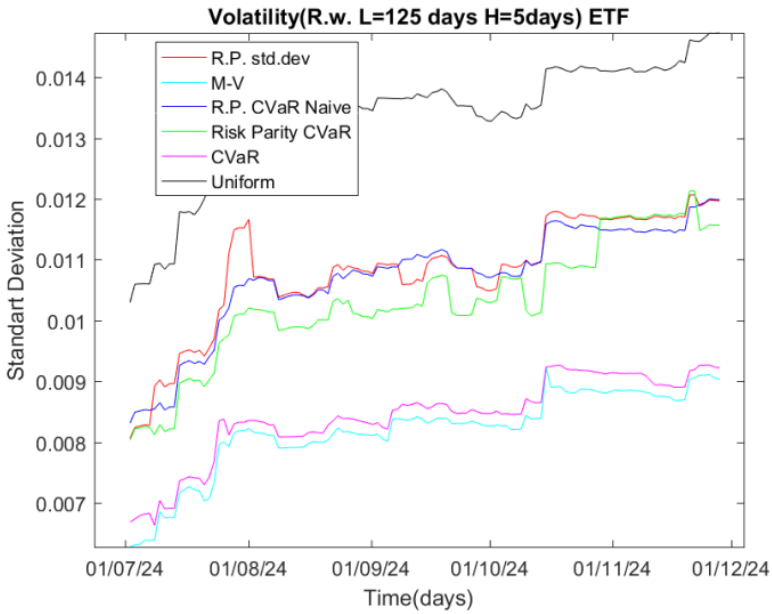
Graph 2. *The performance of EA Bridgeway Blue Chip ETF (BBLU)*



Source: Nasdaq.com

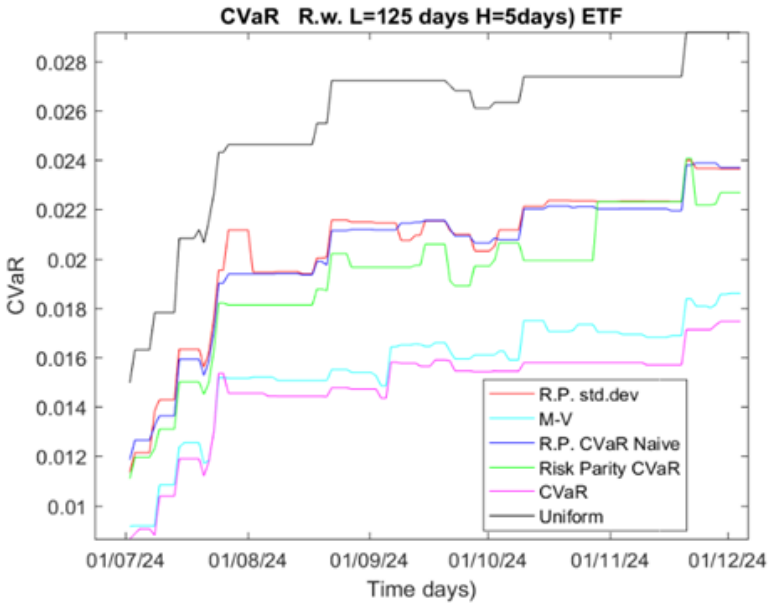
Graph 1 aims to evaluate how different portfolio optimization strategies perform over a rolling half-year period, with a five-day investment horizon, highlighting the trade-offs between return and risk for each strategy. Graph 1 presents a detailed comparison of the performance of different portfolio optimization strategies over time. Most strategies show similar patterns with noticeable ups and downs, reflecting market dynamics, for which are represented using the graph 2. By the end of the time period, some strategies (e.g., "Risk Parity CVaR" and "M-V") outperform others, reaching higher compound returns. The "Uniform" strategy (black) generally underperforms compared to other approaches. The first graph uses compound returns as the performance metric, whereas the second graph uses the ETF price.

Graph 3. *The riskiness of the portfolios measured by the standard deviation (Volatility)*



Source: Computed with Matlab

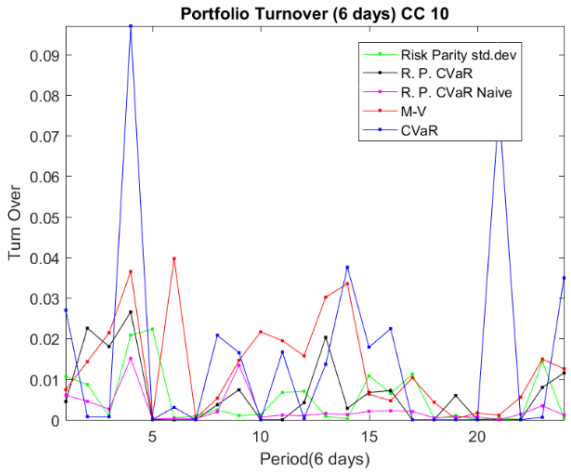
Graph 4. *The riskiness of the portfolios measured by the CVaR*



Source: Computed with Matlab

The CVaR graph focuses on extreme downside risks, while the volatility graph examines total risk. If a strategy shows lower volatility (graph 3), it may also show lower CVaR (graph 4), but this is not always guaranteed. For instance, strategies designed to reduce overall risk (e.g., Risk Parity) might perform differently in tail-risk scenarios. The CVaR values are higher than volatility values, consistent with CVaR capturing extreme losses beyond a certain threshold, whereas volatility reflects average dispersion. Comparing the two graphs can reveal how a strategy balances overall risk (volatility) with tail risk (CVaR). A strategy with low CVaR but higher volatility may be suitable for risk-averse investors, while others might prefere strategies with low volatility for consistent returns. The patterns in the two graphs are likely similar in overall behavior, as both measure aspects of risk across time and are influenced by the same portfolio strategies. However, there may be some nuanced differences depending on how each metric reacts to market changes.

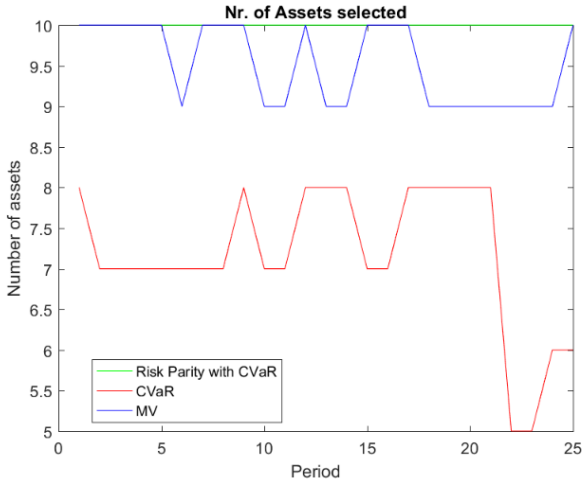
Graph 5. *The turnover of the portolios*



Source: Computed with Matlab

Turnover measures the amount of trading required to rebalance a portfolio to align with a given strategy. Higher turnover generally implies higher transaction costs and more frequent portfolio adjustments. Mean Variance and CVaR are focused in a smaller number of stocks, thus the portfolio turnover will be higher.

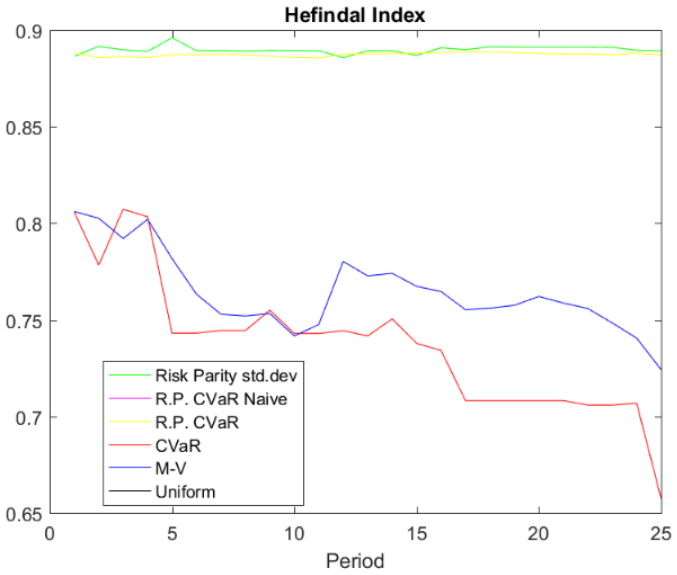
Graph 6. *The number of assets focused*



Source: Computed with Matlab

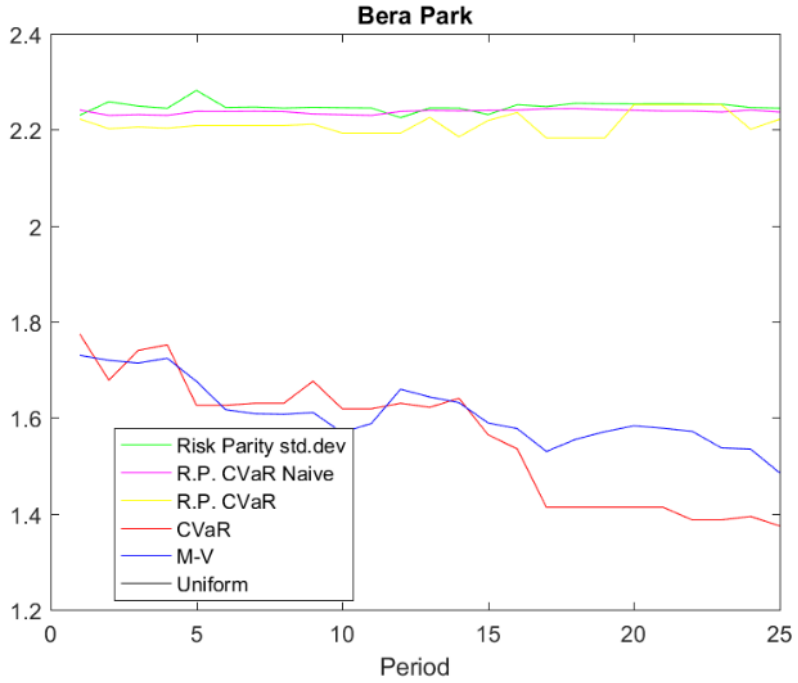
Risk Parity, being less sensitive to extreme market events or return estimates, generally has the lowest turnover. Another way to check the diversification is using the Herfindal and Bera Park indexes.

Graph 7. *The Herfindal Index*



Source: Computed with Matlab

Graph 8. *The Bera Park Index*



Source: Computed with Matlab

The Herfindal (graph 7) and the Bera Park (graph 8) have the same traits with the highest value in the Uniform Portfolio and closer values with Risk Parity strategies. This means that these portfolios are well diversified. The CVaR and mean variance focus on less assets that have the same traits.

All the algorithms are made coding in Matlab without using AI. Today there are several articles that compare the AI role (Tirana & Bejleri, 2024, p.2).

CONCLUSIONS

This study demonstrates the effectiveness of applying the Risk Parity methodology to optimize ETF portfolios, offering a compelling alternative to traditional portfolio allocation techniques. By focusing on balancing risk contributions rather than capital weights, Risk Parity provides a more diversified and stable investment framework. Using ten assets that comprise the EA Bridgeway Blue Chip ETF (BBLU), the research compared various optimization strategies, including Risk Parity with standard deviation, Risk Parity with CVaR, Minimum Variance, Minimum CVaR, and Naïve allocation.

The results highlight the advantages of Risk Parity strategies in achieving superior diversification and risk-adjusted returns. Specifically, Risk Parity with CVaR proved particularly effective in managing tail risks, showcasing robust performance under different market scenarios. Unlike traditional methods such as Minimum Variance, which tend to concentrate heavily on a few low-risk assets, Risk Parity models distribute risk more evenly across the portfolio, mitigating the impact of extreme market events and ensuring a more stable return profile.

The rolling window analysis confirmed that dynamic reallocation based on recent data enhances the responsiveness of portfolios to changing market conditions. While the Naïve strategy provides the highest diversification, it lacks risk considerations, leading to suboptimal outcomes in volatile markets. In contrast, Risk Parity strategies consistently achieved a balance between risk management and return optimization.

This research underscores the utility of ETFs as cost-effective and accessible instruments for implementing sophisticated portfolio optimization techniques like Risk Parity. By addressing practical constraints such as transaction costs and turnover, the study bridges the gap between theoretical portfolio models and their real-world application. This emphasizes also the dynamic of the markets.

It is important to note that in these strategies, the resilience of risk management is also evident in terms of cost-effectiveness, particularly when faced with transaction costs during portfolio calibration.

Also, the financial resilience in these models applied to ETF funds is important in terms of downturns of the markets to mitigate the number of losses of values.

Future research could explore extending this framework to broader datasets, including alternative asset classes and global markets. Additionally, integrating machine learning techniques to forecast risk and enhance allocation models could further improve portfolio performance. Overall, Risk Parity offers a strong foundation for managing ETF portfolios in both institutional and individual investing contexts, providing a pathway for more resilient and diversified investments.

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SOCIAL MEDIA ADVERTISING: A STUDY ON MILLENNIAL PURCHASE INTENTIONS

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Abstract: *Millennials represent one of the most significant consumer groups, combining high purchasing power, technological literacy, and a strong influence on the behaviour of other consumers. Despite their significance, the impact of social media advertising on their purchase intentions remains underexplored in the Slovenian context. The aim of this study was to examine how Slovenian millennials perceive advertisements on social media and how these ads influence their purchasing behaviour and intentions. Data analysis revealed that ad personalization has a positive impact on brand perception, primarily by reducing the perceived intrusiveness of advertising. A key factor influencing purchase intentions is the opinion and recommendations of other users, highlighting the role of social proof. The lack of statistically significant direct influence of advertising on purchasing decisions suggests the importance of long-term trust-building and meaningful user engagement. These findings emphasize the value of strategic approaches that prioritize relevant content and align with consumer values. The study enhances the understanding of millennials' digital behaviour and provides practical guidance for more effective use of social media in marketing.*

Keywords: *millennials, social media, digital advertising, purchase intentions, personalisation, social influence, marketing strategies.*

1 INTRODUCTION

Over the last decades, the development of social networks has radically transformed the way individuals communicate, seek information and make purchasing decisions. As one of the most significant products of the digital age, social networks are now a central hub for social interaction and commercial communication. With their ability to enable the creation and dissemination of user-generated content, they have also become an indispensable part of modern marketing strategies (Kaplan and Haenlein, 2010; Novak, 2020).

Due to their prevalence and influence on consumer decisions, social networks have quickly become one of the key advertising channels for businesses. Today, a large part of marketing budgets is directed to these digital platforms, as they allow for a high degree of audience segmentation and direct contact with consumers (Knoll, 2016; Arora and Agarwal, 2019; Kovačević, 2021). They are particularly prominent in advertising to millennials - Generation Y, born between 1981 and 1996 - who grew up in a digital environment and play an exceptional role in shaping market trends (Mittendorf, 2018; Cech, 2017).

Millennials represent a strategically significant target group, as they are technologically savvy, highly educated and highly connected to digital technologies, including social networks (Helal and Ozuem, 2021). They are known for their orientation towards authenticity, sustainability and their ability to influence other consumers through online platforms (Dabija et al., 2018). This is why advertising on social networks is often based on engagement with

influencers, who enjoy a high level of trust and credibility with this generation (Kovačević, 2021). However, millennials are also critical users of digital content. Their willingness to interact with advertisements is often conditioned by a sense of privacy, transparency and trust in brands (Abraham and Harrington, 2015; Aguirre et al., 2015). Studies show that personalised advertising, although effective, can raise concerns about the protection of personal data, which affects purchase intentions (Schumann et al, On the other hand, well-targeted content and two-way branded communication on social media can positively influence consumer engagement and decisions (Jereb, 2020; Zupančič, 2018).

Modern algorithms based on user behavioural data enable targeted advertising that reflects the interests, location and demographic characteristics of consumers (Bayer et al, At the same time, they offer valuable insights for companies to understand more precisely the behaviour of their target audience and, consequently, optimise their marketing approaches (Kovač, 2018). In the context of millennials, these insights are crucial as they can help to increase the effectiveness of digital campaigns and boost sales.

Given the increasing prevalence of social networks and the complex nature of millennials' behaviour, it is significant to understand what factors influence their response to advertising through these channels. The aim of this study is to explore the impact of social media advertising on millennials' purchase behaviour, focusing on the role of trust, privacy, content authenticity and user engagement. We analyse how different advertising strategies on these platforms influence their decisions to buy products and services. The research identifies the key factors that shape their purchasing behaviour and influence purchase intentions in relation to social media advertising. In doing so, we aim to contribute to a better understanding of millennials' thought processes, their attitudes towards brands and the factors that drive their consumption decisions in a digital environment.

2 SOCIAL NETWORKS

The development and role of social networks

Social networks have evolved from being the original tools for connecting and sharing content to key digital platforms for marketing and communicating with users. They are growing exponentially - with 5.24 billion active users at the beginning of 2025, representing almost 64% of the world's population (DataReportal, 2025). Platforms such as Facebook, Instagram, YouTube and TikTok now allow businesses to interact directly with audiences, personalise content and reinforce brands. With the development of mobile devices, artificial intelligence and algorithms for targeted advertising, social networks have become an indispensable tool for reaching users - especially millennials, who represent the digital natives generation (Kovačević, 2021; Tuten and Solomon, 2017). Their expectations for personalisation, authenticity and rapid responsiveness require companies to adopt innovative and ethically informed approaches (Boerman et al., 2017; Tucker, 2014).

Advertising on social networks

Social media advertising has become a central part of digital marketing over the last decade. In 2024, global spending on advertising on these platforms exceeded 234 billion dollars (Neal, 2024), while in Slovenia this segment already accounts for 20% of digital advertising budgets (iPROM and Valicon, 2024). The biggest focus is on display advertising, influencer marketing and content campaigns that harness the power of platforms such as Facebook, Instagram and TikTok (Statista, 2025). Personalised advertising allows companies to target users precisely based on behavioural, demographic and interest data. Research indicates that such approaches increase user engagement and purchase intentions (Alalwan et al., 2017; Ashley and Tuten, 2015), especially among millennials, who are more receptive to relevant

and authentic content. As a digital generation, millennials expect brands to communicate with them in a way that is meaningful, personalised and trustworthy (Mittendorf, 2018). The impact of ad personalisation on their purchase behaviour is strong, but also conditioned by their sensitivity to data privacy (Cole et al., 2017; Hall et al., 2017). Successful personalisation therefore requires a balance between message relevance and data collection transparency (Boerman et al., 2017).

Advertising strategies and engagement

Effective advertising strategies include personalisation, the use of influencers and content based on an emotional connection with users (Djafarova and Trofimenko, 2019; Hwang and Zhang, 2018). Millennials are looking for brands that reflect their values such as sustainability, social responsibility and innovation (Bart et al, Engagement is a key indicator of campaign success - ads that encourage interaction (e.g. quizzes, sweepstakes) have been shown to increase interest and purchase intentions (Duffett and Wakeham, 2016).

Despite the advantages, companies face challenges such as ad blindness, user oversaturation and privacy concerns (Hall et al., 2017). Success on social networks thus depends on the ability of companies to understand their target audience, respect their values and build long-term trust.

3 MILLENNIALS AS A TARGET GROUP FOR DIGITAL ADVERTISING

Definition and characteristics of generation

The millennial generation, also known as Generation Y, comprises individuals born between 1981 and 1996 (Mittendorf, 2018; Dimock, 2019). The definition of generations is based on shared historical, social and technological circumstances that shape their values, habits and behavioural patterns (Pilcher, 1994; Scully, 2001). Millennials are the first generation to come of age with digital developments - the internet, smartphones and social networks - having a significant impact on their lifestyles and consumption behaviour (Howe and Strauss, 2000). Compared to previous generations, millennials express a greater openness to change, a high level of technological proficiency, a greater emphasis on individuality and values, and a desire for instant information and interaction (Rapp et al., 2013; Nye, 2017). These characteristics have made them a central focus of digital marketing.

Values and behavioural patterns

Millennials often value authenticity, brand responsibility, sustainability and social impact (Mittendorf, 2018; Dabija et al., 2018). They are not only concerned about price or product quality when making purchasing decisions, but also about the values a company stands for. In particular, they pay attention to socially responsible campaigns and transparent brand communication (Ledbetter and Mazer, 2014; Dabija et al., 2018). A large part of their decision-making takes place on social networks, where they seek the opinions, experiences and recommendations of other users. They actively create and share content (UGC), which has a significant impact on digital marketing and electronic word-of-mouth (eWOM) (Gallicano et al., 2012; Young, 2015).

Privacy, personalisation and response to advertising

While millennials value personalisation, they are also concerned about the use of personal data. Their response to ads is often conditioned by feelings of security, trust and privacy (Cole et al., 2017; Tucker, 2014). Research indicates that they are more receptive to ads that are relevant, authentic and tailored to their interests - but only if there is transparency in the use of data (Boerman et al., 2017; Ashley and Tuten, 2015).

Research also demonstrates an increased incidence of "ad blindness", which results from the saturation of ads on social networks. This phenomenon reduces the effectiveness of traditional approaches, and companies are looking for new ways to reach millennials in more subtle and interactive ways (Hall et al., 2017; Arora and Agarwal, 2019).

Technological behaviour and communication habits

Millennials are strongly connected to digital devices and online platforms. Most of them use several social networks on a daily basis, in particular YouTube, Instagram, Facebook and TikTok, where they also actively follow and comment on brands (MMS media, 2024; Atkinson, 2025). They prefer to communicate through visual content - photos, videos, stories - and expect instant responses and personalised experiences (Content Science, 2024).

Their digital engagement is not just about passive consumption of content, but often involves active participation, interaction and co-creation of brand messages. This interactivity allows companies to connect directly with them and increase the chances of building loyalty (Rapp et al., 2013).

The millennial consumer as a strategic focus for business

Increasingly, companies are designing advertising strategies based on an understanding of millennials as digitally literate, socially engaged and informed consumers (Arora and Agarwal, 2019; Smith et al., 2016). This generation not only influences their own purchases, but also the purchasing decisions of others - particularly through digital communities, ratings and recommendations. As a result, they are considered 'influential consumers' who can shape market trends (Diah et al., 2020). They are also significant because of their purchasing power. They represent a large part of the active population and have access to digital channels through which they can quickly compare offers and make informed decisions (Smind, 2020).

4 RESEARCH AND ANALYSIS

Survey methodology and sample

The research is based on a quantitative method, namely an online survey where we asked millennials in Slovenia about their use of and attitudes towards social media advertising. The target population was all residents of the Republic of Slovenia born between 1981 and 1996. For the closed-ended questions, responses were measured using rating scales from 1 to 5 (do not agree at all; strongly agree) and a frequency of use scale (never - every day). We also included structured dichotomous questions (yes/no), with some questions allowing multiple answers. The survey was conducted via an online questionnaire published on the 1ka website. The survey was carried out in the period from 10/12/2024 to 20/12/2024. The sampling was non-probability, ad hoc, and the survey was distributed to groups of millennials and through private channels. The collected data were processed using SPSS.

In this study, the timeframe for millennials is set in line with the definition of Howe and Strauss (2000), which covers the period from 1982 to 2004, and the definition of Mittendorf (2018), which defines millennials as the generation born between 1981 and 1996. In survey, the age group between 25 and 34 years old is the best represented, with 71% of respondents in this age group. The second most represented age group, with 20%, is respondents aged between 35 and 44. The 18-24 age group is represented by 9% of respondents (Table 1).

Table 1. *Age of respondent*

Age class	Frequency	Share [%]
18-24	9	9 %
25-34	71	71,0 %
35-44	20	20,0 %
45-54	0	0
55 or more	0	0 %

The sample is 52% male, 44% female and 4% other sexes (Table 2).

Table 2. *Gender of respondent*

Gender	Frequency	Share [%]
Men	52	52,0 %
Women	44	44,0 %
Other	4	4,0 %

5 RESULTS

Use of social networks

The results on the use of social networks show that Facebook is the most used platform, with 94% of respondents using this platform. Instagram is the second most used social network, used by 88% of respondents. TikTok, used by 49% of respondents, ranks third, while LinkedIn is used by 32% of respondents. Twitter is used by 26% of respondents and Snapchat by 17%. Among the social networks listed under 'other', 6% of respondents cite platforms such as Discord, Pinterest, Quora and Reddit (Table 3).

Table 3. *Use of social networks*

Social networks	Frequency	Share [%]
Facebook	94	94,0 %
Instagram	88	88,0 %
Twitter	26	26,0 %
Snapchat	17	17,0 %
TikTok	49	49,0 %
LinkedIn	32	32,0 %
Other: _____	6	6,0 %

The results on social media use further show that most respondents spend between 1 and 2 hours on social media per day, which is the case for 37% of all respondents. This is followed by the group that spends 2-4 hours daily on social networks, comprising 33% of the respondents. More than 4 hours a day are spent on social networks by 17% of respondents, while less than 1 hour a day is spent on social networks by 13% of respondents (Table 4).

Table 4. *Use of social networks daily*

Time of use	Frequency	Share [%]
Less than 1 hour	13	13,0 %
1-2 hours	37	37,0 %
2-4 hours	33	33,0 %
More than 4 hours	17	17,0 %

Respondents confirm that they sometimes search for product information on social networks. As many as 29% of respondents search for product information on social networks frequently, while 27% do so occasionally. 16% of respondents search for product information very often. Rarely, 20% of respondents do so, while 8% never search for product information on social networks (Table 5).

Table 5. *How often do you search for product information on social networks?*

Frequency of information search...	Frequency	Share [%]
Never	8	8,0 %
Rarely	20	20,0 %
Occasionally	27	27,0 %
Often	29	29,0 %
Very often	16	16,0 %

Advertising and purchase intentions

The main part of the survey was to determine the impact of advertising on purchase intentions. Most respondents, 33%, believe that advertising on social media occasionally influences their purchasing behaviour. 24% of respondents believe that advertising often influences their buying behaviour, while 20% believe that advertising rarely influences their buying behaviour. 15% of respondents believe that advertising never influences their buying behaviour and 8% believe that advertising always influences their buying behaviour (Table 6).

Table 6. *The impact of social media advertising on the purchasing behaviour of respondents*

The impact of advertising...	Frequency	Share [%]
Never	15	15,0 %
Rarely	20	20,0 %
Occasionally	33	33,0 %
Often	24	24,0 %
Always	8	8,0 %

We further asked respondents how significant it is to them that ads are personalised according to their interests. The findings indicate that personalisation of advertisements is significant for most respondents. 26% of respondents consider personalisation moderately significant, 21% consider it significant and 18% consider it very significant. 22% of respondents also consider personalisation to be of little importance and 13% even consider it to be of no importance (Table 7).

Table 7. *Relevance of personalisation of advertisements to respondents' interests*

The importance of personalisation of ads	Frequency	Share [%]
It has no meaning	13	13,0 %
Little important	22	22,0 %
Moderately important	26	26,0 %
Important	21	21,0 %
Very important	18	18,0 %

As regards the impact of social media advertising on increasing purchase intentions, the largest share of respondents, 32%, is undecided. 31% of respondents agree that social media advertising increases their purchase intentions and 13% strongly agree. 21% of respondents disagree that advertising increases their purchase intentions and 11% strongly disagree (Table 8).

Table 8. *Social media advertising increases respondents' purchase intent*

Advertising and purchase intent	Frequency	Share [%]
I strongly	11	11,0 %
I	21	21,0 %
Undecided	23	23,0 %
I	32	32,0 %
I strongly agree.	13	13,0 %

Respondents' engagement with brands is less frequent or occasional. Most respondents engage with brands on social media occasionally, or 34%. 31% of respondents interact with brands rarely, while 24% never interact with brands. 8% of respondents interact frequently with brands, while only 3% interact very frequently.

The opinions and recommendations of other network users play an significant role in purchasing decisions. The findings indicate that 46% of respondents consider the opinions and recommendations of other network users to be significant in purchasing decisions, while 26% consider them to be moderately significant. The opinions and recommendations of other users are very significant for 16% of respondents. 7% of respondents consider other users' opinions and recommendations to be of little importance, while 5% consider other users' opinions and recommendations to be of no importance for their purchasing decisions (Table 9).

Table 9. *Importance of other users' opinions and recommendations for respondents' purchasing decisions*

Relevance of opinions and recommendations	Frequency	Share [%]
It has no meaning	5	5,0 %
Little important	7	7,0 %
Moderately important	26	26,0 %
Important	46	46,0 %
Very important	16	16,0 %

Finally, we looked at whether respondents believe that customising ads makes social media advertising strategies more effective. In this respect, most respondents, or 79%, believe that adapting social media advertising strategies increases their effectiveness. Only 21% of respondents believe that adapting strategies does not improve the effectiveness of advertising (Table 10).

Table 10. *Increasing the effectiveness of social media advertising strategies through customisation*

Effectiveness of adaptation strategies	Frequency	Share [%]
Yes	79	79,0 %
No	21	21,0 %

Respondents gave a wide range of comments and suggestions on social media advertising, reflecting their personal views and experiences. Over-aggressiveness, irrelevant content and repetitive adverts are common criticisms, causing resistance and reducing effectiveness. Some point out that intrusive advertising discourages them from buying, while others stress the need for more sustainable and responsible approaches. Trust in the brand has emerged as a key condition for engagement. There were also positive reactions to the survey, indicating interest in the topic. The comments confirm the need for more sophisticated, tailored and authentic advertising strategies.

Hypothesis testing

The study set out five hypotheses.

H1: Social media advertising has a statistically significant impact on millennials' purchase behaviour and their intention to buy the advertised products.

The first hypothesis was tested with the results of two survey questions:

– 7. Do you believe that social media advertising influences your buying behaviour?

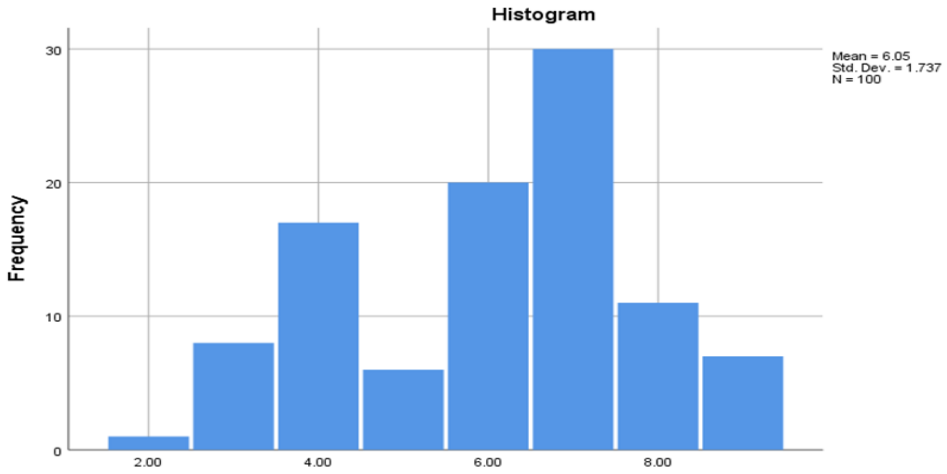
– 9. Do you agree that advertising on social networks increases your intention to buy the advertised products?

For question 7, respondents answered on a 5-point scale from "never influences" to "always influences". For the ninth survey question, respondents answered on a 5-point scale ranging from "strongly disagree" to "strongly agree". From the responses, we generate a new variable, namely a 10-point scale representing the sum of the first two scales. A non-parametric one-sample t-test is used to test the hypothesis. The one-sample t-test is appropriate if the data are normally distributed, so we first perform the Shapiro-Wilk test for normality of distribution (Abu-Bader, 2021). The Shapiro-Wilk test for normality of distribution indicates that the data are not normally distributed. In fact, the shape of the histogram deviates from the symmetric bell-shaped curve that is typical of a normal distribution (Figure 1). The Shapiro-Wilk test confirms the non-normality of the data, as the p-value (sig.) is 0.000 and means that the null hypothesis, which assumes that the data are normally distributed, can be rejected (Table 11).

Table 11. *Shapiro-Wilk test influence on purchase behaviour and purchase intention*

	Statistics	df	Sig.
Influence on purchase behaviour and purchase intention	0,930	100	0,000

Figure 1. *Distribution of influence on purchase behaviour and purchase intention*



Since the data are not normally distributed, we use a non-parametric alternative to the one-sample t-test, the Wilcoxon Signed Rank test, to test the hypothesis. This test is appropriate for ordinal data with the assumption of normality of distribution not satisfied (Abu-Bader, 2021). It provides greater reliability of results and is consistent with methodological recommendations for treating data that do not meet the normality assumption. The Wilcoxon Signed Rank test checks whether the sample median differs from a certain expected or hypothesised value. The hypothetical value was defined as the mean value between the possible maximum (10) and the possible minimum (2) scores.

The results of the Wilcoxon test show that there is no statistically significant difference between the median value of the observed variable (6,000) and the hypothetical value (6,000), with a p-value of 0.000 (Table 12). Most of the values of the observed variable (48 cases) are lower than the hypothetical value, while 32 are higher and 20 are the same (Table 13). This means that the median of the observed variable is not statistically significantly higher than the hypothesised value, which does not allow rejecting the null hypothesis and does not confirm that the observed values are significantly different from the expected values. The test statistic$Z$ = -0.027 also indicates a non-significant difference between the observed and hypothesised values, which is not statistically significant ($p > 0.05$) (Table 14). Based on these results, we reject hypothesis H1.

Table 12. *Descriptive statistics influence purchase behaviour and purchase intention*

	N	AS	SO	Min.	Poppy.	Quartile		
						25 %	50% (Median)	75 %
Influence on purchase behaviour and purchase intention	100	6,05	1,737	2	9	4	6	7
Hypothetical value	100	6,00	,000	6	6	6	6	6

Legend: AS - arithmetic mean; SO - standard deviation, Min - minimum; Max - maximum

Table 13.*Wilcoxon Signed Rank test influence on purchase behaviour and purchase intention*

	N	AS early	Sum of ranches	
Impact on purchase behaviour and purchase intention - hypothetical value	Negative wounds	48a	33,64	1614,50
	Positive mornings	23b	50,80	1625,50
	Court	20c		
	Total	100		

Legend: a. Hypothetical value < Impact on purchase behaviour and purchase intention; b. Hypothetical value > Impact on purchase behaviour and purchase intention; c. Hypothetical value = Impact on purchase behaviour and purchase intention

Table 14. *Wilcoxon Signed Rank Test Statistics of the Impact of the Wilcoxon Signed Rank Test on Purchase Behaviour and Purchase Intention*

	Hypothetical value - Impact on purchase behaviour and purchase intention
Z	- 0,027
Asymp. Sig. (2-tailed)	0,979

H2: Social media advertising has a statistically significant impact on the purchase intention to buy the advertised products.

The hypothesis was tested with the results of the ninth survey question:

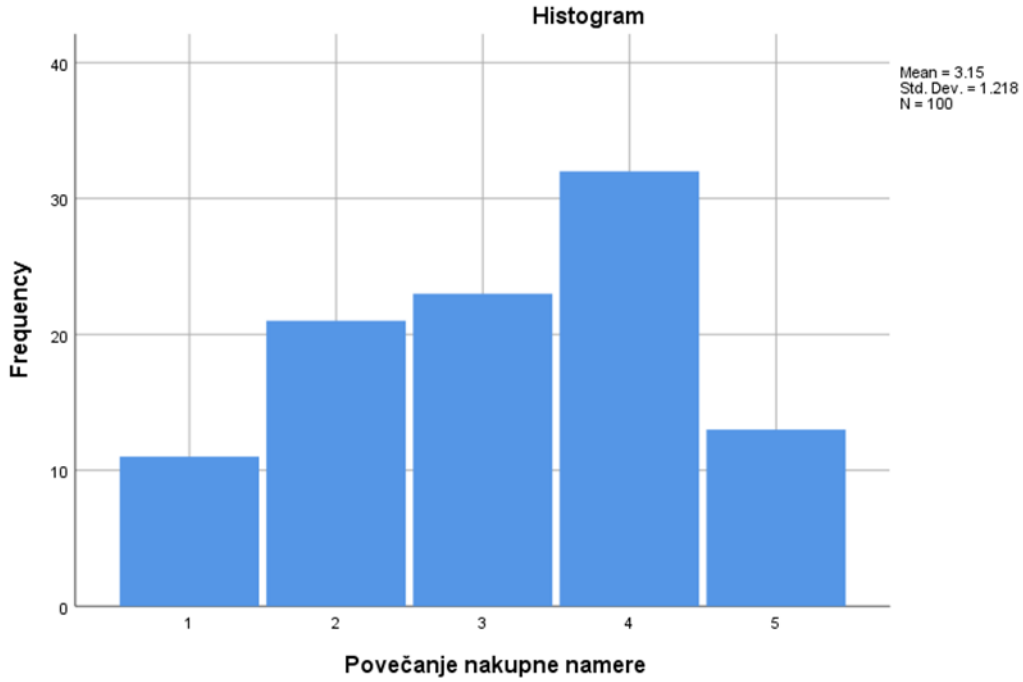
– 9. Do you agree that advertising on social networks increases your intention to buy the advertised products?

To test the hypothesis, we first perform a Shapiro-Wilk test for normality of the distribution to choose between a one-sample t-test for a normal distribution or a Wilcoxon Signed Rank test for an abnormal distribution (Abu-Bader, 2021). The Shapiro-Wilk test for normality of distribution indicates that the data are not normally distributed. This is because the shape of the histogram deviates from the symmetric bell-shaped curve that is characteristic of a normal distribution. It can be seen from the graph that the shape of the histogram is not symmetric and does not resemble the bell-shaped curve typical of a normal distribution. An asymmetry is visible, where the values are more concentrated around the value 4 (Figure 2). The Shapiro-Wilk test confirms the non-normality of the data with a p-value (sig.) of 0.000 (Table 15). Based on the results of the normality test, we reject the null hypothesis that the data are normally distributed and due to the non-normal distribution, we also use the Wilcoxon Signed Rank test to test the second hypothesis.

Table 15. *Shapiro-Wilk test of the results of an increase in purchase intentions*

	Statistics	df	Sig.
Increase in purchase intent	,906	100	,000

Figure 2. *Distribution of the results of the increase in purchase intent*



Due to the non-normal distribution of the data, the second hypothesis is tested using the Wilcoxon Signed Rank test, which tests whether the median of the sample differs from a certain expected or hypothesised value. The results of the Wilcoxon Signed Rank test for hypothesis H2 indicate that social media advertising does not have a statistically significant effect on the purchase intention to buy the advertised products.

Descriptive statistics show (Table 16) that the median of the observed variable (responses to question 9) is 3.0, corresponding to the hypothetical value of 3.0. The Wilcoxon test compares the ranked differences between the observed and the hypothetical value and the findings indicate that in 45 cases the observed value is less than the hypothetical value, in 32 cases it is greater and in 23 cases it is equal to the hypothetical value of 3 (Table 17). The test statistic Z = - 1.137 and the p-value = 0.255 also show that the differences between the observed variable and the hypothetical value are not statistically significant (p > 0.05) (Table 18), so we cannot reject the null hypothesis that the median observed value is equal to the hypothetical value and we cannot confirm the second hypothesis. Based on the results of the Wilcoxon test, we reject hypothesis H2 as there is insufficient evidence that social media advertising has a statistically significant impact on respondents' purchase intentions.

Table 16. *Descriptive statistics on the increase in purchase intent*

	N	AS	SO	Min.	Poppy.	Quartile		
						25 %	50% (Median)	75 %
Increase in purchase intent	100	3,15	1,218	1	5	2	3	4
Hypothetical value	100	3,00	,000	3	3	3	3	3

Legend: AS - arithmetic mean; SO - standard deviation, Min - minimum; Max - maximum

Table 17. *Wilcoxon Signed Rank test of the increase in purchase intent*

	N	AS early	Sum of ranches	

Increase in purchase intent - hypothetical value	Negative wounds	45a	38,12	1715,50
	Positive mornings	32b	40,23	1285,50
	Court	23c		
	Total	100		

Legend: a. Hypothetical value < Increase in purchase intent; b. Hypothetical value > Increase in purchase intent; c. Hypothetical value = Increase in purchase intent

Table 18. *Wilcoxon Signed Rank test statistics for the increase in purchase intention test*

Test Statistics	
	Hypothetical value - Increase in purchase intent
Z	- 1,137
Asymp. Sig. (2-tailed)	0,255

H3: Millennials' interaction with brands on social media has a positive impact on their purchase intentions.

The hypothesis is tested with survey questions 9 and 10:

– 10. How often do you engage with brands on social media?

– 9. Do you agree that advertising on social networks increases your intention to buy the advertised products?

To test the hypothesis, we use Spearman's rank correlation coefficient, which measures the strength and direction of the association between two ordinal variables. The test does not assume a normal distribution of the data, so no distribution testing is necessary.

The test findings indicate that the correlation coefficient is 0.187, indicating a weak positive correlation between the variables. This means that higher levels of engagement with brands on social networks slightly increase the purchase intention of respondents, but the correlation is very weak. However, the p-value (p = 0.063) is higher than the usual threshold for statistical significance (0.05), indicating that the association between the variables is not statistically significant (Table 19).

The findings indicate that there is a weak positive association between engagement with brands and purchase intention, but this association is not strong enough to be considered statistically significant. Based on these data, it cannot be confirmed that engagement with brands on social networks has a significant impact on increasing purchase intent. We reject the third hypothesis H3.

Table 19. *Correlation between engagement with brands and increase in purchase intent*

Correlation coefficient	0,187
Sig. (2-tailed)	0,063
N	100

H4: Adapting social media advertising strategies based on the demographic and behavioural characteristics of millennials leads to more effective advertising in targeting this audience.

The fourth hypothesis was tested with the results of question 12:

– 12. Do you believe that adapting social media advertising strategies increases their effectiveness in reaching millennials?

Respondents answered "yes" or "no" to question 12. We use a binomial test to test whether the responses are statistically significantly different from the hypothesised uniform distribution of responses. The binomial test checks whether the proportion of 'yes' or 'no' responses is statistically significantly different from the expected 50/50 even distribution.

The results of the binomial test show that 79% of respondents confirmed that adapting social media advertising strategies increases their effectiveness in reaching millennials. Comparison with the 50/50 test distribution of expected shares indicates that the observed shares are statistically different from the uniformly distributed responses. A p-value of 0.000 indicates that the difference between the observed distribution of responses (79% and 21%) and the expected distribution (50/50) is statistically significantly different (Table 20). Based on these results, we can conclude that statistically significantly more respondents confirmed than rejected the impact of adapting advertising strategies on increasing effectiveness in reaching millennials. This supports hypothesis H4 that tailoring advertising strategies on social media based on the demographic and behavioural characteristics of millennials leads to greater advertising effectiveness in reaching this target group.

Table 20. *Binomial test of the view that tailoring social media advertising strategies increases their effectiveness in reaching millennials*

Category	N	Observation of proportions	Test proportions	Exact Sig. (2-tailed)
Yes	79	0,79	0,50	0,000
No	21	0,21		
Total	100	1,00		

The results confirm that tailoring social media advertising strategies based on the demographic and behavioural characteristics of millennials leads to greater advertising effectiveness in targeting this audience. This means that companies should focus their efforts on tailoring advertising strategies to the target group, as such approaches will be more effective in achieving the desired effects.

Discussions

Over two decades, social media have evolved from communication tools to key platforms for marketing and advertising. Boyd and Ellison (2007) point out that they allow users to create public profiles, make connections and interact with other users. These features have enabled companies to adapt their strategies to the needs of millennials, defined by Helal and Ozuem (2021) as a technologically literate and adaptable generation. Key mechanisms of influence include personalisation, social proof and direct communication with brands.

The aim of the study was to examine the impact of social media advertising on the purchase intentions of millennials. The findings indicate that the vast majority of respondents use Facebook and Instagram, confirming the importance of these platforms for the target group. The use of other platforms such as TikTok, LinkedIn and Twitter was lower but still present, showing the diversity of preferences within the generation. The average time spent using social networks ranges between one and four hours per day, confirming their role as part of everyday life.

Hypothesis H1 predicted a direct impact of advertising on millennials' purchase intentions. The results did not support this hypothesis ($p > 0.05$), suggesting that advertising on social networks often falls short of being sufficiently persuasive. A possible reason for this is millennials' greater trust in social proof compared to direct advertising. This confirms the need for content-rich advertising based on trust and authenticity.

Hypothesis H2 concerned the impact of advertising frequency. This was also not statistically confirmed ($p > 0.05$), suggesting that frequency of ad impressions is not a sufficient factor to stimulate purchase intentions. Repeated advertising may even lead to advertising fatigue (Zhang and Mao, 2016), suggesting that content elements are more significant than ad quantity.

Searching for product information via social networks proved to be a common practice among respondents, indicating the significant role of these platforms as a tool for product research. In this context, hypothesis H3 was tested, which predicted a positive impact of personalisation on the perceived value of advertisements. This hypothesis was also not statistically confirmed ($p > 0.05$), indicating the complexity of the impact of personalisation. Nevertheless, respondents mostly expressed positive attitudes towards personalised content, if it was appropriately tailored to their interests.

Hypothesis H4 predicted that tailoring advertising strategies to the target audience would increase advertising effectiveness. This hypothesis was confirmed, meaning that content that considers the values and interests of millennials has the greatest impact on their purchasing decisions. This includes authenticity, ethics, transparency and the inclusion of social proof such as recommendations from other users. Advertising on social networks therefore has an impact mainly through indirect factors. Most respondents recognise the importance of personalisation and social proof but are often reluctant to advertise if it is not relevant enough. The mere presence of ads is not enough to increase purchase intentions, as strategic and content-rich communication is needed to build trust and long-term relationships.

Interaction with brands remains limited, except in cases where trust is already established. It is therefore crucial for companies to invest in creating a positive user experience and encourage engagement through authentic content. User-generated content and recommendations have a significant impact on the perception of credibility and trust in a brand, which supports the thesis on the importance of social proof. This confirms that advertising on social networks requires multi-faceted approaches that focus on building long-term relationships with users. The key findings show the importance of contextual, relevant and targeted strategies based on understanding millennials' values, personalising ads, building trust and incorporating social evidence such as other users' opinions.

6 CONCLUSIONS

The survey findings indicated that millennial, as a digitally literate and influential generation, have a selective attitude towards social media advertising. The direct influence of ads on purchase behaviour has not been statistically confirmed, but indirect factors such as personalisation and social proof play an significant role. Recommendations from other users, identified as an element of social validation, have a significant impact on millennials' purchase intentions, suggesting the importance of user-generated content and trust building. To effectively reach this target group, it is recommended to use personalised and ethically based advertising strategies that reduce the feeling of intrusiveness and include relevant and authentic content. Companies should consider the values of millennials such as transparency, sustainability and social responsibility when designing campaigns.

At the same time, the study reveals that while presence on platforms such as Facebook and Instagram remains key to reaching the target audience, presence alone is not enough. Strategic content creation based on trust, user experience and active community engagement is essential for effective user engagement.

In terms of methodological approach, the study contributes to understanding the complexity of millennials' perceptions of digital advertising and makes recommendations for further research. These should include larger and more diverse samples and comparative analyses between different generations. Such an extension could shed further light on the impact of social networks on consumption habits in a changing digital environment.

There are some significant limitations to consider when considering the results of the survey. The first limitation relates to the small sample size ($N = 100$), which was limited to a relatively small number of millennials in Slovenia.

The small number of respondents may affect the reliability of the results and reduce the statistical significance of the findings, making it impossible to generalise the results to the whole population of millennials. Another limitation is related to the survey method itself, which may cause both biases related to socially desirable responses and biases due to poor insight into cause-and-effect relationships and factors. In addition, the use of an online questionnaire may have led to bias as it only surveyed active internet users.

Future surveys should include a larger sample and combine different data collection methods to improve reliability. Despite these limitations, the study contributes valuable insights into the purchasing behaviour patterns of millennials and offers practical guidelines for companies wishing to improve the effectiveness of their social media marketing strategies. We recommend that companies invest in tailoring ads to the interests of the target audience, provide authentic content and avoid intrusive advertising approaches, as these can negatively affect brand perception.

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IMPACT OF MANAGEMENT ACCOUNTING PRACTICES ON THE PERCEIVED FINANCIAL PERFORMANCE OF MANUFACTURING COMPANIES IN SRI LANKA

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Abstract: *In manufacturing companies, management accounting plays a vital role of the company. This research examines the role of management accounting practices in the financial performance of listed manufacturing companies in Sri Lanka. This study undertook a quantitative study of data collected using a structured questionnaire from 59 companies listed on the Colombo Stock Exchange. The companies were selected using the census sampling technique. Analytical tools used as descriptive statistics, correlation analysis, and the Partial Least Squares Structural Equation Modeling (PLS-SEM) method, were used to analyse the data. Major findings suggest that a greater extent of budgeting systems and costing systems enhances financial performance. Information for decision-making can occasionally lower an organization's financial performance in the short term. Performance evaluation systems increase the extent of improved financial performance of organizations, while the analysis of strategic management accounting has the most positive impact on financial performance, supporting its status as a key driver of financial performance in organizations.*

Keywords: *Financial performance, costing system, Budgeting system, Strategic management accounting analysis system*

1. INTRODUCTION

Management Accounting Practices are crucial in cascading effects on operational improvements and market competition, especially in developing countries such as Sri Lanka, due to resource constraints or lack of infrastructure, among others. An essential part of management accounting for manufacturers is the system of concepts and methods that develops knowledge of how companies communicate economically, helping to dispose of what costs things have in actuality and therefore shaping how plans are best made for future operations (Gichaaga, 2014). Management Accounting Practices, such as cost management, budgeting, performance evaluation, and strategic analysis, are of particular importance to enterprises aiming to raise profits and respond effectively to competition. Research questions of the study,

- What is the impact of costing systems on the financial performance of listed companies in Sri Lanka?
- Is there an impact of budgeting systems on the financial performance of listed companies in Sri Lanka?
- What is the impact of performance evaluation systems on the financial performance of listed companies in Sri Lanka?
- What is the impact of strategic management accounting analysis systems on the financial performance of listed companies in Sri Lanka?

- Is there an impact of information for decision-making on the financial performance of listed companies in Sri Lanka?

According to Horngren, (2008), companies that used the Activity Based Costing (ABC) system determined the increases in profitability and cost control. Similarly, Almatarneh et al., (2022) conclude that traditional costing systems, despite their lack of accuracy, continued to provide important data for improving operational effectiveness and cost-reduction processes. According to Alleyne and Weekes-Marshall, (2011), budgeting is a helpful strategy for forecasting, controlling internal operations, and allocating resources to accomplish business objectives and goals and also there are two types of budgeting: Activity-Based Budgeting (ABB) is a technique for allocating funds to sources in line with the intended activities.

The best technique for cost system optimization is the activity-based costing method, or ABC, according to (Richard et al., 2009). According to Alleyne and Weekes-Marshall, (2011), Performance evaluation systems that only focused on financial aspects, such as profit maximization and return on capital investment projects, were criticized. These standards do not account for workforce turnover or the cost of generating capital. The Economic Value Added (EVA) mechanism was developed by organizations in response to these limitations in performance evaluation and these EVA mechanism looks at the company's cost of capital as well as the actual value that has been provided to the organization Alleyne and Weekes-Marshall (2011).

According to Roslender and Hart (2003), strategic management accounting is an external approach to accounting that focuses on how actions and cost structures made by competitors will affect the business's future operations. According to Alleyne and Weekes-Marshall (2011), there is a lack of a robust theoretical framework in strategic management accounting. This point of view has been supported by numerous other academics who contend that because internal factors receive more attention than exterior factors, the external environment is typically ignored. According to Nurullah and Kengatharan (2015), states that the management accounting information systems is important to making timely and accurate information to managerial decision-making processes.

Previous studies indicate that the companies used strong management accounting information systems (MAIS) are more knowledgeable about investment prospects, inventory control, and production scheduling. Richard et al. (2009), state that firm performance can be divided into simply three different types: These assessing results include market performance (such as sales, market share, etc.), shareholder return (total shareholder return, economic values-added, etc.), and financial performance (profits, rate of return of assets, rate of return of investment, etc.). We found that organizations at the business-function level that adopt such strategies related to product differentiation were better placed when they adopted higher levels of sophisticated management accounting techniques such as activity-based management, benchmarking and quality improvement activities(Almatarneh et al., 2022).

However, Sri Lankan businesses and others in developing countries face problems getting these into practice as efficiently because they lack the resources or infrastructure (Kariyawasam, 2018). The present research attempts to contribute to filling this gap in the management accounting theory regarding its practical application in a Sri Lankan context by investigating how MAPs impact the financial performance of listed manufacturing companies in the country (Hapuarachchi, 2019). This is a study "Analyzing Role of Management Accounting Practices on the Financial Performance of the Manufactured Companies listed in the CSE, Sri Lanka" which examines the positive effect of the practice of management accounting (MAPs) on the performance of the Sri Lankan manufacturing firms operating at the CSE.

Current economic conditions, market competition, regulatory framework and corporate governance impact the financial performance of companies but This research study will focus on Management accounting practices only. However, there are many companies that operate in the Colombo Stock Exchange but this research has selected only Manufacturing Sector listed Companies. On this premise, the study aims to identify the relationship that exists between those management accounting practices and the financial performance of such manufacturing companies, which are listed in Sri Lanka.

In a highly competitive corporate world today, corporate entities are using cut throat strategies to maximize profits and attain competitive advantage and management accounting has been seen to be playing a central role in this process (Gichaaga, 2014). The competitiveness of industries due to consumers' demand, technology, and changes in the business environment exert pressure on companies to pay attention to activities that increase their sales volume and, at the same time, reduce costs of production (Adu-Gyamfi, 2020). Current management accounting practices especially in manufacturing industries create a much-needed competitive advantage in the organization by enhancing profitability and controlling for waste (Gichaaga, 2014). However, research on the link between MAP and FP in the manufacturing firms of Sri Lanka is scarce, although it is significant (Perera, 2015; Kariyawasam, 2018; Mohomed, 2021). This study aims at filling this gap by assessing the effects of MAPs including costing, budgeting, performance evaluation, and strategic decision-making on the financial performance in terms of profitability, Return on Equity (ROE) and Return on Asset (ROA).

2. METHODOLOGY

2.1 Introduction

The following study, identifies the relationship between management accounting practices and financial performance concerning Sri Lankan-listed manufacturing companies, based on a conceptual framework, hypothesis development, and operationalization of variables concerning key practices such as costing systems, budgeting systems, performance evaluation, strategic management accounting, and decision-making information.

The target population of 59 listed companies in the Colombo Stock Exchange presents a better representative sampling across various industries. In the mono-method research strategy, the quantitative data collection methodology will be a structured questionnaire survey. There is a basis for appropriate consideration of perception by senior managers and management accountants in the manufacturing industry through a positivist philosophy and a deductive approach. Data collection and data analysis in this research go hand in glove. A self-administered structured questionnaire on a 5-point Likert scale was used to collect views from senior managers and management accountants of selected companies. Afterward, the data from this will be analyzed rigorously with the help of SPSS and SMART PLS.

The independent variable of costing system was measured using five questions (items) as "How often does your firm divide costs with a plant-wide overhead allocation?"; the budgeting systems was measured using another five items as "How frequently does your company use budgeting as a tool for planning future operations and activities?"; the performance evaluation system was measured from five questions as "What is the frequency with which your business uses financial standards to analyze overall performance and its financial health?"; strategic accounting analysis system measured from another five questions as "How frequently does your company utilize long-range forecasting to support strategic decision-making and planning?"; information for decision making also measured from five questions as "How often does your company use the discounted cash flow method to evaluate major capital investment projects?"; the dependent variable of perceived financial performance was measured from five items as "To what extent has the gross profit margin of your company improved due to the application of management accounting practices?" (Gichaaga, 2014).

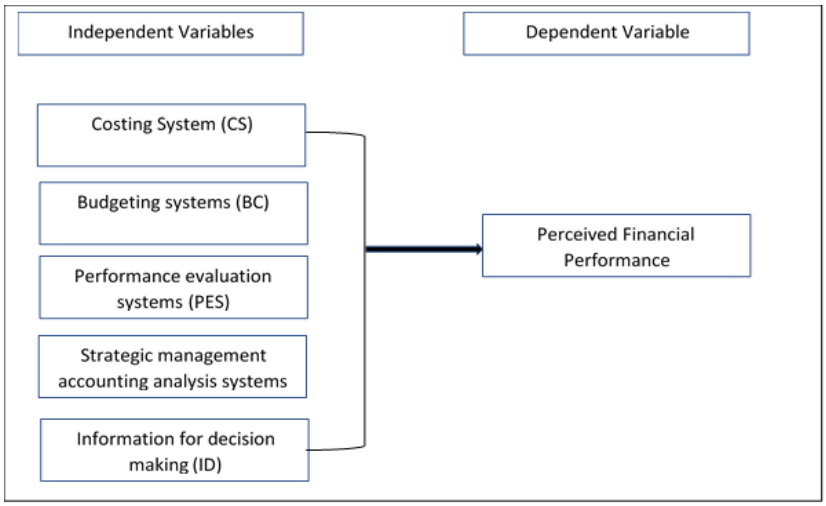


Figure 1: Conceptual Framework

2.2 Analytical method

Partial Least Squares Structural Equation Modeling (PLS-SEM) is a variance-based approach to structural equation modeling that focuses on maximizing the explained variance of the dependent constructs. Unlike covariance-based SEM, which prioritizes model fit, PLS-SEM is more appropriate for exploratory research and predictive analysis. It is particularly well-suited for studies that involve complex models, small sample sizes, or non-normally distributed data.

The decision to use PLS-SEM in this study was driven by several methodological considerations. This research investigates the relationships between management accounting practices and financial performance, an area where theory is still evolving. PLS-SEM is suitable for testing and refining such predictive models. Secondly, the primary goal of the study is to predict the impact of management accounting practices (costing system, budgetary system, performance evaluation systems, strategic accounting information analysis systems and information for decision making) on firm performance. PLS-SEM prioritizes predictive accuracy over model fit, making it ideal for this objective.

Thirdly, preliminary analysis revealed that some variables deviate from normal distribution. PLS-SEM does not require strict normality assumptions, making it robust in handling real-world data. PLS-SEM provides reliable estimates even with a relatively small sample size, unlike covariance-based SEM, which requires larger samples to achieve stable estimates.

The following steps were undertaken in the PLS-SEM analysis:

- *Model Specification*: The structural model was specified to include relationships among latent constructs based on theoretical foundations.
- *Measurement Model Assessment*: The reliability and validity of the constructs were assessed using Cronbach's Alpha, Composite Reliability, and Average Variance Extracted (AVE).
- *Structural Model Evaluation*: Path coefficients were estimated, and their significance was tested to examine the hypothesized relationships.
- *Goodness-of-Fit*: Explained variance (R^2) were evaluated to determine the model's predictive capability.

The analysis was conducted using *SmartPLS 4*, a widely recognized software for PLS-SEM. SmartPLS offers user-friendly functionalities for estimating both measurement and structural models, ensuring rigorous assessment of reliability, validity, and hypothesized relationships.

3. RESULTS – DATA ANALYSIS

3.1 Descriptive Statistics

From Table 1, demonstrated descriptive statistics include mean, standard deviation of both independency and dependent variables.

Table 1: *Descriptive statistic of Independent and Dependent Variables*

Dimension	*Mean*	*Standard Deviation*	*Skewness*	*Kurtosis*	*Decision*
CS_M	4.0000	.69835	-1.439	1.185	High level
BS_M	3.7774	.79582	-.871	-.354	High level
PES_M	3.8981	.74691	-1.355	.568	High level
SMAAS_M	3.9283	.81815	-1.515	1.034	High level
ID_M	3.7019	.86079	-.702	-.419	High level
FP_M	3.9585	.76093	-1.312	.690	High level

(Source: Survey Data, 2024)

Since the descriptive analysis result shown in Table 1, the obtained mean value for the Costing System was 4.00 and the SD was 0.69835. The analysis in the SD reveals that the individual responses is approximately 0.69 point away from the mean. These mean values are pins down into male interval of $3.5<X\leq5$. Last of all, the researcher can assert that the costing system has supported a high level among the selected listed companies in Sri Lankan.

The budgeting system was determined from the analysis result of the mean and standard deviation as indicated in Table 1. Testing on the Budgeting System, the mean was 3.7774 and the standard deviation was 0.79582. Thus, the analysis of variance indicates that, on average, individual responses deviate from the mean by 0.79 of a point. These mean values are between 3.5 of relative importance X and 5 of large relative importance. Last of all, the researcher can state that the budgeting system has a high level among the selected and the listed companies in Sri Lanka. Besides, based on the descriptive analysis of the above Table 1, the mean and SD of the Performance Evaluation System were presented as follows. The mean value of the Performance Evaluation System was 3.8981 and SD was 0.74691. The SD assigns approximately a 0.74-point deviation to an individual response from the mean. These mean values are of the order, $3.5<X\leq5$. CONSEQUENTLY, the researcher can conclude that the Performance Evaluation System is at a highly-rated level among the selected listed companies in Sri Lanka.

Descriptive analysis in finding the mean and SD of the SMAAS was presented. For the strategic management accounting analysis system, the mean value was 3.9283 with SD that was 0.81815. The SD reveals that the individual responses fluctuate about the mean points by 0.81 of a point. These mean values range within $3.5 <X \leq 5$. In conclusion, the researcher can conclude that the level of SMAA System is high among select listed companies in Sri Lanka.

Based on the results of descriptive analysis of the above Table 1, the indices of mean and SD in Information for Decision-making were presented. The overall AM of Information for Decision-making was 3.7019, and the SD was 0.86079. Looking at the individual responses, the SD proves that they vary by .86 points from the mean on average. These mean values range between $3.5<X\leq5$. Last, the researcher can assert that the level of Information for Decision Making among the selected listed companies in Sri Lanka is high.

As indicated in Table 1, descriptive results indicated mean and SD of the dependent variable of this study. The mean value of Financial Performance was 3.9585 and SD was 0.76093. It is also shown by the SD that on an average basis, each of the individual responses deviate 0.76 point from the mean response. These mean values are within range of 3.5 less than 5. Last of all, the researcher can conclude that the level of Financial Performance is high among selected listed companies in Sri Lanka.

3.2 Bivariate Analysis

Pearson's Correlation Analysis

According to Anderson (2014) Pearson correlation coefficient reflects the direction of the strength together with the level of significance of the bivariate relationships among all the variables that were measured using interval level of measurement. As well as in the opinion of Bolboaca and Jantschi (2006) Pearson correlation checks not only for the presence (indicated by the p-value) but also the direction (indicated by the coefficient r) and the magnitude (ranging between -1 and +1) between the two variables.

Correlation Analysis Between Management Accounting Practices and Financial Performance

Table 2: *Pearson's Correlation Analysis*

		Financial Performance
Costing System	Pearson Correlation	.960**
	Sig. (2-tailed)	.000
	N	53
Budgeting System	Pearson Correlation	.843**
	Sig. (2-tailed)	.000
	N	53
Performance Evaluation System	Pearson Correlation	.929**
	Sig. (2-tailed)	.000
	N	53
Strategic Management Accounting Analysis System	Pearson Correlation	.956**
	Sig. (2-tailed)	.000
	N	53
Information for Decisions Making	Pearson Correlation	.778**
	Sig. (2-tailed)	.000
	N	53

(Source: Survey Data, 2024)

The Pearson correlation coefficients of this study (Table 2) were 1.000 for the Costing System construct and 0.960 for the Financial Performance construct, for the respondents. Furthermore, the attained correlation coefficient lies in the coefficient range between 0.5 and 1. Value of the p is 0.000 which is less than alpha value of 0.05. This provides evidence that there is a positive significant association between Costing System and Financial Performance of those selected listed firms in Sri Lanka.

The regression coefficient of Budgeting System against Financial Performance was 0.843 among the respondents. Furthermore, the value of the coefficient of correlation also lies in the coefficient interval of 0.5 to 1. The value of p is 0.000 and this is less that alpha value. They all affirm that there is a good positive correlation between Budgeting System and Financial Performance of selected listed companies in Sri Lanka.

With regards to Performance Evaluation System and Financial Performance the correlation coefficient (r) value obtained was 0.929. Furthermore, the value of the correlation coefficient also belongs to a coefficient range of 0.5-1.0. Once again p-value is equal to 0.000 and less than alpha value of 0.05. Thus, the study finds a strong positive significant correlation exists between Performance Evaluation System and Financial Performance of the selected listed companies in Sri Lanka.

From the analysis result of this study (Table 2), the correlation coefficient (r) was 0.956 for Strategic Management Accounting Analysis System and Financial Performance among the respondents. Furthermore, it means that the obtained value of the coefficient is in the range of a coefficient from 0.5 to 1. The p-value is equal to equal to 0.000 and less than the alpha value. This confirms that there is a positive correlation between the SMMA System and Financial Performance amongst selected listed companies in Sri Lanka.

The respondents got an r-value of between Information for Decisions Making and Financial Performance 0.778. Also, the correlation coefficient value is within the coefficient range of 0.5-1.0 as shown in the figure above. Here they show that p-value = 0.000 which is less than the alpha value. This proves that IM also has a great positive interaction on FDIR and Financial Performance among the selected Listed Companies in Sri Lanka.

From these descriptions above, the result witnesses show that most of the management accounting practices have a positive significant correlation between MA practice and the financial performance of selected listed

Table 3: *Summary of Correlation Analysis Result*

Relationship	*Strength*
Cost system and financial performance	Strong positive relationship
Budgeting system and financial performance	Strong positive relationship
Performance evaluation and financial performance	Strong positive relationship
Strategic management accounting analysis system and financial performance	Strong positive relationship
Information for decision-making and financial performance	Strong positive relationship

(Source: Survey Data, 2024)

Structural Equation Modeling

Reliability Analysis

Reliability refers to the consistency of a set of indicators used to measure a construct. In this study, reliability is assessed using Cronbach's Alpha and Composite Reliability (rho_c and rho_a). Cronbach's Alpha assesses the internal consistency of the constructs. Values above 0.7 are generally acceptable, indicating that the indicators reliably measure their respective constructs. Composite Reliability (rho_a and rho_c) metrics provide an alternative to Cronbach's Alpha, particularly suited for confirmatory research. Values greater than 0.7 are indicative of adequate reliability.

Table 4: *Summary of Reliability Analysis*

Construct	*Cronbach's Alpha*	*Composite Reliability (rho_a)*	*Composite Reliability (rho_c)*
BS	0.851	0.864	0.893
CS	0.903	0.908	0.928
FP	0.892	0.900	0.921
ID	0.898	0.924	0.925
PES	0.890	0.899	0.921
SMAAS	0.895	0.901	0.923

(Source: Survey Data, 2024)

All constructs show high reliability, with Cronbach's Alpha and Composite Reliability exceeding the threshold of 0.7.

Convergent Validity Analysis

Convergent validity examines whether a set of indicators correlates well with their corresponding construct. It is assessed using the Average Variance Extracted (AVE). Average Variance Extracted (AVE measures the proportion of variance captured by the construct in

relation to the variance due to measurement error. AVE values above 0.5 indicate adequate convergent validity.

Table 5: *Summary of Convergent Validity Analysis*

Construct	*AVE*
BS	0.628
CS	0.720
FP	0.702
ID	0.713
PES	0.702
SMAAS	0.708

(Source: Survey Data, 2024)

All constructs have AVE values greater than 0.5, confirming adequate convergent validity.

Structural Model Analysis

In Partial Least Squares Structural Equation Modeling (PLS-SEM), the structural model analysis involves evaluating the *R-square* (R^2) values and the *f-square* (f^2) effect sizes. The R^2 value assesses the explanatory power of the model, while the f^2 values assess the effect size of each predictor variable on the dependent construct, Financial Performance (FP), in this case. The R^2 value indicates the proportion of variance in the dependent variable (Financial Performance - FP) explained by the independent variables. Higher R^2 values suggest better explanatory power of the model. *R^2 for FP is 0.957*. This value indicates that approximately 95.7% of the variance in Financial Performance is explained by the independent constructs (BS, CS, ID, PES, and SMAAS). An adjusted R^2 of 0.952 confirms the model's stability when accounting for the number of predictors, indicating a strong predictive capability of the model.

The f^2 value, or effect size, measures the change in R^2 when a specific independent variable is included or excluded from the model. According to Cohen's guidelines, an f^2 value of 0.02, 0.15, and 0.35 indicates small, medium, and large effect sizes, respectively.

Table 6: *Summary of Structural Model Analysis*

Path	*f-Square (f^2)*	*Effect Size Interpretation*
BS -> FP	0.108	Small to medium effect
CS -> FP	0.150	Medium effect
ID -> FP	0.231	Medium to large effect
PES -> FP	0.142	Small to medium effect
SMAAS -> FP	0.354	Large effect

(Source: Survey Data, 2024)

Budgeting Systems (BS) has a small to medium effect on Financial Performance (FP), with a notable contribution to the variance in FP, supporting its importance in driving financial outcomes *($f^2 = 0.108$).* Costing Systems (CS) have a medium effect on FP, emphasizing that Costing Systems contribute substantially to enhancing financial performance *($f^2 = 0.150$).* Information for decision-making (ID) demonstrates a medium to large effect on FP, indicating that innovation has a strong influence on financial outcomes *($f^2 = 0.231$).* Performance Evaluation Systems (PES) show a small to medium effect on FP, underscoring those efficient processes are beneficial but may not be as influential as other constructs *($f^2 = 0.142$).* Strategic Management Accounting and Analysis (SMAAS) has the largest effect on FP, with a large f^2 value. This result highlights the critical role of effective strategic management accounting systems in achieving financial performance *($f^2 = 0.354$).*

The R^2 and f^2 analyses reveal that the structural model has strong explanatory power, with all independent constructs contributing significantly to the explained variance in Financial Performance (FP). SMAAS has the most substantial impact on FP, followed by ID, CS, PES,

and BS. The findings confirm the model's robustness and highlight the importance of strategic, sustainable, and innovative practices in driving financial success.

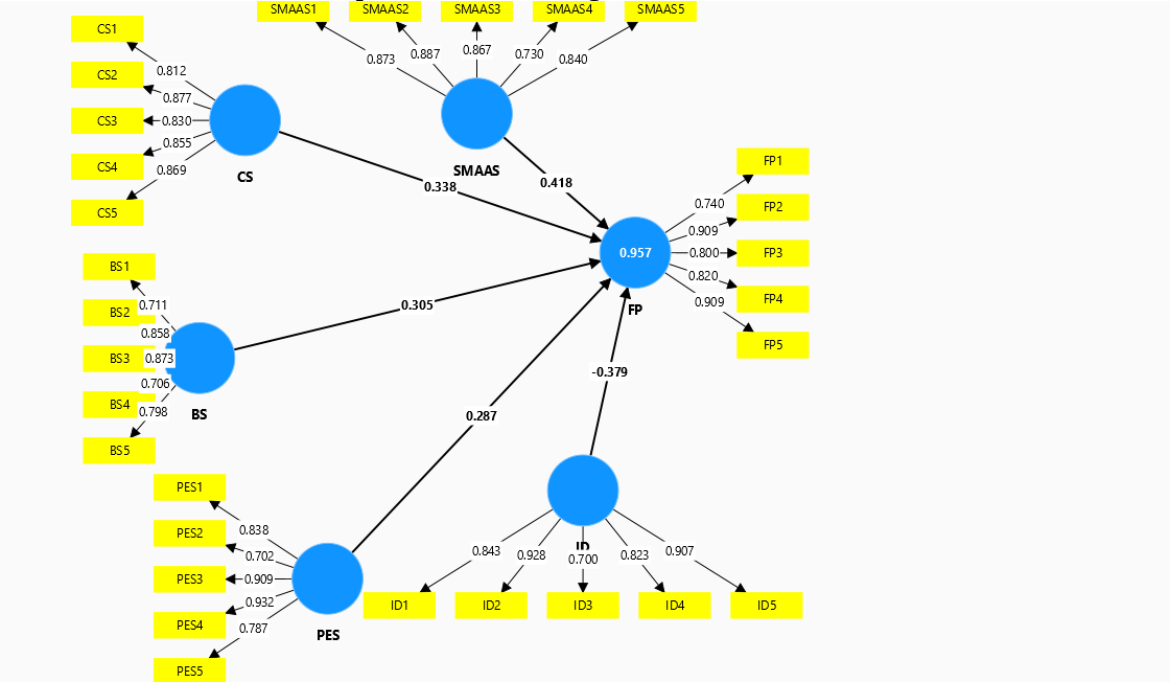


Figure 1: *Summary of Structural Model Analysis*

Bootstrapping Results Analysis

Bootstrapping is a non-parametric resampling technique used in Partial Least Squares Structural Equation Modeling (PLS-SEM) to assess the statistical significance of path coefficients. In this study, 5,000 bootstrap samples were used to estimate the precision of the model's path coefficients and their associated t-statistics and p-values.

- *Path Coefficients and Significance Testing*

Table 07 presents the bootstrapping results for the structural model, including the original sample estimates (O), sample means (M), standard deviations (STDEV), t-statistics, and p-values for each path:

Table 7: *Summary of Path Coefficients and Significance Testing*

	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P values
BS -> FP	0.305	0.302	0.112	2.726	0.006
CS -> FP	0.338	0.332	0.134	2.512	0.012
ID -> FP	-0.379	-0.391	0.104	3.648	0.000
PES -> FP	0.287	0.279	0.127	2.261	0.024
SMAAS -> FP	0.418	0.446	0.145	2.880	0.004

(Source: Survey Data, 2024)

The results indicate the significance of the paths between independent constructs and financial performance (FP):

The relationship between Budgeting System (BS) and Financial Performance (FP) is positive and statistically significant at the 1% level, indicating that firms with stronger budgeting systems tend to exhibit better financial performance ($\beta = 0.305$, $p = 0.006$).

Costing System (CS) positively influences Financial Performance (FP), significantly at the 5% level. This suggests that the costing system contributes to improved financial outcomes ($\beta = 0.338$, $p = 0.012$).

Information for decision making (ID) shows a significant negative relationship with Financial Performance (FP) at the 1% level, indicating that under certain conditions, Information for decision making may temporarily reduce financial performance, possibly due to initial decision-making provision costs ($\beta = -0.379$, $p = 0.000$).

The relationship between Performance Evaluation Systems (PES) and Financial Performance (FP) is positive and significant at the 5% level, highlighting the financial benefits of efficient and sustainable processes ($\beta = 0.287$, $p = 0.024$).

Strategic Management Accounting analysis (SMAAS) has the strongest positive impact on Financial Performance (FP), significant at the 1% level, underscoring the importance of robust strategic management accounting analysis systems in driving financial performance ($\beta = 0.418$, $p = 0.004$).

The bootstrapping results confirm the statistical significance of all hypothesized relationships. These findings demonstrate that various aspects of corporate sustainability, innovation, and strategic management significantly influence financial performance, either positively or negatively, emphasizing the multifaceted nature of these interactions.

4. CONCLUSIONS AND RECOMMANDATIONS

The findings of the bootstrapping and structural model demonstrate how different management accounting techniques have a major impact on financial performance. Strategic management accounting analysis has the biggest positive impact on financial performance, followed by information for decision-making, costing systems, performance assessment systems, and budgeting systems. This indicates that the model has good explanatory power. Similar results were found in other studies (Adu-gyamfi & Chipwere, 2020; Alleyne & Weekes-Marshall, 2011; Mohomed, 2021; Hapuarachchi, 2019), where all researchers have found a positive association between SMAAS and financial performance: that means the financial performance of companies has increased with the adoption of SMAAS.

Although the majority of the correlations are positive overall, the negative correlation between financial performance and decision-making information raises the possibility that performance may be momentarily hampered by the initial expenses of decision-making. Other similar studies found positive findings between decision-making and financial performance (Adu-gyamfi & Chipwere, 2020; Hapuarachchi, 2019), identifying companies which utilized IDM have ended up with higher financial performances. The results highlight how crucial sound strategic, and long-term strategies are to achieving financial success. managerial accounting skills, streamline decision-making and guarantee that their budgeting, performance evaluation, and costing systems are effectively synchronized to maintain long-term profitability.

These results help maximise the internal validity of this study so that the findings are reliable and valid. One of the notable findings of the studies covered in this research is that the use of management accounting practices, including SMA, can increase the company's financial performance and need to incorporate enhanced economic estimate approaches, budgeting and performance assessment tools for enhanced imagining and resource allocation. It also stresses a call for the management accountants to integrate with other organizational segments like the marketing, operations and human resource segments to enhance the overall imprint of the management accounting practices.

In addition, the research has important implications for financial managers, management accountants, organisational leaders, academicians, and policymakers. It offers

potential insights into the ways that managers of financial institutions can manage their institutions in accordance with generally accepted principles in management accounting in order to make sound strategic purposes in the establishments. It also postulates that there is a need for continuous professional development of management accountants to point towards effective practice concerning current trends and practices.

Through training and developing the personnel and promoting cooperation between departments, manufacturing organizations may increase financial results and make better decisions. It also underlines the importance of creating an organisational culture more supportive of the rational use of financial data within the context of the enterprise at various tiers. Such an approach will assist firms in the strengthening of their capacity to adapt to the volatile business environments and in the subsequent facilitation of organisational efficiency.

In addition, it advises that policy makers should formulate a legal environment in which companies practice sound management accounting based on accountability and corporate financial reporting. The research was conducted only on Sri Lankan listed manufacturing companies which restricts the study to some extent to the results of other industries or non-listed companies. The analysis was based on the self-completion questionnaire data, which risks contain bias and the cross-sectional research method does not take into account the dynamic changes in the management accounting practices. In addition, the study mainly relied on a quantitative approach which might not capture the qualitative elements relating to the management accounting practices, which includes culture and leadership to name but a few.

The several recommendations mentioned below are the results of the research, which should be implemented to improve management accounting practices and manufacturing companies' financial performance: The business needs to use technology by investing in modern accounting software and making use of data analytics. A culture of collaboration should be fostered by the organization through cross-functional teams and regular communication channels. Performance evaluation should be appropriately prioritized by the organization through the use of clear performance metrics and regular performance reviews. The organization may improve training and development programs by implementing customized training initiatives and supporting professional certifications.

The business has to create explicit policies and processes to improve its frameworks for management accounting. The business would have to use a balanced scorecard methodology, it is appropriate for the company to focus on ethical practices by establishing a code of ethics and offering ethics training. It is also appropriate for the company to engage stakeholders through regular communication and involve them in decision-making processes. The company is appropriately engaging in continuous improvement with regular assessments and fostering a culture of innovation.

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APPENDIX

SECTION A

01. Name of the company.
02. What is the industrial sector of your company engaging in?

	Energy
	Material
	Capital Goods
	Automobiles & Components
	Commercial & Professional Services
	Food, Beverage & Tobacco
	Consumer Durables & Apparel
	Healthcare Equipment & Services
	Household & Personal Products
	Utilities
	other

03. The number of years in operation.

	1 – 5 years
	6 – 15 years
	16 – 25 years
	Above 25 years

04. What is your position in the company?

	Accountant
	Account Executive

05. What is your age?

	Below 25 years
	25 – 35 years
	35 – 45 years
	45 – 55 years
	Prefer not to say

06. What is your gender?

	Male
	Female

	Other

07. What is your educational qualification?

	A/L only
	Bachelor Degree
	Master Degree
	Phd

SECTION B: Management Accounting Practices
How often does your company use the following management accounting practices?
Score using the key which ranges from 1 (Never) to 5 (Very Frequently).

	1	2	3	4	5
How often does your company use the following management accounting practices relating to costing systems (CS)					
CS1. How often does your company separate variable, incremental, and fixed costs in its financial reporting and production process?					
CS02. How frequently does your company apply a plant-wide overhead rate for cost allocation?					
CS3. How often does your company utilize department-specific or multiple plant-wide overhead rates for more accurate cost allocation?					
CS04. How frequently does your organization implement activity-based costing (ABC) to enhance cost-accuracy?					
CS05. How often does your company set and review target costs for its products to ensure competitiveness?					
How often does your company use the following management accounting practices relating to budgeting systems (BS)					
BS1. How frequently does your company use budgeting as a tool for planning future operations and activities?					
BS2. How often does your company implement budgeting to monitor and control costs throughout the fiscal year?					
BS3. How frequently does your company utilize activity-based budgeting to allocate resources based on the activities that incur costs?					
BS4. How often does your company adopt a zero-based budgeting approach, where every expense must be justified for each new period?					
BS5. How frequently does your company engage in budgeting that aligns with long-term strategic planning goals?					
How often does your company use the following management accounting practices relating to performance evaluation systems (PES)					
PES1. How frequently does your company use financial measures to evaluate overall performance and financial health?					
PES2. How often does your company incorporate non-financial measures related to customer satisfaction and loyalty in performance evaluations?					
PES3. How frequently does your company utilize non-financial measures related to operational efficiency and innovation in its performance evaluations?					
PES4. How often does your company assess non-financial measures related to employee performance and engagement in its evaluation processes?					
PES5. How frequently does your company calculate and use economic value added (EVA) or residual income as a part of its performance evaluation system?					
How often does your company use the following management accounting practices relating to strategic management accounting analysis systems (SMAAS)					

SMAAS1. How frequently does your company utilize long-range forecasting to support strategic decision-making and planning?					
SMAAS12. How often does your company conduct industry analysis to inform its strategic management accounting practices?					
SMAAS3. How frequently does your company analyse its competitive position as part of its strategic management accounting efforts?					
SMAAS4. How often does your company perform value chain analysis to identify areas for improvement and competitive advantage?					
SMAAS5. How frequently does your company use product life cycle analysis to guide its strategic management decisions?					
How often does your company use the following management accounting practices relating to information for decision making (ID)					
ID1. How often does your company use the discounted cash flow method to evaluate major capital investment projects?					
ID2. How frequently does your company assess major capital investments using the payback period and/or accounting rate of return?					
ID3. To what extent does your company document and report non-financial aspects when evaluating major capital investments?					
ID4. How often does your company evaluate the risk of major capital investment projects using profitability analysis or computer simulation techniques?					
ID5. How frequently does your company perform sensitivity "what if" analysis when assessing major capital investment projects?					

SECTION C: Financial performance

To what extent do management accounting practices affect the following aspects financial performance of your company? (FP) Rate on a scale of 1 (no extent) to 5 (very great extent).					
FP1. To what extent has the gross profit margin of your company improved due to the application of management accounting practices?					
FP2. To what extent has the return on equity (ROE) of your company increased as a result of implementing management accounting practices?					
FP3. To what extent has the return on assets (ROA) of your company improved due to the use of management accounting practices?					
FP4. To what extent has financial leverage (measured as Equity / Total Assets) of your company increased as a result of adopting management accounting practices?					
FP5. To what extent does the management accounting function in your company contribute to developing strategies that leverage financial innovations to create a sustainable competitive advantage?					

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REGIONAL INTEGRAL ASSESSMENT OF UKRAINIAN FOREIGN TRADE: SHIFTS IN EXPORTS, IMPORTS, GEOPOLITICAL IMPACT AND SPILLOVER ECONOMIC EFFECTS

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Abstract: *This paper provides an in-depth analysis of the regional features of Ukraine's foreign trade in goods, focusing on export and import dynamics for 2024 and historical trends. The study aims to assess the state of foreign economic activity across different regions of Ukraine, using statistical data from the State Statistics Service of Ukraine and Customs Service of Ukraine. The paper explores the key sectors driving foreign trade, such as products of plant origin, machinery, and mineral products, while considering the impact of the ongoing martial law on trade activities. The methodology includes multidimensional ranking techniques, such as integral estimation, to assess regional economic performance based on export-import volumes, business operations, and economic indicators. The key findings reveal significant regional disparities in foreign trade activity, with Kyiv and Dnipropetrovsk regions showing the highest levels of trade. The paper also highlights a decline in overall trade performance compared to previous years, underlining the adverse effects of the current geopolitical situation. The findings suggest that improving Ukraine's foreign economic activity and expanding its international market presence are essential for economic recovery and growth.*

Keywords: *regional development, foreign trade, region, model, assessment, regional disparities, export, import, regional analysis, multidimensional, ranking, resilience, shocks, spatial, spillover.*

INTRODUCTION

The integration of Ukraine into the global economic landscape is a critical factor for its sustainable development and future prosperity. This paper delves into an in-depth analysis of the regional dimensions of Ukraine's foreign trade in goods, examining both export and import dynamics. Utilizing statistical data provided by the State Statistics Service of Ukraine, this study aims to comprehensively assess the state of foreign economic activity across the diverse regions of the country as of January 1, 2024. Furthermore, it contextualizes these contemporary figures by examining historical trends and comparing them with data from 2015 and 2022, offering a longitudinal perspective on the evolution of regional trade patterns.

The structure of Ukraine's foreign trade in goods reveals key sectors driving its international commerce. Notably, the ongoing martial law in Ukraine has significantly influenced this export composition, leading to a redirection of certain goods, particularly machinery and equipment, towards domestic needs. Regional analysis of export volumes indicates a concentration of activity in Kyiv (28%) and the Dnipropetrovsk region (16.7%), highlighting existing regional disparities in trade contribution (Customs Service of Ukraine, n.d.).

On the import side, machinery, equipment, and mechanical appliances, including electrical devices (19.5%), represent the largest category, followed by mineral products (12%) and products from the chemical and related industries (11%). The demand for imported goods

is also geographically concentrated, with Kyiv city (45%), Lviv region (9%), and Dnipropetrovsk region (8%) exhibiting the highest import volumes in 2024 (Customs Service of Ukraine, n.d.). These regional variations in both export and import activities are likely influenced by a confluence of factors, including population density, geographic characteristics, and the overall level of economic development within each region.

Beyond the sectoral and regional breakdown, understanding Ukraine's key international trade partners is crucial. The data presented in this paper reveals a strong reliance on trade with Europe and Asia, a pattern largely dictated by geographical proximity. Interestingly, imports from these continents significantly outweigh exports, pointing to potential inefficiencies in Ukraine's current foreign economic activity. A notable exception is trade with Africa, where export volumes considerably surpass imports.

A comparative analysis of trade data spanning 2015, 2022, and 2024 reveals a concerning trend of declining overall export volumes coupled with increasing imports, suggesting a weakening of Ukraine's economic position and a growing reliance on foreign goods. This underscores the imperative for strategies aimed at bolstering the international presence of Ukrainian-produced goods and services to foster economic recovery and growth.

To provide a robust assessment of the external economic engagement of Ukraine's regions, this study employs a multidimensional approach. Recognizing the limitations of evaluating regional performance based on single indicators, the methodology incorporates integral estimation techniques. This allows for a comparative analysis of regions across multiple criteria, encompassing export-import volumes, business operations related to customs activities, and broader economic indicators. By standardizing and weighting these diverse factors, this research aims to provide a nuanced understanding of the relative foreign economic activity levels across Ukraine's regions, ultimately informing policy recommendations for enhanced international trade and economic development.

1.1.Literature review

The study of regional trade agreements (RTAs) and their impact on international trade has been a significant area of research in recent decades. Studnicka, Thierie, and Van Hove (2019) examined the impact of RTAs on European exports, providing insights into how these agreements shape trade patterns within Europe. Park (2020) offered a broader perspective by analyzing RTAs in East Asia, discussing their historical context and future implications for the region's development. The Regional Comprehensive Economic Partnership Agreement and its implications for Europe, highlighting the interconnectedness of regional trade dynamics across different continents, are either explored by authors (Hilpert, 2025). Qose and Dibra (2023) provided a broader analysis of international trade policies and markets**.**

Several studies have also investigated the factors influencing trade and economic growth in specific regions. Nurjannah et al. (2023) focused on the relationship between inter-regional trade and economic growth in ASEAN countries, emphasizing the importance of corruption control and human development indicators. The authors examined the effects of regional trade integration and the transition to renewable energy on environmental quality in South Asia, adding an environmental dimension to the analysis of trade dynamics (Murshed et al., 2021).

The resilience of regional economies in the face of global challenges, such as trade wars, has also been a subject of scholarly attention. He et al. (2024) explored the role of global connections and local networks in enhancing regional resilience during trade disruptions. The impact of digital trade, trade openness, and foreign direct investment on productivity has been investigated, highlighting the evolving nature of international trade in the digital age (Dai et al., 2025).

In addition to economic factors, other dimensions of regional trade have been explored, such as the ecological implications of trade practices. Mulligan et al. (2023) assessed the risk of invasive species spread through the live bait trade, underscoring the importance of considering ecological factors in trade analysis. The specific context of Ukraine's external sector and regional trade agreements has been examined by several researchers. Lukianenko, Pokydko, and Tokarchuk (2022) discussed the sustainability of Ukraine's external sector in the context of high risks, while Kryvenko (2021) analyzed the realities and prospects of Ukraine's regional trade agreements. Zomchak and Klochnyk (2023) investigated the tendencies, determinants, and interdependencies between various indicators of Ukraine's external sector. Sirenko et al. (2024) conducted a comprehensive analysis of the relationship between international trade relations and regional development, examining the influencing factors. Further contributions to this area include the work of Vdovyn and Zomchak (2022), who explored Ukraine's export in services during the pre-pandemic period, Covid-19, and the ongoing war. Additionally, Zubko (2024) proposed strategies for the development of international trade in Ukraine, offering insights into future directions.

Several studies have also focused on the methodologies used to analyze trade patterns and their economic impacts. Gopalakrishnan, Ciuriak, and Singh (2015) provided a review of models used to quantify mega-regional trade agreements. Harris and Liu (1998) utilized input-output modeling to analyze urban and regional economies, emphasizing the significance of external trade. Jiang et al. (2020) explored methods for improving subnational input-output analyses using regional trade data. Arbolino, Boffardi, and Di Caro (2023) measured regional trade resilience in Italy during crises. Bludova and Savchuk (2017) modeled the economic security of regional external trade flows. Barbero, de Lucio, and Rodríguez-Crespo (2021) measured the impact of COVID-19 on trade flows through government policy responses. Cai (2023) employed a calibrated gravity model to analyze interregional trade. Zhao and Mun (2023) used a panel vector autoregressive model to analyze the impact of the RCEP on intra-industry trade. Khan et al. (2023) used dynamic autoregressive distributed lags model and kernel based regression and examined emissions-adjusted international trade. Kurniawan and A'yun (2022) used an autoregressive distributed lag (ARDL) model to analyze the relationship between export, FDI, and economic growth in Indonesia. Hatipoglu, Considine, and AlDayel (2023) employed a global vector autoregression simulation to study the transnational effects of sanctions. Jafari, Engemann, and Zimmermann (2023) adopted a network perspective in their analysis of food trade and regional trade agreements. Oberhofer and Pfaffermayr (2021) estimated the trade and welfare effects of Brexit using a panel data structural gravity model. Zomchak and Miskiv (2024) used structural equations method.

The application of machine learning techniques in trade analysis has also gained prominence. Blöthner and Larch (2022) revisited the determinants of regional trade agreements using machine learning. Baier and Regmi (2023) utilized machine learning to capture heterogeneity in trade agreements. Kopczewska (2022) discussed the opportunities of spatial machine learning for regional science. Huang et al. (2021) employed a BP neural network approach for regional logistics demand forecasting, and Cheng and Huang (2022) used a deep neural network to analyze regional economic growth factors in the digital economy. Yotov (2022) examined the role of domestic trade flows in estimating the gravity model of trade.

These studies collectively contribute to a broader understanding of the complexities of regional trade, highlighting the importance of considering economic, environmental, and geopolitical factors in the analysis of trade dynamics. They also provide a valuable context for the present study, which focuses on the regional dimensions of Ukraine's foreign trade in goods, offering additional insights into the specific challenges and opportunities faced by the country in its pursuit of enhanced international trade and economic development.

1.2.Export and import in Ukraine

The analysis is based on statistical data regarding regional volumes of foreign trade in goods, provided by the State Statistics Service of Ukraine.

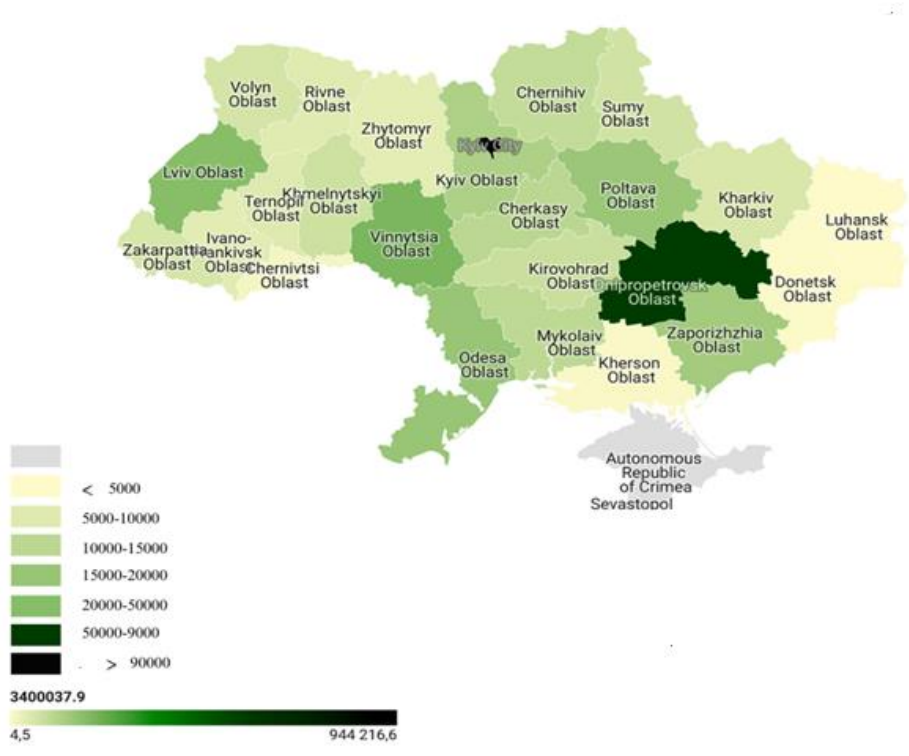
As of January 1, 2024, the total export volume amounted to 3,400,037.91 thousand USD (Customs Service of Ukraine, n.d.). The exported goods can generally be categorized into the following groups: live animals and products of animal origin; products of plant origin; animal or vegetable fats and oils; prepared foodstuffs; mineral products; products of the chemical and related industries; polymeric materials, plastics, and related products; wood and wood products; textile materials and products; footwear, headgear, and umbrellas; articles of stone, gypsum, and cement; natural or cultured pearls, precious and semi-precious stones; base metals and related products; machinery, equipment, and electrical devices; optical and photographic instruments; weapons, ammunition, and their components; various industrial goods; and works of art.

The largest share of exports consists of products of plant origin (37.2%), followed by animal or vegetable fats and oils (15.4%), and prepared foodstuffs (10.1%) (Customs Service of Ukraine, n.d.). This export structure is significantly influenced by the ongoing martial law in Ukraine, as many goods, particularly machinery and equipment, are being redirected for domestic use by the state.

According to the data presented on the map, the highest volume of exported goods originates from Kyiv (28%), followed by the Dnipropetrovsk region (16.7%) (Customs Service of Ukraine, n.d.).

Overall, the structure of regional exports is illustrated in Figure 1.

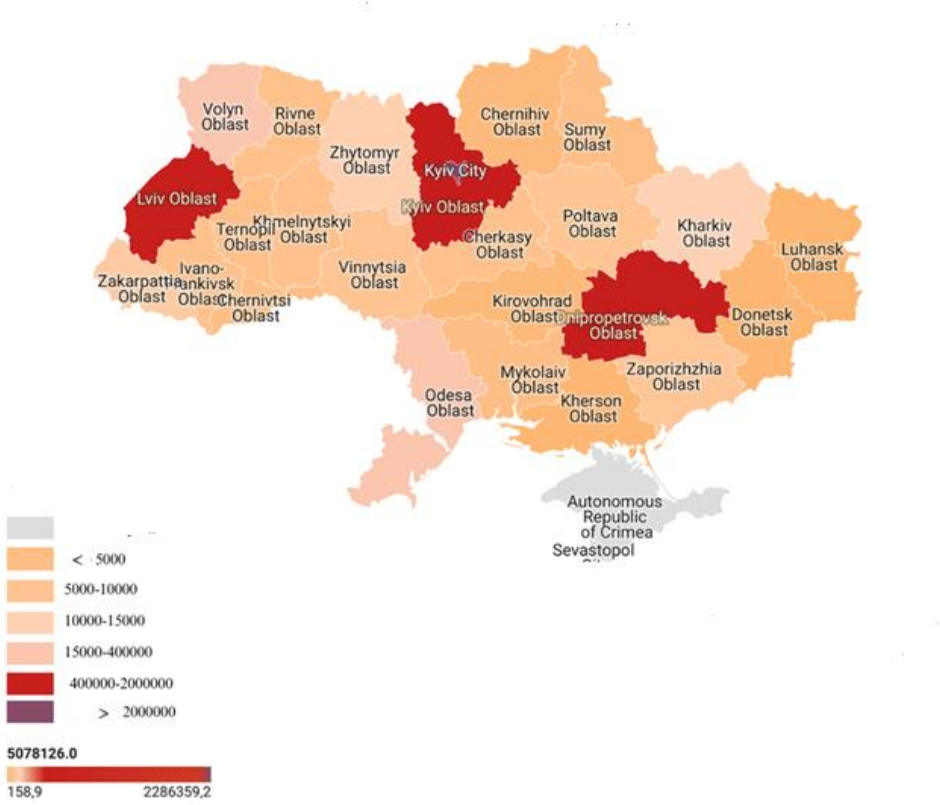
Figure 1. *Regional volumes of goods exports in Ukraine for January 2024*



Source: Developed by the authors based on data from the Customs Service of Ukraine, n.d. and State Statistics Service of Ukraine, n.d.

In terms of imports, the largest categories are machinery, equipment, and mechanical appliances, including electrical devices (19.5%), followed by mineral products (12%) and products from the chemical and related industries (11%) (Customs Service of Ukraine, n.d.). Figure 1.2 illustrates which regions of Ukraine had the highest demand for imported goods in 2024. The leading regions include Kyiv city (45%), Lviv region (9%), and Dnipropetrovsk region (8%).

Figure 2. *Regional volumes of imports of goods in Ukraine for January 2024*



Source: Developed by the authors based on data from the Customs Service of Ukraine, n.d. and State Statistics Service of Ukraine, n.d.

In general, these indicators are influenced by factors such as population size, geographic area, and the level of economic development in each region.

It is also important to examine Ukraine's key trade partners, specifically, the continents with which the country engages in trade and the extent of that cooperation. Relevant data are presented in Tables 1 and 2.

Table 1. *Amount trading partner of Ukraine with continents in exports goods in 2024 (in thousands of US dollars).*

Europe	Asia	America	Africa	Australia and Oceania
1,759	883	108	316	2
EU countries - 1933		CIS countries - 136		

Source: Developed by the authors based on data from the Customs Service of Ukraine, n.d. and State Statistics Service of Ukraine, n.d.

Table 2. *Amount trading partner of Ukraine with continents in imports goods in 2024 (in thousands of US dollars)*

Europe	Asia	America	Africa	Australia and Oceania
2453	1659	324	65	32
EU countries - 2275	CIS countries - 58			

Source: Developed by the authors based on data from the Customs Service of Ukraine and State Statistics Service of Ukraine, n.d.

Ukraine primarily cooperates with Europe and Asia, a trend largely influenced by the country's geographical location. A significant portion of this cooperation consists of imports, which exceed exports by nearly 50%. This imbalance highlights the current inefficiencies in Ukraine's foreign economic activity. The only exception is Africa, where the volume of exported goods is four times higher than the volume of imports.

A comparison of data from Appendix A, which presents statistics for the years 2015 and 2024, reveals a general decline in Ukraine's export volumes, while imports have increased. This trend suggests a deterioration in the country's economic position and a growing dependence on foreign goods. These findings underscore the need to enhance the presence of Ukrainian-produced goods and services in the international market.

METHODOLOGY

To model the external activity of the regions of Ukraine, it is important to analyze the situation that currently exists. It is necessary to compare regions not by one indicator, for example, the balance, but by several that will describe the region from different directions. It is also important to work with the latest data, or by the trend over several years. Such an analysis can be done using a taxonomic or integral assessment (Zomchak, L., & Hakava, S. (2025)).

The first method by which a certain situation can be analyzed is integral estimation. In the initial table X weekend data expressed peculiar for each indicator, in different units measurement. Therefore, it is necessary to calculate the matrix of standardized Z indicators.

The first step is to calculate the average value for each of the criteria. To do this, you can use the formula:

$$\overline{x_i} = \frac{\sum_{j=1}^{m} x_{ij}}{m}, \quad (1)$$

where $\overline{x_i}$is the arithmetic mean value of the criterion,
x_{ij}- value of criterion *i* a certain object research *j* ,
m– number of objects research .

Next The next stage is to calculate the standard deviation for each of the criteria, which is calculated using the formula:

$$\sigma_i = \sqrt{\frac{\sum_{j=1}^{m}(x_{ij}-\overline{x_i})}{m-1}} \quad , \quad (2)$$

where $\bar{x}$is the arithmetic mean value of the criterion,
x_{ij}- value of criterion *i* a certain object research *j*,
m– number of objects research.

These values are needed to calculate the standardized matrix Z. To do this, use the following formula:

$$z_{ij} = \frac{x_{ij}-\overline{x_i}}{\sigma_i}, \quad (3)$$

where $\bar{x}$is the arithmetic mean value of the criterion,
x_{ij}- value of criterion *i* of a certain element *j*,
σ_i– mean square deviation.

Another stage of calculating the integral assessment of the foreign economic activity of the regions of Ukraine is the calculation of partial coefficients, i.e. the matrix K. Assessment comes down to assigning a numerical value level competitiveness.

It should be noted that not all indicators can be converted into partial coefficients in the range (0;1) by dividing by their maximum value, since for stimulating factors the largest value will be the most desirable, and for de-stimulating factors the smallest.

Considering this is necessary distribute all indicators for two groups: stimulating and disincentive factors .

Calculation partial coefficients for disincentive indicators are made as follows:

$$\mathrm{K}_{ij} = \frac{maxz_i - z_{ij}}{maxz_i - minz_i} \quad , \qquad (4)$$

For indicators stimulants The calculation is made using the formula:

$$\mathrm{K}_{ij} = \frac{z_{ij} - minz_i}{maxz_i - - minz_i}, \qquad (5)$$

where $z_{ij}$is the actual value criterion for a certain sample element,
$minz_i$- – minimal value criterion,
$maxz_i$– maximum value criterion.

The final integral score is calculated as the average value for the criteria of each region, that is, according to the formula:

$$\mathrm{I_j} = \frac{\sum_{i=1}^{n} \mathrm{K_{ij}}}{\mathrm{n}} \quad , \qquad (6)$$

where $I_j$is the integral estimate of the jth sample element,
K_{ij}- partial coefficient *i* -th criterion of *j* -th research object,
n– number of criteria.

RESULTS AND DISCUSSION

Each region of Ukraine exhibits varying levels of development, influenced by factors such as geographical location, population size, availability of natural resources, and other indicators. These factors significantly affect the level of foreign economic activity in each region. Assessing the foreign economic activity of Ukraine is a key component in shaping effective economic policy, enhancing competitiveness in the global market, and ensuring the country's sustainable development. Therefore, it is crucial to evaluate the development of foreign economic activity for each region and identify areas where increased state intervention is necessary to support further growth.

In this assessment, both the integral evaluation method and the taxonomic method are used. These methodologies enable equitable comparisons across regions by considering both factors that facilitate and those that hinder development.

Due to the ongoing martial law in Ukraine, data for many indicators in 2024 are unavailable. Consequently, the analysis focuses on the current state in 2024 using the accessible data, alongside a comparative analysis for 2022 and 2015.

For 2024, the following criteria are used to analyze the foreign economic activity of Ukrainian regions:

- Total value of exports of goods and services
- Total value of imports of goods and services
- Number of enterprises authorized to conduct customs brokerage activities
- Number of enterprises authorized to open and operate temporary storage warehouses
- Number of relocated enterprises that have moved to the region

- Consumer price indices

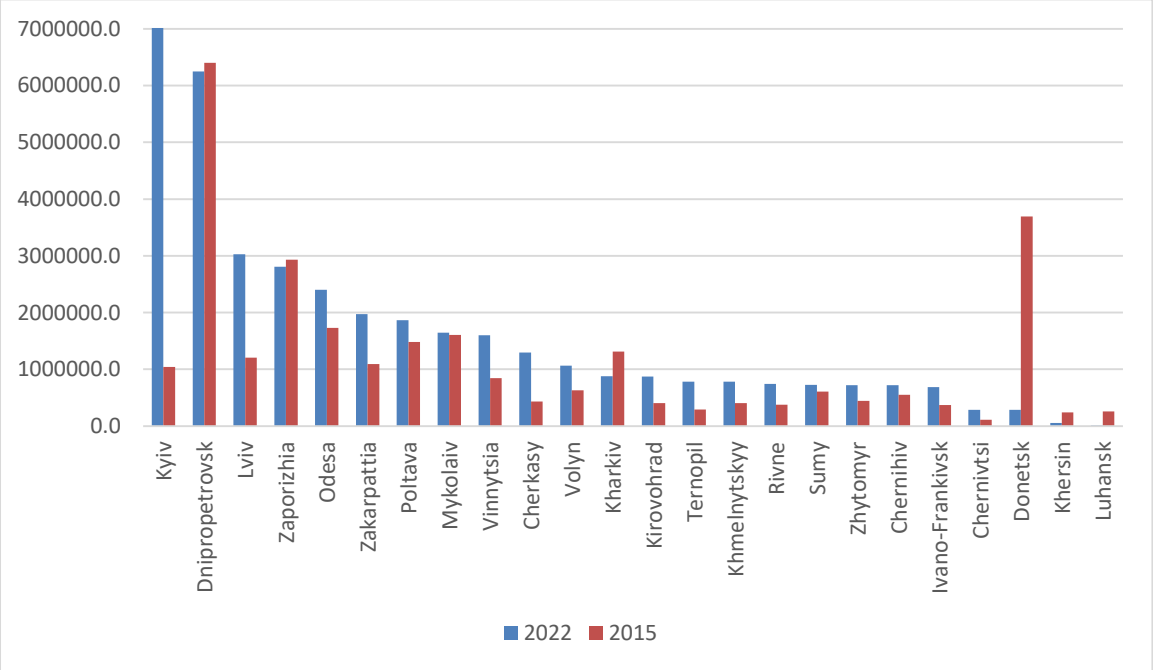
For the years 2022 and 2015, the analysis includes the following indicators:

- Total value of exports of goods and services
- Total value of imports of goods and services
- Number of enterprises authorized to conduct customs brokerage activities
- Number of enterprises authorized to open and operate temporary storage warehouses
- Export volumes by business entities categorized by number of employees
- Consumer price indices
- Capital investments
- Population size
- Import volumes by business entities categorized by number of employees

Data were collected for all 24 regions of Ukraine, with Kyiv included as part of the Kyiv region. The data sources include the State Statistics Service of Ukraine, the National Bank of Ukraine, and the Customs Service of Ukraine.

Since exports and imports are the primary indicators of regional foreign economic activity, it is advisable to track their volumes across the regions. This information is presented in Figures 3 and 4.

Figure3. *Volume of exports of goods and services in 2022 and 2015*



Source: Developed by the authors based on data from the Customs Service of Ukraine, n.d. and State Statistics Service of Ukraine, n.d.

The data on the export of goods of the Kyiv region for 2022 exceed the upper limit and amount to 12,559,421.3 thousand dollars.

From Figures 3 and 4 it can be seen that the highest indicators are in the Kyiv region. This shows the positive development of this region, but imports also have high values, so the situation is ambiguous.

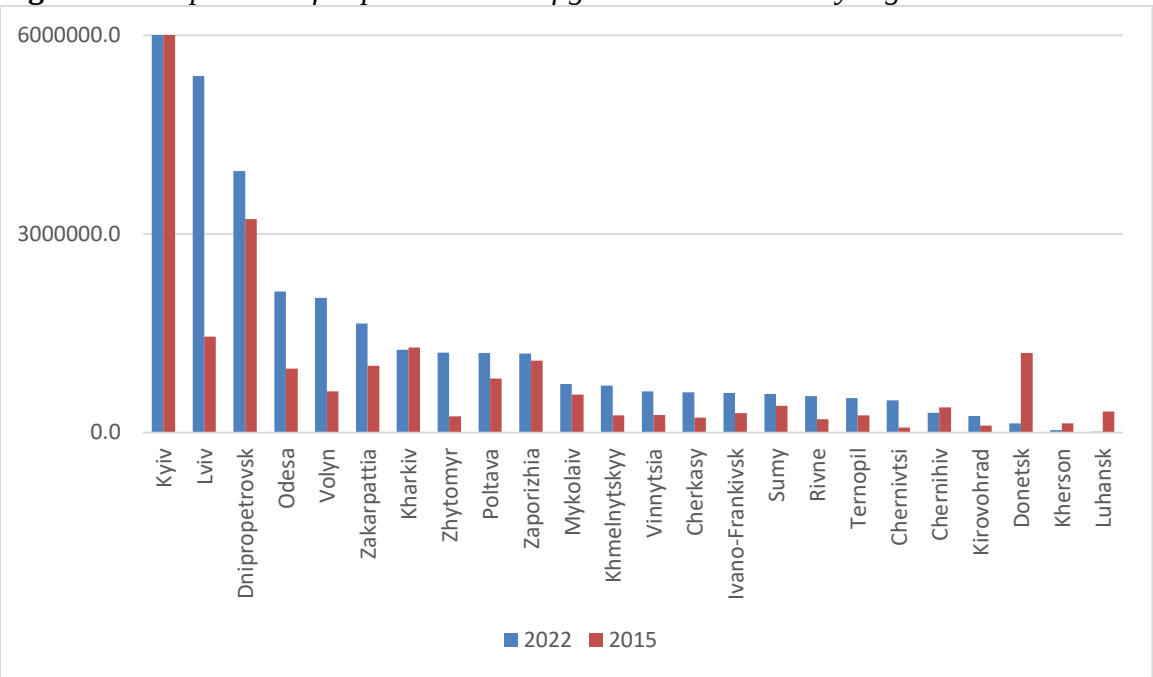
To ensure an accurate assessment of each region, an integral evaluation was carried out using a set of selected criteria, defined as follows:

- Total value of exports of goods and services (X_1)

- Total value of imports of goods and services (X_2)
- Number of enterprises granted permission to conduct customs brokerage activities (X_3)
- Number of enterprises granted permission to open and operate temporary storage warehouses (X_4)
- Number of relocated enterprises that moved to the region (X_5)
- Consumer price index (X_6)

Figure 4 presents a comparison of import volumes of goods and services by region in 2022 and 2015.

Figure4. *Comparison of import volumes of goods and services by regions in 2022 and 2015.*



Source: Developed by the authors based on data from the Customs Service of Ukraine, n.d. and State Statistics Service of Ukraine, n.d.

For the years 2022 and 2015, additional indicators were introduced:

- Total value of exports of goods and services (X_1)
- Total value of imports of goods and services (X_2)
- Number of enterprises granted permission to conduct customs brokerage activities (X_3)
- Number of enterprises granted permission to open and operate temporary storage warehouses (X_4)
- Export volume of goods by business entities, categorized by number of employees (X_5)
- Consumer price index (X_6)
- Capital investments (X_7)
- Population size (X_8)
- Import volume of goods by business entities, categorized by number of employees (X_9)

Using Formula 1, where *m* is the number of regions, average values for each indicator were calculated. The results are as follows:

For 2024: X_1 - 102137.5 , X_2 - 205978.4 , X_3 - 214.6 , X_4 - 7.5 , X_5 - 789.3 , X_6 - 101.0 .

For 2022: X_1 - 1834252.6 , X_2 - 2157382.6 , X_3 - 195.8 , X_4 - 7.0 , X_5 - 930.7 , X_6 - 107.6 , X_7 - 17069.2 , X_8 - 1713768.0 , X_9 - 3880.7 .

For 2015: X_1 - 1185824.2 , X_2 - 1354255.0 , X_3 - 89.6 , X_4 - 1.3 , X_5 - 631.1 , X_6 - 103.1 , X_7 - 10464.8 , X_8 - 1785.2 , X_9 - 985.8 .

The next step involves calculating the standard deviation using Formula 2. The results are presented in Table 3.

Table 3. *Calculated values of the mean square deviation*

	2024	2022	2015
X1	114586.45	2635861.3	1408891.791
X2	541282.39	5151295.573	3418617.903
X3	626.49653	571.5169935	244.01
X4	5.6103876	5.4092	1.6854
X5	1444,408	1088.2	845.27
X6	0.391185	2.9188	0.4634
X7		34519	20272.45133
X8		1030460.687	1035.7
X9		4153.593422	1937.3

Source: calculated by the authors

Since the values of each criterion are expressed in different units of measurement, the matrix of criterion values (X) was standardized to create matrix Z. Standardization was performed using Formula 3, which incorporates the calculated average and root mean square values.

An important consideration in the assessment process is that some criteria reflect a region's development positively when their values are higher, while others have a negative impact. Therefore, the set of criteria is divided into stimulating and destimulating indicators.

For 2024, the stimulating criteria include: X_1, X_3, X_4, and X_5, while the destimulating criteria are X_2 and X_6.

For 2022 and 2015, the stimulating criteria are: X_1, X_3, X_4, X_5, X_7, and X_8, and the destimulating ones are: X_2, X_6, and X_9.

Accordingly, the reference vector for 2024 is:

p = (+, −, +, +, +, −)

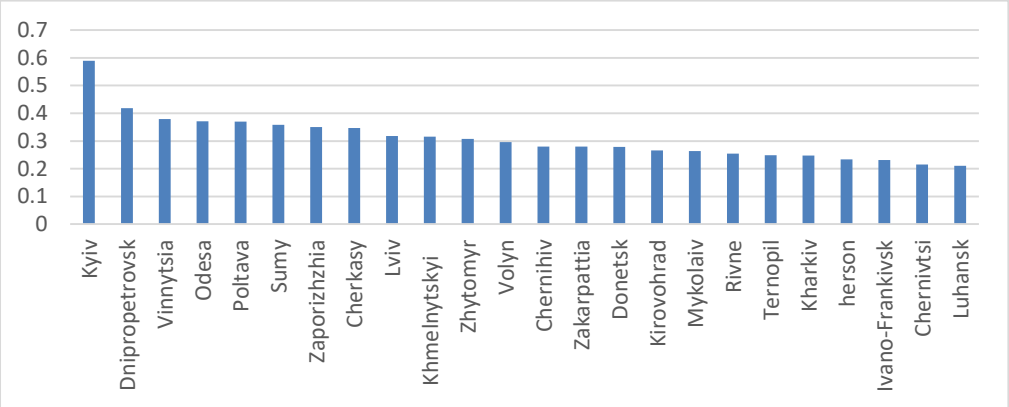
And for 2022 and 2015:

p = (+, −, +, +, +, −, +, +, −)

The next step in calculating the integral assessment of foreign economic activity in Ukraine's regions is the computation of partial coefficients, forming matrix K. At this stage, Formula (1.4) is applied to stimulating criteria, while Formula (5) is used for destimulating criteria.

The final step is the calculation of the integral assessment, obtained as the arithmetic mean of the partial coefficient values (matrix K) for each region. The results are illustrated in Figures 5-7.

Figure 5. *The value of the integrated assessment of regions for 2024*



Source: Calculated by the authors

Based on the data presented in Figures 5–7, it is possible to analyze regional development trends, track the growth or decline of the integral assessment for individual regions, and evaluate the overall situation in the country.

To facilitate this analysis, the regions are classified into five categories based on their integral assessment scores:

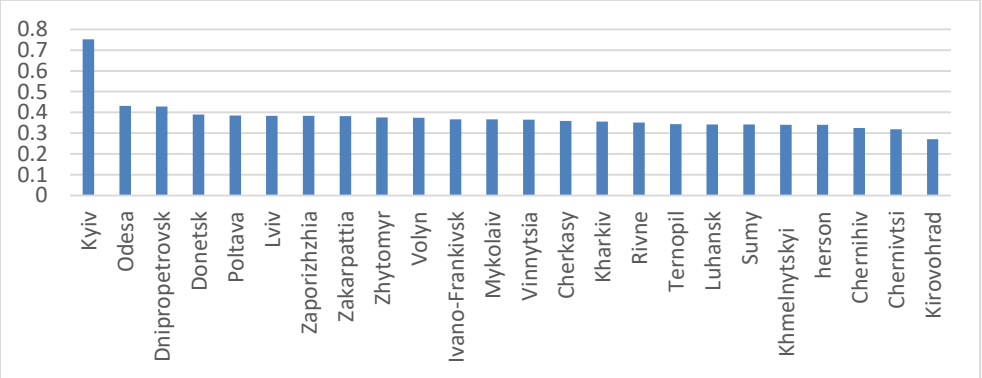
- First class – regions with an integral score of 0.6 and above
- Second class – score within the range [0.5–0.6)
- Third class – score from 0.4 to 0.5 inclusive
- Fourth class – score within the range [0.3–0.39]
- Fifth class – regions with an integral score below 0.3

According to the data for 2024, no region falls into the first class. The second class includes only the Kyiv region. The Dnipropetrovsk region is classified in the third class. Regions such as Vinnytsia, Odesa, Poltava, Sumy, Zaporizhia, Cherkasy, Lviv, Khmelnytskyi, Zhytomyr, and Volyn demonstrate average performance and are therefore assigned to the fourth class. All remaining regions are placed in the fifth class.

It is noteworthy that the Kyiv region demonstrates the highest score, with a gap of nearly 0.2 compared to other regions. This reflects its relatively high level of economic development and active participation in foreign economic activity.

In general, the overall situation in the country is not favorable. The average integral assessment score for Ukraine in 2024 is 0.309, indicating a low level of development in the sphere of foreign economic activity. This outcome is primarily attributed to the ongoing state of war.

Figure 6. *The value of the integrated assessment of regions for 2022*



Source: Calculated by the authors

For 2022 it is slightly better.

In 2022, there is an oblast that belongs to the first group – Kyiv. Its integral score is 0.6. There are no oblasts in the second class.

The third class includes the Odesa and Dnipropetrovsk regions.

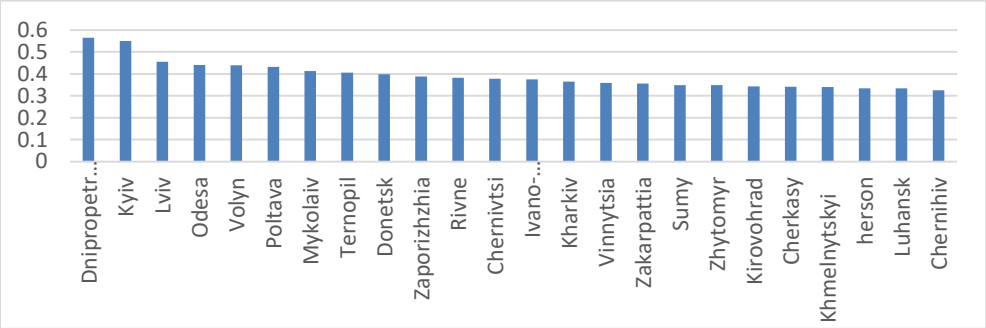
All the rest, except Kirovohrad region, belong to the fourth class. Kirovohrad region, whose integral indicator is 0.27, belongs to the fifth class.

The average value of the integral indicator for all regions of Ukraine is 0.38.

In 2015, no region was included in the first class of regions. Dnipropetrovsk and Kyiv have the highest values, 0.57 and 0.55 respectively, so they belong to the second class. The third class includes 7 regions: Lviv, Odesa, Volyn, Poltava, Mykolaiv, Ternopil and Donetsk. All other regions are classified as class 4. Regions critical fifth- grade students in this year. The average value for all regions is 0.39.

Overall, the trend is downward. The best situation for the country as a whole was in 2015, the worst in 2024. The score fell by 0.09, which indicates the need to improve the foreign economic activity of Ukraine's regions.

Figure 7. *The value of the integrated assessment of regions for 2015*



Source: Calculated by the authors

If we analyze specific regions, we can see that Kyiv region was in second position in 2015, and in 2022 and 2024 it is leading. In 2022, it is the only one that entered the first class. In the remaining regions, such dynamics are not observed.

CONCLUSIONS

This study offers a comprehensive regional integral assessment of Ukrainian foreign trade, meticulously analyzing the shifts in its export and import landscape. Our findings underscore significant disparities in regional performance, with Kyiv and Dnipropetrovsk consistently exhibiting higher trade activity. This concentration reflects an uneven distribution of economic development and participation in international trade across Ukraine, echoing broader regional imbalances observed in contexts like ASEAN countries (Nurjannah et al., 2023). These regional differences are crucial, as they highlight the potential for spatial spillover effects, where the economic vitality or decline of dominant regions can influence the trade performance of neighboring or less developed areas. Understanding these spillover mechanisms is key to fostering more balanced national development.

The analysis further highlights the profound geopolitical impact of ongoing martial law on Ukraine's foreign trade structure and volume. The observed shifts in exports, particularly the redirection of key goods like machinery and equipment towards domestic use and a general decline in overall export volumes, demonstrate the severe challenges posed by the current security situation.

This aligns with Vdovyn and Zomchak's (2022) examination of the war's impact on Ukraine's services exports, reinforcing the notion of widespread disruption. Concurrently, the increasing reliance on imports, predominantly from Europe and Asia, raises concerns about Ukraine's economic vulnerability. This trend resonates with broader discussions on international trade policies and markets (Qose & Dibra, 2023), emphasizing the need to strengthen domestic production capabilities to mitigate future risks and enhance national resilience.

Our integral assessment methodology proved effective in providing a nuanced understanding of regional foreign economic activity. By considering a range of indicators, including export-import volumes, customs operations, and broader economic factors, this approach offers a more holistic evaluation than traditional single-indicator analyses. This innovative methodology builds upon established approaches for analyzing urban and regional economies, such as input-output modeling, but extends it by integrating a broader set of indicators relevant to crisis conditions. The assessment results underscore an urgent need for targeted interventions to improve the foreign economic performance of less developed regions, which are particularly susceptible to negative spatial spillover effects, and to enhance Ukraine's overall competitiveness in the global market.

The comparative analysis of trade data from 2015, 2022, and 2024 reveals a concerning downward trend in Ukraine's foreign trade performance. The deterioration in the country's integral assessment score, particularly amidst ongoing challenges, aligns with the high risks identified for Ukraine's external sector (Lukianenko, Pokydko, & Tokarchuk, 2022). Addressing these challenges is paramount for mitigating the negative economic consequences of the current crisis and laying the foundation for sustainable recovery and growth. This reinforces the importance of proactive measures like those suggested by Zubko (2024) for the development of international trade in Ukraine.

In summary, this research emphasizes the critical importance of enhancing Ukraine's foreign economic activity and expanding its presence in international markets. Our findings call for a multifaceted approach encompassing policy reforms, targeted regional development strategies that account for spatial spillover economic effects, and robust support for domestic industries. This study contributes new insights by offering a detailed, regionally-disaggregated assessment within the context of war. Our use of an integral assessment methodology provides a unique comparative lens, highlighting specific disparities and trends crucial for navigating current difficulties and paving the way for a more resilient and prosperous future.

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PROFESSIONAL GROWTH THROUGH SHORT-TERM INTERNATIONAL MOBILITY: A QUALITATIVE STUDY BASED ON STUDENT REFLECTIONS

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Abstract: *In response to the evolving demands of globalised labour markets, higher education institutions are integrating international and intercultural perspectives into the curriculum to foster students' professional growth by developing core employability skills. This study explores the development of soft and transferable competences through students' participation in a one-week, project-based international mobility programme. Using a structured reflection framework and qualitative content analysis, the article examines 29 student reflections guided by a set of thematically aligned prompts and reflective questions. The findings indicate that even short-term international collaboration can lead to meaningful development of key professional competences, including intercultural communication, adaptability, teamwork, and digital literacy, as shaped by the designed pedagogical activities. Students also reported increased global awareness, clearer career orientation, and enhanced goal clarity in relation to future professional pathways, alongside the practical application of skills in authentic contexts. The results underscore reflective writing as an effective pedagogical strategy in international learning environments, helping students to recognise and articulate otherwise hidden competences. While the study's small sample size presents limitations, the findings support the integration of short, intensive, and internationally diverse learning formats into higher education curriculum to foster employability-relevant skills.*

Keywords: *professional growth, intercultural competence, short-term mobility, international project collaboration, student reflections, employability skills*

INTRODUCTION

Globalisation, the digital transformation of economies, and other contemporary trends require higher education institutions to move beyond the mere transmission of academic knowledge and instead foster the development of competencies essential for professional growth, employability, international engagement, and responsiveness to rapidly changing real-world conditions. In addition to disciplinary expertise, today's graduates must acquire adaptability, flexibility, critical and analytical thinking, technological proficiency, sustainability awareness, and the capacity to clearly communicate and present ideas and innovations (World Economic Forum, 2025). These capabilities are vital for navigating complex, uncertain, and rapidly evolving environments. As a result, higher education institutions are increasingly called upon to adopt flexible, inclusive, and interculturally responsive teaching and learning approaches that support the comprehensive development of students. International learning experiences—regardless of their duration or modality—

provide a critical role in students' professional growth, enhancing their preparedness for effective participation in globally interconnected professional and societal environments.

The objective of this article is to analyse the dimensions of professional growth perceived by students following their participation in a one-week international project-based mobility abroad. This short-term mobility experience was embedded in an innovative teaching and learning framework, where international student teams collaboratively developed project ideas, identified solutions under time constraints, and presented their outcomes. Structured, question-guided student reflections—submitted upon completion of the mobility—were systematically and qualitatively analysed to explore the development of students' experiences, skills, and competencies. The analysis aims to provide insights into how international project collaboration fosters professional growth in a short-term, high-impact learning environment.

The Demand for Trend-Responsive Teaching Methods in International Learning Settings

Innovative, trend-responsive teaching methodologies have proven effective in fostering interactive and student-centered learning environments. These approaches enhance student engagement, performance, and the development of relevant competencies (Al Mamun & Lawrie, 2023; Herodotou et al., 2019; Malekigorji & Hatahet, 2020; Mustafa, 2024; Safapour & Kermanshachi, 2018; Zettinig et al., 2021). In contrast, although traditional teaching methods may deliver content efficiently, they often lack the capacity to promote dynamic engagement and the cultivation of essential higher-order skills such as creativity, critical thinking, and problem-solving (Puranik, 2020). Contemporary education increasingly prioritizes the development of transversal and soft skills—competencies crucial for both societal progress and professional success in today's complex and interconnected world.

Competence-based education reorients learning toward the demonstrable acquisition of skills, moving beyond rote memorization and time-based metrics. Unlike traditional systems that emphasize standardized testing, competence-based education prioritizes mastery of specific competencies—such as problem-solving and technical expertise—while allowing learners the flexibility to progress at an individualized pace (Catacutan et al., 2024; Klein-Collins, 2013). Competence development has emerged as a cornerstone of contemporary pedagogy, aligning educational outcomes with the evolving demands of society and the global labor market. Within this framework, internationally composed classrooms play a critical role in advancing competence development by purposefully integrating global and intercultural dimensions into both formal and informal curriculum. This includes embedding international and intercultural perspectives into the curriculum, such as internationalised learning outcomes, inclusive teaching approaches, culturally diverse study materials, and assessment strategies (Beelen & Jones, 2015; Leask, 2015) that support the development of intercultural competence and other employability skills (Aškerc Zadravec, 2024, 2025).When combined with innovative and trend-responsive teaching methods, such learning environments provide a powerful platform for fostering essential soft skills needed for students' professional growth in international and intercultural settings.

International learning environments—whether facilitated through physical mobility programs, international collaborative projects, virtual mobility (O'Dowd, 2021), or other formats, both short- and long-term—encourage students to step outside their comfort zones. These experiences enable them to navigate unfamiliar contexts, communicate across cultures, and approach challenges from multiple perspectives. In doing so, students develop key competencies such as adaptability, critical thinking, teamwork, digital literacy, and intercultural communication. One of the most prominent European programmes supporting a wide range of international mobility formats is the Erasmus programme, which offers numerous benefits and exerts long-term impacts at the international, national, institutional, and

individual levels, often surpassing the scope of national or regional initiatives (Braček Lalić, 2024). Students participating in Erasmus exchanges consistently report enhanced intercultural openness, personal growth, social engagement, and the development of academic and employability-related skills. Furthermore, they frequently indicate increased European identity, improved communication abilities, strengthened intercultural competence, and a greater capacity to act effectively in unfamiliar situations. These students also describe becoming more open-minded, resilient, and curious (Dolga et al., 2015; European Commission, 2019; Hossain et al., 2022; Rai et al., 2022). The competencies and experiences acquired through such international engagements have also been shown to positively influence students' future employability prospects and career aspirations (Alamo-Vera et al., 2019).

Universities are increasingly skilled in managing internationalisation and providing structured support for the implementation of an *internationalised home curriculum* (Aškerc Zadravec, 2023). This approach plays a crucial role in enhancing the quality of students' international and intercultural experiences, enabling them to engage with diverse teaching methodologies and learning practices comparable to those encountered during physical study abroad (Beelen & Jones, 2015; Leask, 2015; Aškerc Zadravec, 2024, 2025). In a global context where labour markets are becoming more international, interdisciplinary, and dynamic, universities are compelled to adapt their curricula to ensure that graduates are capable of applying their knowledge in diverse, real-world contexts—including international and intercultural settings (European Commission, 2019; Franzenburg, 2017; Marinoni, Bartolomé, & Cardona, 2024; Rumbley & Hoekstra-Selten, 2024).

However, the development of soft skills—and, more importantly, learners' awareness of those skills—often presents a challenge not only for educators but also for students themselves. Learners frequently struggle to recognize the soft skills they have acquired, particularly when such competencies emerge spontaneously or informally. This issue is especially pronounced in intercultural and international learning environments, where competencies developed through cross-cultural collaboration and engagement are often unacknowledged or undervalued by the learners. As a result, these are frequently referred to as "hidden competences" (Finnish National Agency, 2019).

Evidencing Professional Growth Through Student Reflections on International Project Collaboration

Graduates who participate in international exchange programmes often become more confident in competing in the labour market and functioning effectively in everyday life, as such experiences play a significant role in the development of soft skills (Hossain et al., 2022). However, it is essential to raise students' awareness of the specific soft competences they have acquired. Facilitators and lecturers teaching in international or intercultural classrooms should recognise the soft skills students develop in these environments—beyond the acquisition of academic content. Educators can adopt a variety of strategies to enhance students' self-awareness regarding their soft skill development, thereby reinforcing the long-term value of international learning experiences.

Tools for assessing the development of soft skills and professional competences often rely on qualitative methods, such as open-ended survey responses, interviews, or reflective journals. These approaches offer deeper insights into how communication strategies and leadership practices are applied and perceived within academic settings. In particular, the ability to lead and engage students in discussions, collaborative projects, and cross-cultural teamwork requires a nuanced understanding of leadership dynamics in diverse learning environments (Deardorff, 2006). Reflective instruments can be used to evaluate leadership development, not only from the perspective of students but also in terms of how academics

perceive their own growth and apply leadership practices in both classroom and extracurricular contexts (Mestenhauser & Ellingboe, 2011). Pedagogical tools such as teaching or learning portfolios and reflective assessments allow individuals to systematically track their development over time, offering valuable evidence of how their instructional practices adapt to meet the needs of diverse student populations and align with international learning-teaching standards (Marginson, 2011).

According to Daff, Tame, and Sands (2024), reflective practice skills represent a valuable tool for students and graduates in enhancing their self-awareness regarding improved performance and professional development, particularly in relation to critical thinking and the skills and habits acquired through various academic courses. The Oxford English Dictionary (2012) defines reflection as "the action or process of thinking carefully or deeply about a particular subject, typically involving influence from one's past life and experiences." Reflecting on past experiences fosters both personal growth and deeper learning by enabling individuals to extract meaningful lessons and apply them in future contexts. While oral reflection can be insightful, reflective writing offers a more structured and enduring form, allowing individuals to organise their thoughts and explicitly connect personal experiences with academic theory. This process contributes to deeper understanding and supports the development of transferable and professional competences (Beaven & Borghetti, 2015).

The use of reflection significantly influences and supports learning in higher education by emphasizing student-centred and experiential learning approaches and fostering the development of self-directed learners (Chen, Jones, & Xu, 2018). As a pedagogical strategy, reflection enables students to become aware of the competencies they have acquired through engagement with various experiences, emotions, and actions. Experiences alone do not necessarily result in learning or competence development; rather, it is the learner's response—through processes of thinking, evaluating, and making meaning of those experiences—that leads to growth, including planning for future actions (Chan & Lee, 2021; Loughran, 2002). Multiple forms of reflection can be implemented as learning or assessment tools, including blogs, journals, videos, and both in-class and out-of-class reflective assignments. These approaches help students better understand themselves by allowing them to express thoughts, experiences, and knowledge in a structured manner. Through this process, students connect new knowledge with prior understanding, enhancing self-awareness of their actions, strengths, and areas for improvement (Chan & Lee, 2021).

Reflective writing is a valuable pedagogical tool for fostering the development of intercultural competence, as it enables students to critically examine their experiences abroad or in international classrooms and articulate the outcomes of those experiences. This process allows learners not only to gain intercultural awareness but also to demonstrate it through specific instances and examples. Providing students with multiple modes of reflection supports diverse learning styles and facilitates deeper engagement with their study abroad experiences (Nardon, 2019). Furthermore, Matthews (2020) emphasizes the importance of reflexivity in understanding intercultural communication, particularly in enhancing individuals' ability to interpret and adapt to new cultural contexts. Reflexivity serves as a mediating mechanism between intercultural experiences and individual behaviour, supporting the transition from awareness to action. To assist students in recognising and articulating these often-overlooked competences, the Finnish National Agency developed A Toolkit for Recognizing International Competences for Students in Higher Education (2019). This resource provides guiding questions and examples that help students describe the competences developed through international experiences, making them more visible and applicable in the context of employability—where such skills often remain hidden during the job application process.

The Framework of the Research

The significance of developing soft competences through participation in international and intercultural settings has been emphasized in the theoretical framework of this article. Carefully structured student reflections, guided by systematically developed prompts, can play a crucial role in enhancing students' awareness of the soft or hidden competences they acquire in such environments. Despite numerous studies in this field, a *research gap* persists in the analysis of student reflections that are elicited through specifically designed guiding questions. In this study, international students were asked to reflect—using a structured format—on the soft competences they developed during a one-week international mobility experience, which involved intensive, project-based collaboration in diverse student teams.

To address the identified research gap, the following research question is posed:

- What types of soft skills, competences, and impacts are identified in students' reflection essays following their one-week stay abroad and intensive participation in International Project Week activities within internationally diverse student teams?

METHODOLOGY

Context of the Short-Term Mobility Abroad

The reflections analysed in this study were written by international students—most during their Erasmus semester abroad—following their participation in a one-week, intensive, international project-based mobility abroad (with one domestic student included). The programme was preceded by an initial online meeting held one week prior to the on-site activities. This preparatory session introduced the structure and goals of the International Project Week and covered the basics of intercultural communication. The mobility initiative was organised through a collaboration between B2 Ljubljana School of Business (Slovenia) and NHL Stenden University of Applied Sciences (Netherlands), although it was not formally implemented as a Blended Intensive Programme under the Erasmus+ framework. The project week took place in spring 2024 in Ljubljana, Slovenia, and was structured as an innovative teaching and learning model based on experiential, project-based methodology.

During the project week, students were assigned to internationally mixed teams and tasked with developing original project ideas related to international trade, with a specific focus on the Slovenian market context. They engaged in intensive group work, conducted field research and interviews in public spaces and organisations, studied relevant literature, attended facilitators' sessions, and gradually refined their project solutions. Each team presented their progress through daily pitches, guided by clear instructions and mentorship from three experienced international facilitators. The final outcomes were presented to an external panel of professional evaluators and showcased at the International Student Business Fair. There, teams prepared and presented their business stands to an external audience comprising students, faculty, institutional staff, and representatives from industry and the labour market. The event culminated in the selection of a winning team, based on the quality and innovation of their project. The international project week was formally recognised as part of the regular or elective curriculum, integrated within an existing course structure. Upon completion of the programme, students were required to submit structured, question-guided reflections. These reflections were thoughtfully structured to capture evidence of hidden competencies, soft skills, and to highlight students' professional growth and development pathways gained through the intensive, facilitated teamwork experience in an international setting.

Structure of the Population and Data Collection Toolkit

The international student project week involved 33 participants, primarily undergraduate (first-cycle) students, with one student from the second-cycle level. The group

represented 13 different nationalities—Albanian, American, Bosnian, Bulgarian, Dutch, Georgian, Moldovan, Serbian, Slovenian, South African, Syrian, Italian, and Ukrainian. Upon completion of the international project week, all students were required to submit individual reflections. For the purpose of this study, 29 reflections were analysed, provided by students who consented to the use of their reflections for research purposes in anonymous way. Each reflection was approximately 1,250 words in length and written in essay format.

The reflection form consisted of three main sections. The first section collected basic demographic information, including the student's name, home university, country of the home institution, and nationality. The second section focused on competence development and guided students through structured reflection using specific prompts across the following thematic areas: General and networking skills; Communication and interpersonal skills; Teamwork, leadership, and project-related skills; Field-specific competences; and Digital skills.

The third section of the form included appendices with guidelines for reflective writing. These materials provided students with a brief theoretical background on reflection, sample reflections, writing instructions, and an overview of transferable skills and personal qualities valued by employers. These guidelines were also introduced to students during a plenary session.

The reflection form was adapted from the Toolkit for Recognising International Competences (Finnish National Agency, 2019) and was tailored to the specific structure and pedagogical objectives of the International Student Project Week.

Method Used – Qualitative Content Analysis Approach

A qualitative content analysis was conducted to examine students' reflective writings, drawing on the methodological frameworks of Elo and Kyngäs (2008) and Cohen, Manion, and Morrison (2007), with adaptations to suit the specific objectives of this study. The data were inductively coded using a modified interpretative approach based on the work of Glaser and Strauss (as cited in Kordeš & Smrdu, 2015, p. 53; see also Mayring, 2014). Coding units—ranging from individual words and short phrases to complete statements—were identified to capture key ideas and underlying meanings. These units were then grouped into lower-level categories, which were subsequently abstracted into higher-order conceptual themes.

To support the categorisation process, the AI language model ChatGPT was employed as a supplementary analytical tool. Its use facilitated the initial organisation of content into thematic clusters, which was then refined through manual coding and validation. This hybrid approach enabled more efficient pattern recognition while ensuring that analytical rigor and authors' judgment remained central to the interpretative process.

The analytic process involved both segmentation and synthesis of the reflection texts, ensuring that interpretations were grounded in the empirical material. Through iterative linking of coded content to broader conceptual abstractions, the analysis facilitated the identification of semantic patterns and trajectories of intercultural and professional learning emerging from authentic student reflections. Illustrative excerpts from the students' texts were included to support the interpretation of key findings.

RESULTS

Students' reflections were analysed ranging from individual words and word combinations to partial and complete statements in order to identify key ideas, competences, and perceived impacts. In this section, the identified high-level categories are supported by concrete examples drawn from the data, thereby illustrating the core findings and addressing the research question.

It is acknowledged that the categorisation of reflections could be further refined or articulated with greater specificity. Given the complexity and richness of the open-ended essay responses, the statements could have been organised using alternative frameworks or more nuanced structural layers. Nevertheless, for the purposes of this study and in response to the research question, the current structure is considered sufficiently robust to offer meaningful insights. Furthermore, to ensure participant anonymity, individual excerpts have not been attributed to specific students, nationalities, or home institutions.

Table 1 presents the range of competences developed by students through international project collaboration, with particular emphasis on intercultural, communication, and global awareness competencies. The higher-order categories include Developing Intercultural Communication and Teamwork Skills, which is further subdivided into the first-order categories: Flexible Communication Across Cultures, Developing Intercultural Teamwork Skills, and Adapting to Cultural Differences. Another higher-order category, Expanding Global and Regional Perspectives, comprises the subcategories: Exploring Diverse Regional Perspectives and Staying Ahead with Global Trends in the Discipline. Each category is illustrated with representative examples drawn from students' reflective responses, offering insight into the perceived outcomes and professional growth experienced during the short-term mobility programme.

Table 1. *Development of Intercultural, Communication, and Global Awareness Competences*

Higher-Order Category	First-Order Categories	Respondents' Statements – Representative Examples
Developing Intercultural Communication and Teamwork Skills	Flexible Communication Across Cultures	• 'Through projects and teamwork, I honed my ability to adapt my communication to different cultural contexts, fostering understanding.' • 'The bootcamp experience taught me the importance of flexibility in communication, […] and understand non-verbal cues in a dynamic international environment.' • 'Through the bootcamp, I learned to [adapt communication], enhancing my ability to […] collaborate harmoniously across diverse teams.' • '[I gained] valuable skills in cross-lingual communication.' • 'I focused on improving my real-life communication […], project presentation skills […].' • 'I needed to communicate in a different way than I normally would […] due to the different levels of English and the different ways of communication.' • '[I am] able to listen carefully, to be patient and to be able to find a common language even when there are language or cultural barriers.'
	Developing Intercultural Teamwork Skills	• '[International collaboration] enabled me to develop the ability for effective teamwork […].' • 'If there are problems, I know that we can solve them as a team. [Group work] helped me improve my communication and interpersonal skills cross cultures […].' • 'Communication was the key to a nicely done group project […]. We all had to practice it through this international project […].' • 'We had to collaborate as a group to solve the problem […]. I see I am able to work effectively in international group.' • 'Working with new team members from different nationalities and being able to work together […] is already a skill.'
	Adapting to Cultural Differences	• 'I feel that this experience has led me to really adapt to other cultures when it comes to being direct […].' • 'My groupmates were shocked at first by my directness, but they didn't think it was a problem and enjoyed [directness].'

		• '[I] enhanced my adaptability, allowing me to better engage with diverse people and perspectives […].' • 'I learned what it feels like to work in a [foreign environment]. But if I want to learn and explore new experiences then I must [feel] uncomfortable.' • '[I] enhanced my cultural proficiency and [now have] more inclusive and empathetic approach when working with people from diverse backgrounds.'
Expanding Global and Regional Perspectives	Exploring Diverse Regional Perspectives	• 'I strongly feel that my experience during this project has helped me establish very strong connections within the Balkan region and the Caucasus region.' • '[The bootcamp] truly opened my eyes to a completely different Europe than I was used to.' • 'Looking for specialist inspiration in different nations and their markets, this project made me look at everything from a different point of view.' • '[I] gained insights into global markets and trends in different countries.'
	Staying Ahead with Global Trends in the Discipline	• 'Now that I made such a diverse group of friends that I can call my friends, following global trends and markets is going to be much easier.' • 'I consulted with my peers on which channels could be useful for staying informed on future global trends, […] ensuring I can adapt to and leverage these trends for professional growth.' • 'Keeping up with global trends […] helps me anticipate market shifts in various regions, identify opportunities, and mitigate risks.'

Table 2 presents an overview of the career-related skills, goal clarity, and applied learning outcomes that students reported gaining through international project-based collaboration. The higher-order category Shaping Professional Identity and Career Direction is further subdivided into the following subcategories: Boosting Career Opportunities, Clarifying Goals, and Building Essential Transferable Skills. The second higher-order category, Applying Practical Skills for the Workplace, includes the subcategories Applying Skills to Real Work and Advancing Digital and Tech Skills. Each category is supported by representative excerpts from students' written reflections, providing qualitative justification for the identified competence areas.

Table 2. *Career Skills, Goal Clarity, and Applied Learning*

Higher-Order Category	First-Order Categories	Respondents' Statements – Representative Examples
Shaping Professional Identity and Career Direction	Boosting Career Opportunities	• '[These skills are] highly valued by employers, […] a very high competency. […] I significantly improved my soft and hard skills, which I will not forget to mention in my resume.' • 'The skills I learned […] will make me stand out.' • '[It] can greatly benefit my future employer by improving overall efficiency and problem-solving capabilities within the organization.' • '[This] will be useful not only for me and my future job, but even now, it will make my studies at university a lot easier.' • 'These networks can provide valuable resources, mentoring opportunities, career connections, and collaborative partnerships.' • 'I underwent a transformative journey where I realized the critical significance of [international impact]. This awareness extends beyond mere curiosity […].' • 'I have created more connections with incredibly talented and experienced people, which can be very useful in the future.'
	Clarifying Goals	• 'This week was instrumental in helping me identify my true passion and what I aspire to become.' • 'I started to make clearer steps towards my goal, […] clearly understanding […] and finding ideas that would help me achieve it.'

		• 'In a fairly short time, I understood myself better and decided on the profession I want to combine my life with in the future […].'
	Building Essential Transferable Skills	• 'Some specialist skills that I acquired [are] creativity, resilience and complex problem-solving. These skills are easily transferable from/to any job.' • '[…] this project made me look at everything from a different point of view, thinking all the time: 'What would my friend from Georgia say to this?' or 'How would [colleague] from Cyprus solve this problem?' • 'The time pressure that was on this project has taught me that you can still have a result you can be proud of despite having little time.' • 'Strong attention to detail and problem-solving allows me to tackle challenges creatively and adapt to dynamic environments.' • 'I learned new best practices […] such as setting clear communication protocols, establishing deadlines, and utilizing tools effectively.' • 'Conflict resolution and finding compromises – I am ready to quickly respond to problems and find constructive solutions.' • 'I learned the importance of quick decision-making and thinking outside the box […].' • 'The qualities I developed were the ability to control the project and bring all processes to completion, to write concisely and listen actively, the ability to interview people and speak on the go, I […] learned to be more emotionally stable.'
Applying Practical Skills for the Workplace	Applying Skills to Real Work	• '[…] during the bootcamp, I focused on digital marketing and video editing, successfully applying my skills in product promotion.' • 'I developed expertise in data analysis, project management, and strategic planning, […] directly applicable to my desired job.' • '[…] specialist competencies in project management, data analysis, and strategic planning, directly applicable to my job application.' • '[It] helped in gaining insights, easily look into financial trends, come up with different marketing strategies and investment plans.'
	Advancing Digital and Tech Skills	• 'I have developed a hidden competence in working with text-generative AI models. I have gained high-quality skills in prompting these models […].' • 'I enhanced my skills in web development, Canva design, and digital marketing, learning best practices in coding and data visualization.' • 'I used Microsoft Excel to analyse data and create reports. Advanced PowerPoint for creating presentations and graphic materials.' • 'I now have knowledge of Adobe Express, Wix, and Excel. I can express my creativity and do projects quicker […].'

DISCUSSIONS

International student collaboration presents numerous opportunities for learners to develop soft and transversal competencies essential for effective participation in today's unpredictable, fast-changing, and globally interconnected world and labour market. This article investigates how a short-term mobility experience abroad—specifically, an intensive, one-week, project-based collaboration within internationally diverse teams—can meaningfully contribute to students' professional development. The programme applied interactive, trend-responsive pedagogical approaches, with students intentionally placed in culturally diverse teams. Within this framework, students' professional growth was assessed through the analysis of their written reflections. The primary aim of this study was to explore the perceived impact of the international project experience and to identify the competencies students reported developing, thereby addressing the research question of what types of soft skills and outcomes are reflected in students' reflective essays.

Although the reflection form toolkit covered a broad range of focus areas—including general and networking skills, communication and interpersonal skills, teamwork, leadership and project-related skills, field-specific competencies, and digital skills—this article deliberately focuses on selected sections of the reflections most relevant to the research objective. Based on the analysis, and supported by illustrative examples, our findings indicate that students demonstrated notable development in intercultural, communication, and global awareness competences, particularly in the areas of flexible communication, adaptation to intercultural settings, and teamwork within diverse environments. Students also broadened their global and regional perspectives, showing an enhanced capacity to engage with global trends within their respective disciplines. Furthermore, they reported greater career orientation and professional goal clarity, reflecting a strengthened sense of professional identity. These findings align with the Erasmus+ Higher Education Impact Study (European Commission, 2019), which similarly highlights the development of soft skills and career-related benefits—despite the Erasmus study focusing on long-term physical mobility, whereas our findings suggest comparable impacts arising from short-term mobility experiences. These outcomes were frequently linked to applied learning opportunities that supported the development of essential transferable skills applicable across diverse professional contexts. In this regard, it is also relevant to consider the Future of Jobs Report by the World Economic Forum (2025), which identifies international mobility as a key driver in cultivating emerging core skills expected to be in high demand by 2030, including resilience, empathy, social influence, curiosity, flexibility, leadership, etc. Moreover, students described the application of practical skills in real-world settings, with particular emphasis on the advancement of digital and technological competences.

Based on the results obtained from students' reflections, the authors support the view that trend-responsive teaching methods in international learning settings represent a valuable approach for fostering key competences required in today's globalised world—competences that are increasingly sought after by employers. In this regard, various international learning environments, including physical mobility programmes, online international collaborative projects, or virtual mobility, play a critical role in soft and transversal competence development (O'Dowd, 2021). It is equally important to ensure that students become aware of the soft skills and competences they acquire in international and intercultural contexts, as these often remain unrecognised or are referred to as hidden competences. Structured reflective writing, guided by appropriately designed prompts or guiding questions, can enhance students' awareness and articulation of these skills. Our findings align with those of Daff, Tame, and Sands (2024), as well as Beaven and Borghetti (2015), who argue that structured written reflections are an effective means of helping students and graduates become critically self-aware of their professional development and of the skills and habits cultivated through diverse academic experiences, including those in international settings.

Educators facilitating international modules or initiatives should recognise the importance of structured reflective writing as a highly effective pedagogical approach across all forms of international teaching and learning—whether delivered physically or virtually, at home or abroad. This form of reflection enables students to critically process and articulate the international and intercultural perspectives and competences they have acquired, ensuring that these do not remain unrecognised or hidden. At the same time, it is essential to acknowledge the inherently subjective nature of reflective writing and the potential for bias in students' self-reported experiences.

This study has certain limitations, most notably the relatively small sample size of student reflections analysed (29), which restricts the generalisability of the findings. Future research should therefore explore other forms of international collaboration and activities—

whether physical or virtual, conducted abroad or embedded within an internationalised home curriculum. Further investigations could employ alternative qualitative research designs or be complemented by mixed-method approaches. In particular, follow-up studies incorporating quantitative surveys could offer additional empirical support and enable longitudinal tracking of the impact of international learning experiences on students' professional development.

Recognising the added value of even short-term international project-based activities—whether conducted in physical or virtual formats—the integration of brief, diverse, and intensive international projects into the regular higher education curriculum is strongly recommended. Such integration provides students with enriched opportunities to develop competencies that are increasingly valued by employers in today's globally interconnected and rapidly changing world.

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TIME VALUE OF MONEY IN THE LITHUANIAN CREDIT MARKET: A PRACTICAL ANALYSIS OF CONSUMER LOAN OFFERS

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Abstract: *This report uses the Time Value of Money (TVM) framework to evaluate and compare consumer loan offers from three Lithuanian credit providers: Inbank, Artea, and Saldo Bank. Focusing on a loan amount of €5000, the study examines repayment terms of 12, 24, and 36 months, each with different interest rates and administrative fees. By calculating key financial indicators such as monthly payments (PMT), total repayment, total interest paid, and present value (PV), the analysis identifies differences in the actual cost of borrowing. The results show that Inbank offers the most financially favorable terms overall, yet borrowers may still choose more expensive options based on short-term affordability. These findings emphasize the value of using TVM principles in personal finance and highlight the importance of transparent loan structures in helping consumers make informed financial decisions in the Lithuanian credit market.*

Keywords: *TVM, consumer loans, Lithuanian credit market, personal finance*

1. INTRODUCTION

In the recent decade, borrowing has become increasingly popular in Lithuania, explained by rising consumer demand and easy credit access through banks and non-bank lenders (Kanapickienė et al., 2022). According to publicly accessible data on TheGlobalEconomy website, total consumer credit in Lithuania has been recorded at 2.79 billion Euros in March 2025, with a clear positive trend. Lithuania has numerous credit companies offering varying interest rates, fees, and repayment terms. This environment of high lender variety and complex loan structures places importance on reliable evaluation methods. Consumers may be drawn to attractive monthly payments or promotional interest rates without fully understanding how additional fees or longer repayment periods affect the real cost of borrowing (Johnson, 2022). To address this problem, applying the Time Value of Money (TVM) concept may become instrumental. TVM allows individuals to assess the real value of future loan payments in today's terms, which enables them to compare offers by their full financial impact over time, not only surface rates (Kahn & Baum, 2019).

As borrowing becomes more embedded in everyday financial behavior, the ability to interpret complex loan structures can influence not only individual financial well-being but also broader economic stability (Lin & Bates, 2022). Additionally, financially informed consumers are less likely to become overindebted and are better equipped to make optimized borrowing decisions (Lusardi, 2019).

The purpose of this report is to apply the principles of the Time Value of Money (TVM) to evaluate and compare three consumer loan offers from Lithuanian credit providers - Inbank, Artea, and Saldo Bank. By analyzing loans of equal amounts (€5000) across varying repayment terms, the study aims to determine how differences in interest fees, administrative fees, and loan durations affect the total cost of borrowing. Through this assessment, the report seeks to

identify the most financially efficient loan offer and to demonstrate how the concept of TVM can serve as a tool for consumers to make informed borrowing decisions.

2. Literature analysis

The concept of the Time Value of Money (TVM) is a foundational principle in finance, which claims that a monetary unit in the present time is worth more than the same unit received in the future. The principle explains the potential of current funds earning returns over time, which is a central notion in financial decision-making (Fabozzi, 2021). In finance, the TVM is used not only as a theoretical foundation but also as a practical tool to evaluate loans, investments, and annuities - understanding TVM is necessary to accurately determine the value of financial assets with cash flows (Brigham & Ehrhardt, 2017).

Similarly, Ross, Westerfield, and Jordan (2003) present the TVM as a framework through which all future cash flows are evaluated, mainly in the context of investment appraisal and capital budgeting. The authors emphasize that without appropriate discounting of future values, financial analysis becomes flawed. To reinforce this perspective, Gitman and Zutter (2015) describe TVM as a foundation to financial rationality, a tool that allows decision-makers to track the trade-off between immediate consumption and deferred investment.

The quantitative foundation of TVM comprises several key formulas that enable the valuation of cash flows occurring at different points in time. Present Value (PV) reflects the current worth of money that will be paid or received in the future. The calculation of PV involves discounting the future cash flows back to today's terms by accounting for the opportunity cost of capital or interest rate (Brealey et al., 2000). Future Value (FV) represents the amount an initial investment will grow to at a specified point in the future, assuming it earns interest or returns over time. It captures the compounding effect, where interest is earned not only on the original principal but also on accumulated interest from prior periods (Gitman & Zutter, 2006). Payment (PMT) explains the regular, fixed amount of money paid or received in each period of a financial agreement, such as a loan or an annuity. It is calculated based on the loan amount or investment principal, the interest rate per period, and the total number of payment periods (Bracker & Lin, 2018). Interest rate is used to discount or grow money over time. It represents the cost of borrowing or the return on investment, and is expressed as an annual percentage, though in most cases it needs to be adjusted to match the frequency of the payment (monthly, quarterly, etc.) (Westerfield et. al., 2019). As for Total Repayment and Total Interest Paid, the former is the sum of all payments made over the entire term of a loan or investment, representing the full amount returned by the borrower to the lender, and the latter indicates how much additional money is paid over the original amount borrowed or invested, due to interest accumulation (Mishkin & Eakins, 2018).

The concept of TVM is implemented in structuring loan repayment schedules. Once a borrower takes out a loan, the lender will use TVM principles to calculate the fixed periodic payments needed to fully repay the loan over time, factoring in the interest rate and the number of payment periods, which ensures that the lender recovers both the interest and the principal (Dahlquist & Knight, 2022). Borrowers are often faced with multiple loan options with differing interest rates, fees, and payment terms. Applying TVM principles allows them to differentiate between lenders by calculating the present value or effective cost of each loan, revealing which loan is truly less expensive when accounting for timing and size of payments (Gould, 2021).

3. Study Sample

Three consumer credit companies – Inbank, Artea, and Saldo Bank – were selected for their active presence in the Lithuanian lending market and diverse consumer loan offerings. On

each of their websites, an amount of 5000 EUR was chosen and found their annual interest rates respectively: 7.90%, 9.90%, 12%. Although this paper analyses three different repayment periods (36 months, 24 months, 12 months) for the same three companies, the annual interest rate did not change for all three terms. Additionally, all three companies have administration fees: Inbank – monthly 0.29% of the borrowed amount; Artea – monthly 0.25% of the borrowed amount; Saldo Bank – 8,95 € / month.

4. Methodology

This analysis applies Time Value of Money (TVM) principles to evaluate and compare three consumer loan offers from Inbank, Artea, and Saldo Bank. All three companies were analyzed assuming an identical loan amount of 5000 EUR, with varying repayment terms (36,24, and 12 months) and their fixed annual interest rates. The goal was to assess how loan structure affects total repayment cost and the financial burden on the borrower over time.

To conduct the comparison, the following financial indicators were calculated:

Periodic Payment Amount (PMT)

The amount the borrower must pay each month to repay the loan. Calculated using the standard formula:

$$PMT = PV \times \frac{r(1+r)^n}{(1+r)^n - 1}$$

PV – present value
r – monthly interest rate
n – number of periods

Real PMT

Most credit companies have administration fees that are added each month to the PMT and influence the total repayment amount. Calculated by simply adding:

$$Real\ PMT = PMT + fees$$

Fees – monthly administration fees found on each company's website

Total Repayment

The total amount repaid over the life of the loan. In this study, real PMT is used because of the monthly fees. Calculated:

$$TR = real\ PMT \times n$$

Total Interest

The total cost of borrowing. Calculated:

$$TI = TR - PV$$

Present Value

Used to confirm that the value of all three loan offers, when discounted at different rates, results in the same financial value at the time of borrowing. This analysis does not include external costs. PV is also used to illustrate how future payments are valued today using:

$$PV = PMT \times \frac{1 - (1+r)^{-n}}{r}$$

By calculating and comparing these values, the analysis demonstrates how the loan term affects the total cost to the borrower when the present value is constant but interest rates are different. All calculations were performed manually and cross-verified using a financial calculator and Excel.

5. Results

Monthly Payment (PMT) and Administration Fees

The tables present the monthly payment amounts (PMT) and the monthly payment, including administrative fees for a €5000 loan over 36, 24, and 12-month terms from Inbank, Artea, and Saldo Bank.

Table 1. *PMT and Real PMT of a 36-month repayment term*

Term	Company	PMT (€)	PMT incl. admin (€)
36 months	Inbank	156.45	170.95
36 months	Artea	161.1	173.6
36 months	Saldo bank	166.07	175.02

Table 2. *PMT and Real PMT of a 24-month repayment term*

Term	Company	PMT (€)	PMT incl. admin (€)
24 months	Inbank	225.91	240.41
24 months	Artea	230.49	242.99
24 months	Saldo bank	235.37	244.32

Table 3. *PMT and Real PMT of a 12-month repayment term*

Term	Company	PMT (€)	PMT incl. admin (€)
12 months	Inbank	434.71	449.21
12 months	Artea	439.35	451.85
12 months	Saldo bank	444.24	453.19

Data shows a consistent pattern throughout all three loan terms (12, 24, and 36 months): Saldo Bank offers the highest base monthly payments (PMT) due to its higher interest rate, while Inbank generally has the lowest PMT. However, when administrative fees are included, the total monthly cost differences narrow, and in some cases, the company with the lowest interest rate does not offer the lowest total monthly burden.

Total Repayment and Interest Paid

Table 4. *Total Repayment and Total Interest Paid of a 36-month repayment term*

Term	Company	Total Repayment (€)	Total Interest Paid (€)
36 months	Inbank	6154.25	1154.25
36 months	Artea	6249.65	1249.65
36 months	Saldo bank	6300.78	1300.78

Table 5. *Total Repayment and Total Interest Paid of a 24-month repayment term*

Term	Company	Total Repayment (€)	Total Interest Paid (€)
24 months	Inbank	5769.80	769.80
24 months	Artea	5831.85	831.85
24 months	Saldo bank	5863.62	863.62

Table 6. *Total Repayment and Total Interest Paid of a 12-month repayment term*

Term	Company	Total Repayment (€)	Total Interest Paid (€)
12 months	Inbank	5390.53	390.53
12 months	Artea	5422.16	422.16
12 months	Saldo bank	5438.33	438.33

The tables show that while all three companies offer the same amount of €5000, the total repayment and interest paid increase with both the loan term and the interest rate. Saldo Bank consistently has the highest total cost, while Inbank offers the most cost-effective option across all terms. Shorter terms significantly reduce the total interest paid, demonstrating that borrowers who can afford higher monthly payments benefit from lower overall loan costs.

6. Discussions and Recommendations

6.1 Financial Evaluation Using Time Value of Money

Based on the Time Value of Money (TVM) calculations, Inbank is the most financially favorable option across all repayment periods. Despite having slightly higher administrative fees than its competitors, Inbank consistently offers the lowest base monthly payment (PMT) and lowest total interest paid, which directly translates to a lower total cost of borrowing when measured in present value terms. Since all three loans have an equal present value, the differences in total repayment are solely influenced by interest rates, repayment terms, and administrative fees. This confirms the central TVM insight that the longer and more expensive the repayment schedule, the greater the overall costs.

Saldo Bank, in contrast, offers the least favorable loan terms, with the highest interest rate (12%), leading to the highest PMTs and total repayment values. Artea falls between the two but remains closer to Saldo Bank in overall cost than to Inbank.

6.2 Likely Consumer Behavior

From a behavioral standpoint, typical consumers may prioritize monthly affordability over total cost. In this case, Saldo Bank's longer-term loans with lower apparent administrative fees may seem attractive, despite being more expensive in the long run. Borrowers focusing on short-term financial comfort might choose a 36-month option, where monthly payments are more manageable, even though it leads to higher cumulative interest paid. Thus, while Inbank is financially optimal using TVM, a typical borrower might still choose a less cost-effective option due to cash flow constraints or a lack of awareness about the real cost of borrowing.

6.3 Limitations of the Analysis

This study is based on clear, objective TVM metrics, but it does have several limitations. Subjective weights were not assigned to factors such as risk tolerance, income stability, or borrower preferences. The analysis does not account for penalties, early repayment conditions, or promotional offers, which may affect the real cost It assumes borrowers are fully rational, while consumer behavior is often influenced by emotions, financial literacy, or marketing tactics. Monthly administrative fees were treated as fixed, though in practice, they may vary based on conditions not publicly disclosed.

6.4 Recommendations

For borrowers: If financial flexibility allows, choosing shorter-term loans — especially from Inbank — results in lower overall borrowing costs. Borrowers should not focus solely on monthly payments but should also compare total repayment amounts and interest paid.

For lenders: Transparency about total cost, including fees, can build trust. Providing visual comparisons or TVM-based breakdowns may improve financial literacy and client satisfaction.

For future research: Including qualitative assessments, borrower profiles, or simulations with varying income levels would provide a more comprehensive picture of borrowing decisions.

7. CONCLUSIONS

This report applied the Time Value of Money (TVM) framework to compare three consumer credit offers from Inbank, Artea, and Saldo Bank. Although each company offered the same loan amount (€5000), differences in interest rates, repayment terms, and administrative fees significantly influenced the total cost of borrowing. The analysis showed that Inbank consistently provided the most cost-effective option, while Saldo Bank was the most expensive, particularly over longer terms.

The findings confirm that both the length of the loan and the interest rate are critical in determining a loan's true financial impact. While borrowers often prioritize low monthly payments, this study highlights the importance of considering total repayment and interest paid over time. By using TVM principles, borrowers can make more informed financial decisions and better evaluate the real cost of credit.

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