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~ Resilience and Institutional Adaptation in a Context of Systemic Transformations

Resilience and Institutional Adaptation in a Context of Systemic Transformations

Let us be direct: what we call „resilience" has become a convenient substitute for institutional failure.

Across policy documents, strategic frameworks, and managerial discourse, resilience is presented as a desirable outcome. Systems should be resilient. Organisations should adapt. Societies should absorb shocks. Yet the evidence reflected in the contributions to this issue suggests a different reality: resilience is increasingly required not because systems work, but because they do not.

This distinction matters.

A persistent assumption in public policy is that crises are external: economic shocks, technological disruption, geopolitical instability. But the cases analysed in this volume point in another direction. Failures do not originate primarily in shocks. They originate in institutional design choices that systematically prioritise efficiency over robustness, speed over control, and formal compliance over real capacity.

In governance systems, this is visible in its most explicit form. Delegation expands, but oversight does not. Information circulates unevenly, but decisions continue to rely on incomplete signals. Incentives reward delivery, not accuracy; speed, not verification. When breakdowns occur, they are framed as exceptions. In reality, they are logical outcomes of how systems are built.

The same pattern appears in policy frameworks. Digitalisation strategies promise transformation. Energy policies promise transition. Sustainability agendas promise integration. What is consistently missing is structural alignment. Systems are not redesigned; they are layered. New objectives are added without removing old constraints. The result is not transformation, but institutional overload masked as progress.

This is particularly evident in the public sector, where reform is often reduced to tool adoption. Lean, digital platforms, performance indicators–each introduced as a solution. Yet the evidence remains clear: no managerial instrument compensates for structural deficits. Without autonomy, resources, and coherent governance, improvement initiatives remain performative. They exist in reports, not in outcomes.

At the societal level, the gap becomes even more visible. Where institutions underperform, individuals and communities adapt. Informal networks substitute formal coordination. Resilience emerges despite the system, not through it. This dynamic is often interpreted optimistically as social strength. It should be read differently: as a redistribution of responsibility from institutions to individuals.

In this sense, resilience becomes a burden. It shifts risk downward. It normalises instability. It allows systems to persist without addressing their underlying weaknesses.

This raises a policy question that is rarely asked explicitly:

Are we building resilient systems, or are we expecting society to compensate for fragile ones?

If resilience depends primarily on informal adaptation, then institutional reform has already failed. If communities must continuously absorb inefficiency, uncertainty, and inconsistency, then resilience is no longer a property of the system—it is a requirement imposed on those operating within it.

The contributions in this issue do not converge toward a single solution, but they point toward a common constraint: adaptation without structural reform is not resilience—it is prolonged dysfunction.

From a policy perspective, the implication is clear and uncomfortable. The current model—incremental adjustment, layered reform, and symbolic adoption of „best practices"—is insufficient. Systems designed for stability cannot operate effectively in conditions defined by continuous volatility. Yet instead of redesigning them, policy responses continue to optimise within the same constraints.

This is not a technical limitation. It is a governance choice.

Until that choice is addressed, resilience will remain what it increasingly is:

not a sign of system strength, but evidence of how much failure the system can absorb before it is forced to change.

Prof. Ph.D. Paul Marinescu

Regulatory Governance, Managerial Decision-Making, and Safety Failure: The Boeing 737 Max Case

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Abstract: *The Boeing 737 MAX crisis offers a paradigmatic case study in the governance of private and public sector relationships in safety-critical industries. This article examines how the Federal Aviation Administration's progressive delegation of certification authority to Boeing, through the Organisation Designation Authorisation (ODA) programme, created structural conditions for regulatory and managerial failure. These conditions contributed to two fatal accidents in 2018 and 2019. Drawing on institutional theory, principal–agent frameworks, and organisational safety literature, the article analyses four interconnected dimensions of governance failure: the institutional design of the certification system; the informational asymmetries and incentive misalignments that shaped managerial decision-making; the governance of automation as a socio-technical challenge; and the contextual financial consequences of sustained governance failure. The article argues that the MAX crisis was not primarily a product of individual misconduct or isolated engineering error. Rather, it resulted from organisational and institutional structures that systematically discouraged transparency, independent oversight, and safety-first decision-making.*

Keywords*:* Boeing 737 MAX, corporate governance, principal–agent theory, automation governance, organisational decision-making

JEL: L93, L22, M14

1. Introduction

The relationship between private corporations and state regulatory authorities is one of the most consequential dimensions of modern governance. In sectors where technical complexity is combined with public safety, such as aviation, pharmaceuticals, and nuclear energy, effective regulatory oversight depends on the quality of organisational interfaces. These interfaces include the design of delegation mechanisms, the management of information flows, and the alignment of incentives between regulated entities and their regulators.

The Boeing 737 MAX crisis is one of the most thoroughly documented instances of governance failure at this interface in contemporary business history. On 29 October 2018, Lion Air Flight 610 crashed into the Java Sea twelve minutes after take-off, killing all 189 people on board. On 10 March 2019, Ethiopian Airlines Flight 302 went down six minutes after departure, killing all 157 passengers and crew. Subsequent investigations established that both aircraft had been brought down by the erroneous activation of the Maneuvering Characteristics Augmentation System (MCAS), a flight-control software that pilots had not been adequately informed about or trained to counter (Committee on Transportation and Infrastructure, 2020).

The central aim of this article is to examine the Boeing 737 MAX crisis as a failure of managerial governance at the interface of a private firm and a public regulator. The analysis focuses on how organisational design, incentive structures, and the management of automation produced systemic safety failure. Three specific research questions guide the analysis. First, how did the institutional design of the FAA–Boeing certification relationship create structural preconditions for governance failure? Second, how did information asymmetries and incentive misalignments shape key managerial decisions within Boeing and between Boeing and the FAA? Third, how does the way automation is managed within the organisation help explain the governance failures reflected in MCAS design, deployment, and disclosure decisions?

This article contributes to the management literature by integrating regulatory governance theory, principal–agent analysis, and automation governance scholarship into a unified analytical framework. The financial consequences of the crisis are treated as contextual evidence of the magnitude of governance failure, rather than as a primary analytical focus.

2. Literature Review and Analytical Framework

2.1 Regulatory Governance and the Firm–Regulator Interface

The governance of complex technological industries has long been characterised by the agency problem in regulation identified by Mitnick (1980). Regulated entities typically possess superior technical knowledge, which creates an informational advantage that regulators struggle to offset. Baldwin et alle (2012) argue that regulatory effectiveness depends on the degree to which regulators can access, interpret, and act upon information generated by the industries they oversee.

The concept of regulatory capture was first theorised by Stigler (1971) and subsequently elaborated by Carpenter and Moss (2013). It describes a process whereby a regulatory agency

advances the commercial interests of the entities it regulates rather than the public interest. The FAA's progressive delegation of certification authority to manufacturers from the 1990s onward has been characterised as consistent with regulatory capture dynamics (Lutte, 2021; MacPherson and Dillingham, 2020). The ODA programme, formalised under the FAA Modernisation and Reform Act of 2012, institutionalised this delegation. It authorised manufacturers to designate their own employees to perform certification tasks on the FAA's behalf, a design that, according to Lutte (2021), generated structural tensions between independent oversight and commercial incentives.

2.2 Principal–Agent Problems in Certification Systems

The principal–agent framework offers a productive lens for analysing the FAA–Boeing relationship. The FAA, as principal, delegates certification authority to Boeing, the agent, expecting Boeing to act in the public interest. Agency theory predicts that agents will act in their own interests when monitoring is imperfect and incentives are misaligned (Jensen and Meckling, 1976). The United States Senate (2020) documented precisely this dynamic. Boeing employees acting as ODA designees faced internal pressures to accelerate certification timelines, creating a structural conflict of interest that may have influenced the integrity of their assessments.

Coglianese and Lazer (2003) argue that management-based regulation is effective only when accompanied by robust external auditing and transparent information disclosure. The Boeing case illustrates what may occur when these conditions are absent. The FAA's capacity to exercise independent oversight was constrained by staffing limitations, and key decisions about MCAS were made by Boeing engineers who were simultaneously subject to internal commercial pressures.

2.3 Automation Governance and Human–Machine Interaction

Wiener et all (2019) argue that automation introduces categories of failure not addressed by traditional crew resource management frameworks. According to Bainbridge (1983) identified what is called the Ironies of Automation. Automation tends to reduce human proficiency in manual tasks precisely at the moments when manual intervention becomes most necessary. This dynamic was consequential in both MAX accidents: pilots confronted an automated system acting against their inputs under time-critical emergency conditions.

Casner and Hutchins (2019) argue that pilots cannot effectively monitor or override automated systems whose operating parameters have not been disclosed to them. Dekker (2014) observes that system accidents are caused by the interaction of multiple system components rather than by individual error, and therefore require systemic responses. Both perspectives apply directly to the MAX case, where MCAS-related failures reflected a combination of software design choices, inadequate disclosure, and the absence of sensor redundancy.

2.4 Organisational Culture and the Normalisation of Deviance

Vaughan's (1996) analysis of the Space Shuttle Challenger disaster introduced the concept of the normalisation of deviance. This refers to the gradual organisational acceptance of practices that deviate from safety standards when those deviations produce no immediately visible adverse consequences. The framework is applicable to Boeing's handling of MCAS. The decision to classify it as a non-essential system for pilot training appears to reflect a pattern of incremental risk normalisation rather than a single deliberate choice.

Reason (1997) and Hollnagel (2014) emphasise the role of latent failures. These are organisational and managerial deficiencies that create preconditions for active failures at the operational level. Reason's Swiss Cheese Model is particularly relevant here. The MAX accidents illustrate how multiple governance layers exhibited aligned gaps that allowed systemic risk to propagate undetected. These layers included internal safety oversight, ODA certification, FAA independent review, and pilot training standards.

Based on the reviewed literature, the analysis that follows is structured around four analytical dimensions: (1) institutional design and delegation mechanisms; (2) information asymmetry and incentive misalignment; (3) automation governance and human–machine interaction; and (4) the contextual financial consequences of regulatory failure. While prior studies often examine these dimensions in isolation, this article integrates the first three to analyse how managerial and organisational decisions at the firm–regulator interface generated systemic safety failure. The financial dimension is treated only indirectly, as contextual evidence of cumulative governance costs.

3. Institutional Design and Delegation Failure

The institutional design of the FAA–Boeing certification relationship reflects decades of progressive delegation. While this delegation was justified as a means of leveraging manufacturer expertise, it created structural conditions in which independent oversight became increasingly difficult to exercise. The ODA programme placed Boeing employees in a structurally ambiguous position. They were formally acting on the FAA's behalf, but organisationally embedded within Boeing management. This dual accountability structure represents a textbook precondition for principal–agent failure (Jensen and Meckling, 1976).

The Boeing 737 MAX was not a new aircraft type. It was a redesign of the established 737 Next Generation platform, driven primarily by competitive pressure from Airbus's A320neo family. By preserving the MAX's classification as a 737 derivative, Boeing limited the scope of oversight applied to significant engineering changes, including those related to MCAS. Under FAA certification rules, a derivative aircraft is subject to less rigorous independent evaluation than a new type certificate (United States Senate, 2020). This classification illustrates how delegation mechanisms can enable regulatory arbitrage when the boundaries between derivative and novel engineering changes are institutionally ambiguous.

FAA engineers responsible for reviewing MCAS's system safety assessment were not

consistently informed of the full scope of changes Boeing had made to the system. Significant portions of the review were conducted by Boeing engineers who were simultaneously subject to internal scheduling pressures (United States Senate, 2020). The FAA lacked the engineering staffing capacity to independently verify delegated assessments. This was not an incidental deficiency but reflected deliberate policy choices about the appropriate scope of government regulatory activity. The result was a configuration in which managerial incentive misalignment and insufficient monitoring capacity reinforced each other.

4. Information Asymmetry, Incentives, and Managerial Decision-Making

The governance failures observable in the MAX case were shaped by informational and incentive dynamics that influenced managerial decision-making at multiple organisational levels. Two dimensions are analytically important. The first is the asymmetry between Boeing and the FAA regarding MCAS's technical parameters. The second is the internal incentive environment within Boeing, which appears to have discouraged full disclosure of safety-relevant information.

Regarding the Boeing–FAA informational relationship, Boeing engineers substantially expanded MCAS authority during development. The maximum stabiliser deflection was increased from 0.6 degrees per activation in the original certification configuration to 2.5 degrees per activation in the final operational version, a fourfold increase. This change was made without updating the system's safety assessment or communicating it to the FAA's certifying engineers (Committee on Transportation and Infrastructure, 2020; Lutte, 2021). This represents a significant informational asymmetry of the kind that Baldwin et all (2012) identify as a central challenge in governing technically complex industries.

Regarding Boeing's internal incentive environment, organisational pressures appear to have discouraged full upward disclosure of safety-relevant information. The competitive urgency to match Airbus's A320neo, the commercial importance of maintaining the derivative classification, and the financial penalties Boeing faced for delivery delays created an environment where raising safety concerns carried high institutional costs. Vaughan's (1996) normalisation of deviance framework suggests that individual decisions in such environments are rarely straightforwardly unethical. Rather, they represent incremental accommodations to institutional pressures, each locally rational, whose cumulative effect is to erode safety margins.

The decision not to document MCAS in pilot operational manuals illustrates this dynamic clearly. The choice was framed internally as a determination that MCAS was a non-essential system from a training perspective. However, this classification carried significant commercial implications. Disclosure would have triggered simulator training requirements and eliminated one of the MAX's principal competitive advantages. The decision was therefore primarily a managerial one, shaped by competitive and financial incentives rather than by independent safety analysis.

5. Automation Governance and Human–Machine Interaction

MCAS was designed to address an aerodynamic characteristic of the 737 MAX arising from the repositioning and enlargement of the CFM LEAP-1B engines. At high angles of attack, the engine nacelles generated additional aerodynamic lift, increasing the nose's tendency to pitch upward. The system was intended to command the horizontal stabiliser to trim the nose downward automatically when the aircraft's angle of attack exceeded defined parameters (Gelles et al., 2019). From a governance perspective, the critical issue is not the technical design of MCAS per se. It is the managerial and organisational decisions that shaped how MCAS was developed, disclosed, and integrated into the broader socio-technical system in which it would operate.

MCAS highlights the risks that emerge when automation is governed primarily as a technical solution rather than as a socio-technical management system. Three specific governance dimensions are analytically relevant. First, MCAS relied on input from a single angle-of-attack sensor without redundancy. Aviation design standards generally require redundancy for flight-critical systems. This requirement was not applied to MCAS because the system had not been categorised as flight-critical in the aircraft's Failure Modes and Effects Analysis. This categorisation was itself a managerial and regulatory determination. A flight-critical classification would have triggered more rigorous certification requirements and potentially more extensive pilot training.

Second, the absence of pilot awareness of MCAS created a human–machine interaction gap of the kind that Casner and Hutchins (2019) identify as a central risk in automated systems. Pilots who had not been trained on MCAS were unable to recognise its activation, diagnose its behaviour, or implement the procedures that could have counteracted it. Bainbridge's (1983) observation that automation reduces human proficiency in precisely the areas where it intervenes was directly operative in both accidents.

Third, the governance of MCAS disclosure illustrates Dekker's (2014) point that system accidents reflect organisational and managerial choices as much as technical design decisions. The decision not to document MCAS in pilot operational materials was an organisational choice. It was made within an institutional environment that structured the costs and benefits of disclosure in ways that discouraged transparency. Managing automation as an organisational system would have required explicit processes ensuring that automated system parameters were communicated to all relevant stakeholders, including the pilots who depended on understanding those parameters for safe operation.

6. Contextual Note: Financial Consequences of Governance Failure

The financial consequences of the MAX crisis are treated here as contextual evidence of the cumulative magnitude of the governance failures examined above, rather than as a primary analytical focus. Table 1 presents Boeing's consolidated financial performance from 2018 to 2024, based on the company's annual reports (Boeing, 2020; Boeing, 2021; Boeing, 2023; Boeing, 2024a; Boeing, 2024b).

Table 1. Boeing consolidated financial performance, 2018–2024.

Year	Revenue (USD bn)	Net Profit/Loss (USD bn)	Net Margin (%)
2018	101.1	+10.460	+10.3%
2019	76.6	−0.636	−0.8%
2020	58.2	−11.873	−20.4%
2021	62.3	−4.202	−6.7%
2022	66.6	−5.053	−7.6%
2023	77.8	−2.242	−2.9%
2024	66.5	−11.829	−17.8%

Source: Boeing Annual Reports (2019–2025).

Boeing's revenues declined from USD 101.1 billion in 2018 to USD 76.6 billion in 2019. The commercial aircraft segment contracted by 43.9% following the grounding of the MAX fleet in March 2019. The compound effects of the MAX crisis and the COVID-19 pandemic produced a net loss of USD 11.873 billion in 2020 (Boeing, 2021). Across the period 2019–2024, Boeing recorded cumulative net losses of approximately USD 35.8 billion (Boeing, 2024b). Its shareholder equity turned negative from 2020 onward. These outcomes illustrate a central proposition of governance theory: the short-term competitive advantages obtained through regulatory arbitrage were substantially exceeded, over time, by the costs of the governance failures they enabled.

7. Discussion: Managerial and Governance Implications

7.1 Implications for Corporate Governance

The Boeing case suggests that corporate governance frameworks in safety-critical industries need to structurally separate safety authority from commercial authority. When safety assessments are produced within organisational units subject to commercial performance pressures, the institutional conditions for normalisation of deviance are systematically present (Vaughan, 1996). Effective governance requires internal escalation channels that give safety concerns a structural pathway to senior decision-makers. These channels must be insulated from commercial deadline pressures. Board-level safety oversight, distinct from financial performance monitoring, is also necessary.

The ODA programme's structural design highlights an additional corporate governance dimension. When a firm's employees are authorised to certify the firm's own products on behalf of a public regulator, the firm's governance structures bear direct responsibility for the integrity of that certification process. The absence of internal governance mechanisms able to protect ODA designees from commercial pressures represents a corporate governance failure, not merely a regulatory design problem.

7.2 Implications for Managerial Decision-Making

Deadline pressure and cross-functional organisational silos appear to have constrained the upward flow of safety-relevant information within Boeing. The engineers who understood MCAS's operational parameters were not consistently in communication with those responsible for pilot training documentation. Neither group was institutionally empowered to delay commercial delivery commitments on the basis of safety concerns that had not yet produced observable adverse outcomes. This pattern is consistent with Reason's (1997) analysis of latent failures.

The conditions for active failure were created not by a single managerial decision but by the cumulative effect of numerous locally rational choices made within an institutional environment that systematically underweighted long-term safety risks. Managers in analogous environments may benefit from structural mechanisms requiring explicit, documented safety trade-off analysis at key decision points. Accountability for those analyses should be independent of commercial performance metrics. The Boeing case suggests that normalisation of deviance is primarily an organisational design problem requiring institutional solutions.

7.3 Managing Automation as an Organisational Risk

The MAX case illustrates the risks that arise when automation is treated as a self-contained technical system rather than as an organisational and managerial system. Automation in safety-critical systems creates categories of organisational responsibility. These include ensuring that automated system parameters are communicated to all relevant stakeholders, designing human–machine interfaces comprehensible under conditions of stress, and establishing governance processes that treat software-based safety systems as requiring the same standard of independent review as structural or mechanical safety systems.

Where automation is used to compensate for design constraints, the governance of that automation requires particular rigour. When a software system is introduced to manage aerodynamic characteristics that would otherwise require structural redesign, the system inherits the safety criticality of the characteristic it addresses, regardless of how it is classified in internal documentation. Managerial processes for classifying automation systems by safety criticality should be subject to independent review and transparent to all relevant stakeholders.

8. Limitations

This study has several limitations. First, the analysis relies primarily on secondary sources, including official investigation reports, publicly available corporate documentation, and peer-reviewed scholarship. While these sources are authoritative, they do not permit direct observation of internal managerial deliberations. The reconstruction of decision-making processes necessarily involves inference from documented outcomes and institutional records.

Second, the study focuses on the U.S. regulatory context and the specific institutional design of the FAA–Boeing relationship. Generalisation of these findings to other regulatory regimes would require careful contextual analysis. Delegation structures and regulatory design vary significantly across jurisdictions.

Third, the article adopts a qualitative, analytically driven approach rather than a causal

empirical design. The analysis aims to underline the governance mechanisms through which systemic safety failure was produced. It does not seek to establish quantified causal effect sizes. The theoretical propositions advanced here should be understood as analytically grounded arguments rather than as empirically demonstrated causal claims.

9. Contributions and Conclusions

This article conceptualises the Boeing 737 MAX crisis as a failure of managerial governance at the interface of private firms and public regulators. It extends regulatory capture theory and principal–agent analysis into the domain of organisational decision-making processes. Second, the article integrates institutional design analysis, incentive-based decision-making theory, and automation governance scholarship into a single analytical framework. This demonstrates how decisions across multiple organisational levels and functions interact to produce systemic safety failure. Third, the article advances the literature on managing automation. It argues that software-based safety systems must be governed as organisational and managerial artefacts, not solely as engineering solutions.

The Boeing 737 MAX crisis is one of the most consequential and thoroughly documented failures of public and private sector cooperation in the history of commercial aviation. This article has argued that the crisis was not primarily the result of isolated misconduct or individual engineering error. It resulted from structural deficiencies in the institutional relationship between Boeing and the FAA, deficiencies that were themselves the product of deliberate policy choices, competitive pressures, and decades of progressive regulatory delegation.

Addressing these structural deficiencies requires more than regulatory reform, though regulatory reform is necessary. It also requires managerial governance frameworks that separate safety authority from commercial authority, create institutional channels for the transparent upward communication of safety-relevant information, and treat automation governance as an organisational responsibility rather than a purely technical one. The Boeing 737 MAX case underlines that public safety in aviation can be guaranteed only through genuinely transparent, institutionally robust, and managerially disciplined cooperation between private manufacturers and government regulatory authorities.

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Reframing Donabedian's Model as an Operational Maturity Framework: Evidence from the Romanian Public and Private Healthcare

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Abstract: *The relationship between operations management practices and healthcare quality is well-established in the literature, yet the conditions under which these practices can be successfully transferred across organisational contexts remain poorly understood. This paper proposes a reinterpretation of Donabedian's classic structures-processes-outcomes model as a hierarchical operational maturity framework for healthcare organisations, in which progress on higher-order dimensions is conditioned on sufficient maturity at lower-order dimensions. The framework is applied to the Romanian healthcare context, where a sharp and well-documented asymmetry between the public and private sectors provides an instructive analytical setting. Drawing on documentary analysis of public sources including ANMCS accreditation reports, Eurostat and OECD data, peer-reviewed governance assessments, and private network annual reports, the paper identifies a structural maturity gap as the primary constraint on the transferability of operational excellence tools (TQM, Lean, Six Sigma) to Romanian public hospitals. Four theoretical propositions are advanced, with implications for healthcare management practice and future empirical research.*

Key words: operations management, operational excellence, Donabedian model, healthcare quality, public-private healthcare

JEL: M11, L32

1. Introduction

Healthcare quality stands as one of the most persistently debated subjects in contemporary management science - across academic literature, among clinicians and patients, and between managers of public and private hospitals alike. The role that quality management plays in health services, and the degree to which successful management practices from other sectors can be integrated into healthcare organisations, have generated a substantial and unresolved body of research. At the centre of this debate lies a fundamental and still-open question: to what extent are management practices and processes applicable across a wide range of organisations, regardless of their public or private nature?

This paper argues that the existing literature has insufficiently addressed the structural preconditions for operational excellence in healthcare. While much attention has been devoted to the tools of quality improvement - Total Quality Management, Lean, Six Sigma - considerably less has been given to the organisational conditions that must be in place before these tools can function effectively. A hospital that lacks managerial autonomy, adequate infrastructure, and integrated information systems will not benefit from Lean implementation in the same way as one that possesses these structural foundations.

To address this gap, the paper proposes a reinterpretation of Donabedian's (2003) model - the most widely used conceptual framework in healthcare quality - as a hierarchical operational maturity grid. In this reinterpretation, the three Donabedian dimensions (structures, processes, outcomes) function not merely as independent evaluation categories but as interdependent maturity levels. This theoretical contribution is then applied to the Romanian care system, which provides an unusually clear empirical setting: a well-documented, extreme asymmetry between a chronically underfunded public sector and a rapidly professionalising private sector makes the structural dimension of quality analytically visible in ways that more uniform systems would not permit.

2. Relevant literature

Two branches of management science developed historically in parallel: one inside the private domain and one inside the public domain. This conventional taxonomy has been increasingly disputed, and a more generic approach to management - one that transcends the public-private divide - has developed around it. Researchers today claim that management has universal applicability, whether in business or in the non-profit public sector. Yet one of the major unresolved problems in the management literature has been the extent to which management processes and practices are transferable across a wide range of organisations (Fottler, 1981).

The debate dominated the 1970s and 1980s, questioning whether meaningful differences exist between the ways organisations in the public and private fields are structured and managed. One perspective identified significant differences reflected in the very terminology used: 'management' described how private companies were run, while 'administration' described how public organisms were run. The former was associated with decision-making driven by efficiency and organisational growth; the latter with the implementation of governmental policies within

a legal framework, in which efficient resource use was of secondary importance (Farnham and Horton, 1996).

A convergent perspective, however, gained ground. Murray (1975) suggested that management practices for public and private organisations are convergent, as both face similar constraints and challenges. A central element of the New Public Management reform agenda (Ferlie et al., 1996) is precisely the proposition that public organisations should import leadership processes and behavioural patterns from the private sector. Yet this position was also strongly challenged. Allison (1979) argued that the idea of a significant body of management knowledge directly transferable from private to public management - in ways that would produce genuine improvements - was fundamentally mistaken. Quantitative research has discovered differences between public and private organisations in human resource management (Boyne et al., 1999), ethical issue management (Berman et al., 1994), and decision-making processes (Nutt, 2000), while qualitative studies found differences in strategic management styles (Boyne, 2002).

This argument aligns closely with contingency theory in organisational analysis, which rejects the existence of universally optimal management practices and instead emphasises the fit between organisational context and managerial structures and processes. Donaldson (2001) argues that organisational performance depends on the alignment between contextual contingencies - such as size, environment, technology, and institutional constraints - and internal organisational arrangements. From a contingency perspective, management tools and practices cannot be evaluated independently of the structural conditions within which they are deployed. Applied to healthcare operations, this implies that process-level improvement instruments such as Lean, TQM, or Six Sigma cannot be expected to generate consistent performance gains in organisations whose structural endowment is misaligned with the requirements of these tools. The reinterpretation of Donabedian's framework proposed in this paper is therefore compatible with contingency theory, insofar as it treats structural maturity as a binding condition that shapes the effectiveness of process interventions.

The conclusion that management techniques can be successfully exported from one sector to another is therefore questionable, given differences in organisational environments, goals, structures, and managerial values. Such variables represent a set of contingencies that may require substantially different management approaches in public and private organisations. Yet Voss et al. (1985), Chase and Prentis (1987), and Prasad and Babbar (2000) demonstrated that public organisations including schools and hospitals - and even international bodies such as the United Nations - can improve their operational efficiency by adopting tools and techniques developed in manufacturing systems.

The literature on quality management in healthcare adds a further dimension. Arndt and Bigelow (1995) specifically examined the fit between TQM and hospital environments, identifying structural and cultural factors that complicate implementation. Goldstein and Naor (2005) provided empirical evidence linking the publicness of an organisation to its quality management practices, finding that more public organisations exhibit systematically different quality management profiles from more private ones. This paper builds on this tradition while advancing the argument that the structural dimension - rather than sector identity per se - is the operative

constraint.

A complementary explanation is provided by institutional theory, particularly the concept of institutional isomorphism. DiMaggio and Powell (1983) argue that organisations operating within highly institutionalised fields tend to adopt formal structures and practices primarily to achieve legitimacy rather than to improve performance. In such contexts, managerial reforms may function as symbolic compliance mechanisms, decoupled from underlying operational realities. This perspective is particularly relevant to publicly funded healthcare systems, where accreditation systems and quality certification requirements may encourage ceremonial adoption of quality frameworks without the structural capacity required for their effective implementation. The Romanian accreditation regime, as discussed in this paper, can be interpreted through this lens: quality management structures exist formally, but their operational impact remains limited in the absence of managerial autonomy, financial resources, and integrated information systems. Institutional theory thus helps explain why adherence to quality standards does not automatically translate into performance improvement in structurally constrained public hospitals.

3. Landmarks in operations and quality management

The lineage of operations and quality management stretches from Adam Smith's 1776 account of the division of labour through the Industrial Revolution and into the systematic frameworks of the twentieth century. F. W. Taylor's scientific management (1911) introduced data-driven analysis of production processes; Walter Shewhart's Statistical Process Control (1920s) shifted the emphasis from post-production inspection to real-time defect prevention. After 1940, the rise of computing gave managers new analytical capabilities and accelerated the shift from quantity to quality as the primary performance criterion.

The major quality management frameworks emerged in the second half of the twentieth century. Deming, Juran, Crosby, Feigenbaum, and Ishikawa each contributed to the body of knowledge now known as Total Quality Management (TQM), centred on statistically controlled processes, total employee involvement, and continuous improvement. The Toyota Production System gave rise to Lean manufacturing, which eliminates seven categories of waste: overproduction, waiting, transport, overprocessing, excess inventory, motion, and defects. Six Sigma, developed at Motorola in the 1980s, added a rigorous statistical methodology for reducing process variation. All three frameworks share a common ambition: to improve quality and reduce costs through systematic process management. Their extension from manufacturing to service organisations, including hospitals, has been extensively documented (Voss et al., 1985; Chase and Prentis, 1987; Prasad and Babbar, 2000) and constitutes the direct lineage of this paper.

Operational performance is currently measured across five dimensions: cost, quality, availability, flexibility, and innovation. Crucially, the adoption of best practices cannot be treated as a universally applicable solution: industrial context, national culture, organisational size, and structural endowment all mediate the effectiveness of operational improvement efforts - a finding central to the argument developed in this paper.

4. Quality dimensions in healthcare: the Donabedian model

Avedis Donabedian is considered the creator of the modern quality concept in healthcare. He defined healthcare quality as 'the kind of care that will maximise the patient's wellbeing, taking into account the balance between expected gains and losses in all stages of the healthcare process' (Donabedian, 2003). The World Health Organization defines the quality of a healthcare system as the 'degree to which it achieves the implicit goals of improving health and responding to general expectations'. Healthcare quality depends on human resources as well as physical, financial, and technological resources.

Donabedian identified three fundamental dimensions of healthcare quality: structure, process, and outcome. Structure represents the relatively stable features of the healthcare provider, including buildings, equipment, staffing, and financial resources; it is the precondition for process, because without adequate structural endowment, processes cannot be systematically managed or improved. Process refers to the activities carried out within the provider-patient relationship, including clinical evaluation, treatment, communication, and support activities. Outcome refers to the change in current or future health status attributable to healthcare provided - the ultimate validator of quality, reflecting whether structural and process investments have achieved their purpose.

From these three dimensions, Donabedian derived a comprehensive set of quality attributes: efficacy, efficiency, optimisation, accessibility, legitimacy, professional competence, interpersonal relationships, continuity, safety, physical infrastructure and comfort, patient choice, and equity. Notably, Donabedian himself, in interviews with Fitzhugh Mullan (published posthumously in 2001), reflected that the model's analytical power was inseparable from human motivation: 'Systems are only mechanisms that allow reaching quality. It is the ethical dimension of individuals that becomes essential in achieving success for a system. One must love the patient and one's profession' (Mullan, 2001). This humanistic complement to a structural-analytical framework is important: the model describes necessary conditions, not sufficient ones.

Within the healthcare quality literature, Berwick's work on continuous improvement provides further support for the proposed framework. Berwick (1989) argues that quality improvement in healthcare requires not merely the application of technical methods, but the creation of organisational systems capable of learning, measurement, and sustained change. Later work emphasises that improvement initiatives fail when organisations lack the infrastructural and cultural foundations necessary to support them (Berwick, 1996). This resonates directly with the hierarchical reinterpretation of the Donabedian model advanced here: structural maturity enables learning and process control, which in turn make outcome improvement sustainable rather than episodic. Berwick's emphasis on systems thinking reinforces the view that quality tools cannot compensate for fundamental structural deficiencies but instead presuppose their existence.

A similar conclusion is reached in Øvretveit's work on quality improvement in health services, which stresses the contextual and organisational preconditions for effective quality management. Øvretveit (1992; 2009) highlights that successful quality improvement depends on leadership capacity, information systems, resource availability, and organisational stability, factors that correspond closely to the structural dimension of Donabedian's framework. Quality

methods are described not as standalone solutions, but as components of broader organisational systems. This perspective supports the argument developed in this paper that process-level interventions cannot substitute for structural reform. In healthcare systems characterised by constrained resources and politicised governance, the impact of quality improvement programmes is therefore expected to remain limited unless accompanied by changes at the structural level.

5. Theoretical framework: Donabedian as an operational maturity grid

The theoretical contribution of this paper lies in the reinterpretation of Donabedian's model - originally conceived as an evaluative framework for healthcare quality - as a hierarchical grid for assessing and guiding operational maturity in healthcare organisations. The proposal is not merely terminological. It argues that the three dimensions function as interdependent levels in which progress on higher-order dimensions is conditioned on sufficient maturity at lower-order dimensions.

In the original Donabedian model, structures, processes, and outcomes are related but essentially parallel evaluation categories. The contribution here is to make their dependency relationship explicit and directional: adequate structural endowment (D1) is a necessary precondition for effective process management (D2), and reliable outcome improvement (D3) follows from, and cannot systematically precede, process excellence. The instruments of operational excellence - TQM, Lean, Six Sigma, PDCA - are fundamentally process-level tools (D2). Their documented failure when deployed in structurally deficient organisations is not a failure of the tools themselves, but a predictable consequence of deploying D2 interventions in organisations that have not achieved D1 maturity. The framework provides a diagnostic logic: before committing to process-level improvement programmes, organisations should assess their structural maturity. Where structural deficits are severe, investment in process tools is likely to produce marginal returns unless accompanied by parallel structural reform.

This argument also has a normative implication for policy. When public health systems attempt to improve quality outcomes through accreditation mandates and quality certification programmes - without addressing the underlying structural deficit - the framework predicts that improvements will be limited and unstable. The Romanian case, examined in the following section, provides a particularly clear illustration of this dynamic.

While Donabedian's structure–process–outcome framework is sometimes criticised for implying a linear and simplified view of quality production, this paper does not treat the model as a mechanistic or predictive device. Instead, it draws on Donabedian's original emphasis on necessary rather than sufficient conditions to reinterpret the framework as a diagnostic logic of organisational maturity. The proposed hierarchical reading does not assume deterministic causality between structures, processes, and outcomes; rather, it foregrounds structural adequacy as an enabling condition for process-level interventions to function systematically and for outcome improvements to become reliable rather than episodic. In this sense, the model is used analytically, not normatively: it serves to identify binding organisational constraints on quality improvement, not to prescribe a universal sequence of reform. This interpretation is consistent with both

Donabedian's later reflections on the human and ethical dimensions of quality and contemporary operations management research on contextual contingency, which shows that identical process tools produce divergent results depending on underlying organisational endowments.

6. Application to the Romanian healthcare context

The Romanian healthcare system provides an instructive setting for applying the proposed framework. It is characterised by a sharp and well-documented asymmetry between a chronically underfunded public sector and a rapidly professionalising private sector - a contrast that makes the structural dimension of Donabedian's model analytically visible in ways that more uniform systems would not permit. This section draws on documentary evidence from publicly available sources: ANMCS reports, Eurostat and OECD data, peer-reviewed governance assessments, and private network annual reports. No primary data collection was conducted; the analysis is documentary in nature and serves as illustrative evidence for the theoretical propositions in Section 7.

6.1 Comparative analysis: the Donabedian maturity framework applied

Table 1 presents the framework applied across the three Donabedian dimensions, comparing public hospitals and private healthcare networks in Romania.

Table 1: Donabedian Operational Maturity Framework - Romanian public versus private healthcare

Dimension	Indicator	Public hospitals (Romania)	Private networks (Romania)
D1 Structures	Funding and physical infrastructure	5.8% of GDP - lowest in the EU; per capita spending EUR 1,800 vs. EU average EUR 3,832 (European Commission/ OECD, 2025). Of 554 public hospitals in 2023, only 4 were built after 1989; most buildings predate 1980 (Statista, 2025).	Continuous investment. MedLife and Regina Maria deployed over EUR 100 million in infrastructure (2019-2024). Modern facilities with advanced imaging, robotic surgery and integrated IT platforms (MedLife, 2024).
	Managerial autonomy	Severely constrained. Hospital managers are politically appointed and subject to replacement upon government changes. Governance studies confirm systematic misalignment between responsibility and decision-making authority (Duran et al., 2019).	High autonomy. Professional management teams operate under market-driven KPIs with full strategic, financial and operational independence, accountable to boards rather than political authorities.
	IT and information systems	Fragmented. Inconsistent reporting formats across hospitals; limited analytical capability; digital health tool use below EU average (European Commission/ OECD, 2025; Duran et al., 2019).	Integrated ERP and HIS systems. ISO 15189 in all MedLife laboratories; online patient portals; network-wide KPI dashboards enabling real-time performance monitoring.

D2 Processes	Quality management framework	ANMCS accreditation is mandatory but sets minimum compliance thresholds, not excellence. No public hospital holds Category I (highest) accreditation. Most achieve Category II ('accredited with recommendations') (ANMCS, 2024).	Certifications beyond ANMCS minimum: ISO 9001, ISO 15189. MedLife Maternitate: CONAS accreditation at highest confidence level; UNICEF 'Baby-Friendly Hospital' certification (MedLife, 2024).
	Lean, TQM, Six Sigma deployment	Largely absent. Quality committees documented as non-functional in governance case studies. Resistance to change and bureaucratic rigidity are systemic barriers. No evidence of systematic Lean or Six Sigma deployment in public hospitals (Duran et al., 2019).	Lean applied to supply chain and patient flow. Appointment scheduling optimised across network locations. Continuous improvement culture embedded in management contracts and performance reviews.
	Organisational improvement culture	Politicisation of management undermines continuity. Research confirms managerial decisions shaped by political and economic pressures rather than quality imperatives (Cumpăt et al., 2024). Voluntary rather than mandatory quality improvement mechanisms persist (Vlădescu et al., 2016).	Market competition drives continuous improvement. Patient satisfaction (NPS) measured systematically. Management tenure linked to performance rather than political cycle. Publicly reported KPIs create external accountability.
D3 Outcomes	Patient safety and clinical outcomes	Romania has the highest treatable mortality rate in the EU: 215 deaths per 100,000 population (2022), defined as deaths avoidable through timely healthcare (European Commission/OECD, 2025). Nosocomial infection reporting is acknowledged as underestimated.	Private networks report lower adverse event rates, linked to standardised clinical protocols and systematic infection control. Targeted specialties (oncology, maternity) show measurable outcome improvements.
	Patient satisfaction and access	Unmet medical care needs above EU average (Eurostat, 2024). No national NPS or satisfaction benchmarking. Waiting times unmonitored and unreported in standardised format.	Patient satisfaction systematically tracked via NPS. Online booking and reduced waiting times are competitive differentiators. Regina Maria and MedLife report satisfaction indicators in publicly available annual reports.
	Transparency and benchmarking	No national hospital benchmarking system. ANMCS publishes aggregated accreditation data, not comparative institutional performance indicators. Monthly public reporting became legally mandatory from October 2025, a first step toward transparency (FEMS/CFSMR, 2025).	Annual sustainability and performance reports published (MedLife, Regina Maria). Investor-grade operational KPIs publicly available. Network-level benchmarking enables internal comparison across facilities.

Source: Authors' own contribution, based on documentary analysis of sources cited in the table.

Note: Characterisations are qualitative and based on documentary analysis of the sources cited. They illustrate the direction and relative magnitude of the gap between sectors, not empirical measurement. Individual hospitals within each sector may deviate from the patterns described.

6.2 The structural gap as the primary constraint

The comparative analysis reveals a consistent pattern: the most pronounced asymmetry between the public and private sectors occurs at the structural level (D1). Romania's public health expenditure at 5.8% of GDP is the lowest in the European Union - less than half the EU average of 10.0% - translating into per capita spending of EUR 1,800 against an EU average of EUR 3,832 (European Commission/OECD, 2025). This chronic underinvestment is compounded by a physical infrastructure that has seen virtually no new construction: of 554 public hospitals operating in 2023, only four were built after 1989 (Statista, 2025). The structural deficit is thus not merely financial but material and technological.

Managerial autonomy - a structural precondition for any systematic quality improvement initiative - is severely constrained in the public sector. A governance assessment of Romanian public hospitals commissioned by the World Bank identified that 'incoherent policy design, outdated and often disjointed regulatory frameworks, and cumbersome administrative procedures limit managerial autonomy and obstruct efficiency gains' (Duran et al., 2019, p.199). The politicisation of management appointments has been a persistent feature of the system, documented across multiple reform cycles. By contrast, MedLife and Regina Maria operate with professional management structures accountable to performance indicators rather than political cycles.

6.3 The process gap: why tools alone cannot close it

At the process level (D2), the asymmetry is equally marked, but its causes are structurally determined. The ANMCS accreditation system - while mandatory for all hospitals - establishes minimum compliance thresholds rather than operational excellence. No Romanian public hospital has achieved Category I accreditation, the highest level in the national system (ANMCS, 2024). Governance studies document quality committees that were non-functional at the time of assessment and a systemic absence of the analytical capabilities required to drive continuous improvement.

The private sector, operating under competitive pressure and with professional management, has deployed Lean principles in supply chain and patient flow management, standardised clinical protocols across network locations, and implemented systematic patient satisfaction measurement. The qualitative difference is not primarily one of tool availability - TQM and Lean methodologies are accessible to public and private managers alike - but of the structural conditions that enable or preclude their effective deployment. This is the key analytical finding: the process gap is a consequence of the structural gap, not an independent failure.

6.4 The outcome gap and the invisible benchmark problem

The outcome dimension (D3) reveals a specific systemic failure: the absence of a national benchmarking infrastructure. Romania records the highest rate of treatable mortality in the EU - 215 deaths per 100,000 population in 2022, defined as deaths avoidable through timely healthcare intervention (European Commission/OECD, 2025). Yet these outcomes are not systematically linked, at institutional level, to the quality of hospital processes or structures. ANMCS publishes aggregated accreditation data but not comparative performance indicators by hospital.

This constitutes what this paper terms the invisible benchmark problem: in the absence of comparative outcome data at institutional level, the gap between structural and process maturity and patient outcomes remains analytically invisible to managers, policymakers, and patients alike. Without this visibility, there is no institutional pressure for structural reform - a negative feedback loop that perpetuates the status quo. The legislative requirement for monthly public reporting by hospital managers, introduced in October 2025 (FEMS/CFSMR, 2025), represents a necessary first step toward resolving this deficit, though not a sufficient one.

7. Theoretical propositions and discussion

The analysis in the preceding sections supports four theoretical propositions. These propositions derive their support from the documentary evidence reviewed and the logical structure of the proposed framework. They are not empirically tested here; they are offered as theoretically grounded claims intended to guide future empirical research.

Proposition 1 (P1). The Donabedian model can be reinterpreted as a hierarchical operational maturity framework, in which progress on higher-order dimensions is conditioned on sufficient maturity at lower-order dimensions. This proposition formalises the dependency relationship implicit in the Donabedian model. It aligns with operations management research showing that process improvement tools produce systematically weaker results in structurally deficient environments (Fottler, 1981; Arndt and Bigelow, 1995; Goldstein and Naor, 2005).

Proposition 2 (P2). In the Romanian healthcare context, the structural maturity gap between the public and private sectors constitutes the primary constraint on the transferability of operational excellence instruments to public hospitals. Romania provides an unusually clear setting for observing this constraint: the structural gap is extreme, well-documented, and cross-validated by multiple independent sources. P2 is an application of P1 to this specific national context and connects to the broader literature on contextual contingencies in management transferability (Allison, 1979; Bozeman, 1987).

Proposition 3 (P3). The deployment of process-level improvement tools in organisations with severe structural deficits will produce marginal or negligible results, regardless of the technical quality of the tools deployed. P3 provides a theoretical explanation for the recurrent empirical finding of high failure rates in TQM and Lean implementations in public-sector healthcare (Arndt and Bigelow, 1995; Swiss, 1992). Rather than attributing failure to implementation deficiencies, P3 locates it structurally - in the absence of preconditions that enable process tools to function effectively.

Proposition 4 (P4). The absence of a national hospital performance benchmarking system perpetuates the invisibility of the quality gap and reduces institutional pressure for structural reform - a negative feedback mechanism specific to publicly funded healthcare systems. P4 identifies a self-reinforcing systemic mechanism. Without comparative outcome data at institutional level, the consequences of structural and process deficits remain diffuse and politically manageable. Romania's highest-in-EU treatable mortality rate is a system-level indicator; without hospital-level benchmarking, it cannot be translated into managerial accountability. The 2025 legislative requirement for monthly public reporting represents a necessary, though not sufficient, step toward breaking this cycle.

7.1 Implications for management practice

For managers and policymakers, the framework proposed here offers a diagnostic sequence. Before committing resources to process-level interventions - quality certification programmes, Lean training, Six Sigma deployment - organisations should assess their structural maturity against the D1 indicators in Table 1. Where the structural deficit is severe, as in much of Romania's public hospital system, investment in process tools is likely to be wasteful unless accompanied by parallel structural reform.

The private sector's trajectory in Romania demonstrates that structural investment - in physical infrastructure, IT systems, and management autonomy - creates the enabling conditions for process excellence to take hold organically. This does not imply that the public sector should replicate the private model; the differences in mission, patient population, and financing are substantial. It does suggest that structural adequacy is a necessary precondition for quality improvement, regardless of sector. Policymakers focused on healthcare quality cannot achieve sustainable results by mandating quality standards on organisations that lack the structural foundations to meet them.

7.2 Limitations and directions for future research

This paper has several limitations that future research should address. First, the documentary analysis is selective: publicly available sources are more comprehensive for the private sector, which publishes voluntary annual reports, than for the public sector. A systematic documentary review using a broader source base - including hospital-level reporting data as they become available under the 2025 legislation - would strengthen the evidentiary foundation of the framework.

Second, the propositions advanced are theoretical and require empirical testing. A natural extension of this work would be a multi-case comparative study examining a matched sample of public and private hospitals against the D1-D2-D3 indicators in Table 1, using primary data collection through interviews, process audits, and outcome data.

Third, the framework is presented here in the Romanian context, but its logic is potentially generalisable to other healthcare systems characterised by a public-private asymmetry - particularly in Central and Eastern Europe, where similar structural patterns have been documented. Comparative applications across national contexts would test the generalisability of the propositions.

8. Conclusions

Operational excellence in healthcare organisations occurs when organisational efforts are aligned toward strategic goals, when culture is oriented toward continuous and deliberate performance improvement, and when these aims are pursued by design rather than coincidence. This paper has argued that achieving this state is not primarily a matter of selecting the right tools - TQM, Lean, Six Sigma, PDCA - but of ensuring that the structural preconditions for those tools to function are in place.

The paper's central focus is the reinterpretation of Donabedian's structures-processes-outcomes model as a hierarchical operational maturity framework. Structural maturity (D1) is a necessary precondition for process excellence (D2), which in turn enables reliable outcome improvement (D3). This hierarchical logic, applied to the Romanian healthcare system, reveals a structural maturity gap between the public and private sectors as the primary constraint on the transferability of operational excellence to Romanian public hospitals.

Four theoretical propositions follow from this analysis. They advance the argument that process tools deployed in structurally deficient organisations will produce marginal results (P1, P3); that Romania's extreme public-private structural asymmetry constitutes the operative constraint on quality improvement in the public sector (P2); and that the absence of a national benchmarking system creates a negative feedback loop that perpetuates structural under-investment by rendering its consequences invisible to managers, policymakers, and the public (P4).

As Donabedian himself observed, systems are merely mechanisms that allow quality to be achieved. The ethical and human dimensions of healthcare remain primary. But the structural and process conditions that enable those human dimensions to translate into measurable outcomes are the province of management science - and the subject of this paper.

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Sri Lankan Labour Migrants in Romania: Work Conditions and Gendered Vulnerabilities

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***Abstract**: Romania has recently emerged as a destination for Sri Lankan labour migrants due to labour shortages in Eastern Europe and worsening economic conditions in Sri Lanka. Previous studies on migration to new European destinations have highlighted precarious employment, limited institutional protection, and gendered vulnerabilities; however, empirical evidence on Sri Lankan migrants in Romania remains limited. This study examines the drivers of migration, recruitment processes, working and living conditions, gendered challenges, and future migration aspirations of Sri Lankan labour migrants in Romania. The study is theoretically grounded in Push–Pull Theory, Dual Labour Market Theory, and Migration Systems Theory. Using a qualitative research design, data were collected through in-depth interviews with thirty migrants, focus group discussions, key informant interviews, and participant observation conducted in Romania and Italy between September and December 2025. The findings indicate that migration decisions in Sri Lanka are shaped by unemployment, indebtedness, and economic crisis, alongside pull factors such as labour demand and perceived opportunities for European mobility. Migrants experience precarious employment, misleading recruitment practices, language barriers, and limited institutional support. Gendered challenges are particularly evident among women, including restricted job mobility, housing insecurity, and reliance on informal support networks. Although Romania offers relative safety and income opportunities, dissatisfaction with labour conditions fuels aspirations for onward migration. The study highlights the need for stronger recruitment regulation, gender-responsive migration governance, and enhanced bilateral cooperation to promote safer and more sustainable labour migration pathways.*

***Key words*:** Labour migration; Sri Lankan migrants; Romania; precarious employment; gendered vulnerabilities; migration governance

JEL Classification: J61; J16; J49; F22

1. Introduction

Labour migration has been a key driver of Sri Lanka's socioeconomic development since the 1980s. Economic liberalization, together with rising demand for labour in Middle Eastern markets, facilitated large-scale overseas employment. Government policies also indirectly encouraged labour out-migration, particularly to developed countries and the Middle East. International labour migration has long served as a livelihood strategy for Sri Lankans facing economic insecurity and limited employment opportunities. Over the past decade, however, migration patterns have been shifting away from traditional destinations such as the Middle East toward newer destinations in East Asia and Europe. In this context, migration policies in Romania, including work permits for non-EU nationals and the country's entry into the Schengen Area, have made migration to Romania more feasible for foreign workers.

Since 2020, Romania has emerged as a key destination for Sri Lankan workers due to labour shortages in construction, manufacturing, hospitality, and service sectors, along with relatively accessible recruitment pathways for non-EU workers. The situation was further accelerated by Sri Lanka's economic crisis in 2022, which was marked by severe foreign exchange shortages, rising debt, inflation exceeding 70%, and poverty rates above 24% (Central Bank of Sri Lanka, 2023). The crisis compelled many, particularly working-age men and women, to seek employment abroad, making Romania one of the fastest-growing European destinations for Sri Lankan workers. Despite this emerging trend, migration to Romania remains largely absent from academic literature, which continues to focus on Western Europe and Gulf countries.

This study addresses this gap by examining the lived experiences of Sri Lankan Labour migrants in Romania. It focuses on migration drivers, recruitment mechanisms, working and living conditions, gendered vulnerabilities, and migrants' plans, including return and onward migration. By doing so, the paper contributes to migration scholarship on emerging European destinations and offers policy-relevant insights for improving migrant protection.

2. Literature Review

Migration is a complex process shaped by economic, social, cultural, and political forces. Classical migration theory, particularly Lee's push–pull framework, explains mobility as the interaction between pressures in origin countries and attractions in destination contexts (Lee, 1966). For migrants from Sri Lanka, low wages, limited employment opportunities, and household financial pressures operate alongside pull factors such as labour demand, legal migration pathways, and perceived economic stability in emerging European destinations, including Romania (Castles, de Haas & Miller, 2014).

Over the past decade, Romania has emerged as a key destination for non-EU labour migrants due to demographic decline, labour shortages, and sectoral growth in construction,

manufacturing, hospitality, retail, and agriculture. Data from the Organisation for Economic Co-operation and Development indicate a sharp increase in work permits issued to non-EU nationals, reflecting Romania's growing reliance on migrant labour (OECD, 2023). Recruitment is mediated through licensed agencies and informal intermediaries, shaping migrants' expectations regarding wages, employment conditions, and mobility (Glick Schiller, Basch & Blanc-Szanton, 1995). Official statistics further reveal a strong gender imbalance among Sri Lankan migrants, with men dominating manual labour sectors while women are concentrated in service-oriented and often more precarious employment. Despite these trends, research on Sri Lankan migrants in Romania remains limited, as most scholarship focuses on the Middle East or Western Europe. Transnational migration perspectives emphasize household decision-making, remittances, and gendered responsibilities, highlighting migration as a negotiated social process across borders (Mahler & Pessar, 2001; Parreñas, 2001). OECD studies also show that migrants' experiences vary significantly by gender, legal status, and sector of employment, with women facing heightened vulnerability (OECD, 2020). Migration produces important transnational outcomes through remittances and livelihood diversification but may also reinforce dependency and gendered inequalities (Castles et al., 2014). Decisions regarding settlement, onward migration, or return are shaped by labour conditions, legal precarity, and family considerations (Lee, 1966; OECD, 2021).

To address existing gaps, this study draws on Push–Pull Theory, Migration Systems Theory, and Dual Labour Market Theory to examine migration drivers, labour market participation, and gendered experiences of Sri Lankan migrants in Romania.

Theoretical Framework

These three theories provide a structured lens for analyzing the factors influencing migration and the roles migrants play in the host country.

Push and Pull Theory (Lee,1966)

The Push and Pull Theory provide a foundational lens for understanding the motivations behind Sri Lankan migration to Romania. According to Lee (1966), migration decisions arise from a combination of push factors in the country of origin and pull factors in the destination. In the Sri Lankan context, push factors include economic instability, unemployment, low wages, limited career opportunities, inadequate social services, and broader social and political uncertainties. These conditions create strong incentives for individuals, particularly youth, to seek better prospects abroad. Conversely, Romania offers several pull factors, such as higher wages, improved employment opportunities, safer living environments, and better access to healthcare and education. Additionally, Romania's recent entry into the Schengen Area has enhanced its attractiveness by providing greater mobility within Europe. The rapid expansion of Romania's foreign labour market, from 15,000 workers in 2018 to nearly 100,000 annually since 2022, further illustrates the growing demand for non-EU migrant labour and situates Sri Lankan migration within broader regional labour dynamics.

Migration Systems Theory (Castles & Miller, 1993)

Migration Systems Theory posits that migration flows are shaped by the interaction of multiple structural and relational factors, extending beyond individual motivations. Castles and Miller (1993) highlight the influence of global economic inequalities, labour market demands,

state policies, social networks, and historical and geopolitical ties in sustaining migration pathways. In the case of Sri Lankan migration to Romania, this theory is particularly relevant as it explains how formal recruitment agencies, manpower companies, and informal migrant networks create a system that facilitates labour mobility between the two countries. These interconnected channels not only generate opportunities for migration but also reproduce vulnerabilities, including dependence on intermediaries, limited bargaining power, and heightened exposure to exploitative recruitment and employment practices. This framework helps contextualize the Sri Lanka–Romania migration corridor as a product of systemic forces rather than isolated individual decisions.

Dual Labour Market Theory (Doeringer & Piore, 1971)

Dual Labour Market Theory provides insight into why migrant workers, including Sri Lankans in Romania, are often concentrated in low-wage and precarious forms of employment. Doeringer and Piore (1971) argue that labour markets in receiving countries are structurally divided into a primary and a secondary sector. The primary sector consists of stable, well-paid jobs with career advancement, typically reserved for local workers who have the required qualifications, language proficiency, and institutional advantages. Migrants, by contrast, are frequently channelled into the secondary sector, which is characterised by low wages, insecure contracts, limited protections, and minimal opportunities for upward mobility. In Romania, this includes sectors such as construction, hospitality, manufacturing, and care work—jobs often avoided by local workers due to poor working conditions and low prestige. This theory underscores how structural labour market conditions in receiving countries create demand for migrant labour and shape the employment trajectories and vulnerabilities of Sri Lankan migrants.

Together, the three theoretical frameworks provide a comprehensive lens for analysing the multifaceted experiences of Sri Lankan migrants in Romania. Push and Pull Theory clarifies the motivations behind migration, highlighting how structural conditions in both Sri Lanka and Romania shape individual decisions. Migration Systems Theory situates these movements within broader global processes, showing how institutions, networks, and policies link the two countries and influence migrants' opportunities and vulnerabilities. Dual Labour Market Theory explains why Sri Lankan migrants are concentrated in specific sectors of the Romanian economy and how labour market structures shape their working conditions, integration challenges, and long-term prospects. By combining these perspectives, the study is able to capture the structural, relational, and economic dynamics that underpin migration, offering a richer and more nuanced understanding that strengthens both the analysis and the policy relevance of the findings.

3. Research Methodology

This study adopts a qualitative research design to capture the lived experiences of Sri Lankan Labour migrants in Romania, with supplementary interviews conducted in Italy. Qualitative methods are particularly suitable for examining migration precarity, recruitment processes, and gendered vulnerabilities, as they enable in-depth exploration of migrants' perceptions and everyday realities. Fieldwork was carried out between September and November 2025.

Data collection employed multiple methods to facilitate triangulation: thirty semi-structured in-depth interviews with Sri Lankan migrants (20 males and 10 females); four focus group discussions (three in Romania and one in Italy); key informant interviews with officials from the Sri Lankan Embassy, recruitment agencies, and intermediaries; participant observation in migrant residences, workplaces, and community spaces; and a review of policy documents, migration statistics, and media sources. Snowball sampling was used to access participants across diverse employment sectors, a common approach in qualitative migration research involving hard-to-reach populations. Interview transcripts and field notes were analyzed using thematic analysis, focusing on migration drivers, recruitment pathways, working and living conditions, gendered experiences, institutional support, and future migration aspirations. This approach allows systematic identification of recurring patterns and meanings across narratives.

Ethical safeguards included informed consent, confidentiality, and anonymity, with particular care taken when engaging undocumented migrants. Participants were informed of the study's purpose and their right to withdraw at any stage, and identifying details were removed to minimize potential risks.

4. Result and discussion

4.1 Profile of Respondents

The study sample exhibited considerable variation in education, skills, and prior work experience. Among participants, some males and females had completed education up to ordinary level (O/L), while the majority had completed advanced level (A/L), and a smaller group from both genders were university graduates, reflecting slightly lower educational attainment among females. Most female participants and over one-third of males were unskilled, whereas skilled workers were predominantly male, with only a small number of females in skilled employment. A few female respondents were students. About one-third of respondents had prior overseas work experience before migrating to Romania, although only a limited proportion were currently employed in jobs aligned with their previous occupations in Sri Lanka. One female explained:

"I completed my education up to the O-level exam. My husband works as a hospital attendant in Sri Lanka, while my mother takes care of our children. I came to Romania in 2023, paying 3,700 euros to an agency and mortgaging land I owned. Before this, I worked as a domestic worker in Kuwait, Qatar, and Saudi Arabia for six years. I had always dreamed of moving to a developed European country and living there with my family. I am currently working my second job in Romania as a warehouse labourer"

In terms of marital status, most male respondents and more than half of female respondents were married with family responsibilities, while some females were divorced and a smaller group from both genders were unmarried.

Regarding employment and age distribution, many migrants had changed their job field after their initial employment in Romania, and a substantial number had also changed workplaces. Male migrants were employed across diverse sectors including bike delivery, construction, bakery work, tailoring, CNC operation, hotels, sales, recruitment services, housekeeping, marketing,

engineering, and business. Female migrants were mainly engaged in cleaning, garment work, hospitality, bakery work, engineering, and childcare. Three respondents were undocumented—one dismissed after one year and two following company closures, yet they continued to hold Temporary Residence Certificates (TRCs) despite the expiration of their 90-day period. Age-wise, the sample was dominated by middle-aged migrants, with fewer younger participants and only a very small number above 50 years.

4.2 Drivers, Barriers, and Pathways of Migration

Sri Lanka has functioned as a labour-exporting country since the early 1980s. In recent years, however, migration dynamics have shifted significantly in response to a series of internal crises. The 2019 Easter Sunday attacks, the COVID-19 pandemic beginning in 2020, and the severe economic crisis of 2022 profoundly disrupted small businesses, self-employment, and household livelihoods. The 2022 crisis, marked by severe foreign exchange shortages, rising debt, inflation exceeding 70 per cent, and poverty rates surpassing 24 per cent (Central Bank of Sri Lanka, 2023), created acute shortages of fuel, medicine, and other essential goods, intensifying socio-economic instability. In this context, Romania emerged as an attractive destination, offering accessible migration and job opportunities for both skilled and unskilled workers, particularly those with limited education and financial resources.In response to these challenges, the Sri Lankan government introduced a policy allowing public-sector employees to obtain up to five years of unpaid leave to pursue overseas employment. One migrant, who previously worked in the government sector, explained:

"I came to Romania in mid-2024. Previously, I worked in the Special Task Force of the Sri Lanka Police and also ran a business alongside my government job, which collapsed during the 2022 economic crisis. Due to the economic difficulties caused by the crisis, the government granted a five-year leave without pay for government workers, which prompted me to seek employment abroad. I spent 4,750 euros to migrate, selling my property to cover the cost. I now work as a bike rider, earning 700 euros per month, in addition to a food card and tips. This income allows me to cover my living expenses and send money to support my family in Sri Lanka."

As a consequence of these overlapping crises, labour migration intensified markedly. According to the Sri Lanka Bureau of Foreign Employment (SLBFE, 2024), more than 923,213 Sri Lankans, including a considerable proportion of women and skilled workers, departed for employment abroad between 2022 and 2024, primarily to developed countries and the Middle East. Since 2020, a total of 45,244 Sri Lankans have migrated to Romania (as of 31 October 2025), with over 55 per cent departing during the peak crisis period of 2022–2023. The migration flow is highly gendered, with approximately 86 per cent men and 14 per cent women. Reflecting this broader national trend, 43 per cent of respondents in the present study arrived in Romania during 2022–2023, while 63 per cent migrated after 2022, highlighting the post-crisis acceleration of overseas labour mobility.

Decisions to migrate are strongly shaped by multiple information and support networks, including print and electronic media, social media platforms, family members, friends, and

established Sri Lankan communities in Romania. These networks provide practical guidance, initial accommodation, and assistance in securing employment opportunities. Intermediaries operating in both Sri Lanka and Romania, including recruitment agents also actively promote Romanian job prospects and facilitate the migration process for prospective workers. The appeal of the "European dream," together with expectations surrounding Romania's potential accession to the Schengen Area, further enhances its attractiveness as a destination.

Migration to Romania involves substantial upfront costs, approximately €4,300–5,000, which constitute a significant financial barrier. Many prospective migrants finance these costs through high-interest loans, pawning jewellery, or selling household assets. Although migration was comparatively affordable in its early phase, recruitment costs have risen sharply due to increased competition among agencies, high demand following Romania's Schengen accession, and substantial profit margins for intermediaries in Sri Lanka. Recruitment agencies often fail to explain contracts adequately, provide insufficient time for review, or offer copies in migrants' own languages, creating further challenges. Previously, processing work permitted, and related documentation could take nearly a year; more recently, this period has been reduced to approximately six months. Despite these improvements, a significant number of applicants fail embassy interviews after paying substantial initial fees, resulting in financial losses and deepening economic vulnerability.

Recruitment agencies and intermediaries play a central role in Sri Lankan migration to Romania, assisting migrants with visas, work permits, and job placements. Some migrants rely on official agencies, while others turn to independent intermediaries. Despite regulations such as the 2024 ban on self-migration, intermediaries continue to operate alongside official channels, often in opaque ways. Many function outside formal frameworks, creating risks of hidden fees, misinformation, and contract issues. While they provide essential support, intermediaries also expose migrants to financial and legal vulnerabilities, highlighting their complex and ambivalent role in the migration process.

Recent initiatives, such as the SLBFE's five-day pre-departure training, have sought to improve preparedness; however, migrants report dissatisfaction with these programs, which are general in nature and primarily designed for Middle East–bound workers. These challenges highlight the ongoing importance of support networks, practical guidance, and tailored training to facilitate successful integration abroad.

4.3 Working Conditions, Agency Practices, and Migrant Vulnerability

Compared with other major destinations for Sri Lankan labour migrants, Romania offers certain welfare-related incentives that enhance its appeal. Free accommodation and food cards are often highlighted as key benefits, particularly for low- and semi-skilled workers, and migrant families with children report satisfaction with government-provided welfare benefits and healthcare facilities. Many migrants also value the smaller hierarchical gap between employers and employees compared with Sri Lanka. However, these benefits are not always consistent, with some companies providing overcrowded or poorly maintained accommodation and insufficient food

allowances, particularly during periods of high inflation. Poor Romanian language skills further hinder workplace adaptation and access to essential services.

Working conditions in Romania vary widely. Migrants often face reduced or delayed salaries, unpaid overtime, mandatory holiday work, unagreed duties, and disrespectful treatment, particularly in sectors such as construction and garbage sorting where safety and sanitation facilities are inadequate. Some employers require migrants to sign contracts upon arrival that differ from those in Sri Lanka, and recruitment agencies often provide misleading information about working hours, salaries, holidays, job roles, accommodation, and overtime. Despite these challenges, migrants who build trust with employers report fair treatment and opportunities for promotion.

Many migrants are placed with manpower agencies rather than directly employed, which increases vulnerability through frequent relocations, salary withholding, and minimal basic support. Recruitment costs for migration are substantial, approximately €4,300–5,000, often financed through high-interest loans, asset sales, or pawning jewelry. Some Sri Lankan agencies also require a refundable security deposit of up to €860, which is returned only after 1 year of service, further constraining financial flexibility. Migrants frequently work long hours or hold multiple jobs, often at levels below their qualifications, to repay loans and support families in Sri Lanka, resulting in skill underutilization and heightened financial strain. According to one male migrant:

"I came to Romania in 2024 through an intermediary. My work permit stated that my job role was cleaning. I paid him €5,000. I used my savings, took loans, and pawned my wife's jewellery to pay this amount. Before coming to Romania, I worked on a construction site in Sri Lanka as a technical assistant. However, due to the 2022 economic crisis, I lost my job. After that, I decided to migrate to a foreign country.I am now working as a waiter assistant at a hotel. However, during the off-season, I also have to do gardening and construction work. In the summer, we work from 10 a.m. to 12 midnight. If I work more than 11 hours, they pay overtime; if I work fewer than that, I do not receive overtime pay. After one year of service, I requested a job release, but they did not give it. I am hoping to go to the labour department in Romania. I still have to pay €1,700 of my debt. I explained my difficulties to the intermediary, but he did not respond. They have a good connection with the hotel owner."

Migrants with prior experience in the Middle East or East Asia reportedly adapt more easily to Romanian work culture. Social media, family contacts, and community networks remain essential for maintaining ties with relatives, as only a small proportion of migrants live with family in Romania. Access to health services is available through insurance, but some migrants incur out-of-pocket costs for medication. Language barriers, limited legal knowledge, and fear of job loss often prevent migrants from addressing workplace disputes, contributing to stress, emotional strain, and, in some cases, substance misuse.

Remigration to Italy has emerged as a related challenge. Some migrants initially view Romania as a gateway to Italy, while others relocate due to poor working conditions in Romania, including delayed salaries, unpaid overtime, and unagreed tasks. Recruitment agencies and intermediaries sometimes actively encourage this "Italy wave" for personal gain, using social media and financial incentives. Remigration often increases physical and emotional distance from

families in Sri Lanka, exacerbates living costs, extends working hours, and limits access to stable employment. Many migrants who moved to Italy later expressed regret, citing high accommodation costs, long commutes without transport allowances, restricted mobility due to work permit regulations, and limited savings potential. These patterns of remigration also create operational challenges for employers, agencies, the Romanian government, and the Sri Lankan embassy, as well as for remaining Sri Lankan workers.

Overall, while Romania provides certain welfare benefits, fair treatment opportunities, and relative safety compared with Sri Lanka, persistent challenges—including agency malpractices, inadequate working conditions, language and cultural barriers, and financial pressures—contribute to ongoing vulnerability among Sri Lankan migrants. Effective oversight of recruitment practices, improved workplace standards, targeted pre-departure and on-site training, and tailored support networks are essential to mitigate these risks and enhance the well-being and integration of migrants.

4.4 Social & Economic Impacts of Migration

Sri Lankan migrants in Romania experience a range of social and economic impacts, shaped by income, living conditions, family responsibilities, and work patterns. Some migrants survive primarily on food cards and tips, while others supplement their income through part-time or commission-based work. Food allowances generally range between 400 and 900 lei per month, while manpower workers earn approximately 30 lei per day, reflecting relatively low- and unstable-income levels. Rising inflation disproportionately affects migrants receiving minimum wages, as food allowance amounts typically remain fixed despite increasing living costs. Commission-based employment, particularly delivery work, further contributes to income instability. At the same time, many migrants spend more than a year repaying migration-related debts while continuing to provide financial support to their families in Sri Lanka, intensifying economic pressure and financial precarity. Remittance remains a critical lifeline for households, funding education, healthcare, and family events, creating ongoing financial pressure on migrants.

Despite higher qualifications, many migrants remain in low-skilled positions, leading to skill underutilization. To meet financial commitments, migrants frequently work long hours or hold multiple jobs, which impacts their well-being and work–life balance. Housing conditions are often shared or overcrowded, reducing privacy and comfort. Access to healthcare is available through insurance, but some migrants still incur out-of-pocket costs for medication. Social connections are maintained through social media, as migrants visit family in Sri Lanka only every few years. About 17% of migrants reported that their spouse or children also migrated to Romania, either living together or apart, adding complexity to household arrangements. Economic insecurity, job instability, and prolonged separation from family contribute to stress, anxiety, and emotional strain. Some male migrants report substance abuse, including unrestricted alcohol use and occasional use of illegal drugs, as a coping mechanism. Agencies and migrants have also raised concerns regarding the misconduct of certain Sri Lankan workers in workplaces, residences, and public areas, which can affect community dynamics and social cohesion.

Overall, migration generates both opportunities and challenges. While remittances enhance the economic well-being of families in Sri Lanka, migrants face financial, emotional, and social pressures that impact their quality of life and integration in the host country. These dynamics underscore the need for targeted support measures, including financial literacy, mental health services, and safe housing initiatives, to mitigate vulnerabilities and improve migrants' social and economic outcomes.

4.5 Migration Decisions and Future Aspirations

A notable share of Sri Lankan migrants in Romania are reconsidering their long-term plans. Many express interest in returning to Sri Lanka or relocating to another EU country, while a substantial portion prefers to remain in Romania. Female migrants, in particular, are more likely to consider leaving, either by returning home or moving onward within Europe. Although the desire to return is common, Sri Lanka's ongoing economic challenges—persistent inflation, limited job opportunities, and financial instability—discourage immediate repatriation, especially among those still repaying migration loans or supporting families back home. Among migrants choosing to stay in Romania, long-term plans primarily focus on securing legal residence, pursuing citizenship, and achieving family reunification. However, economic caution remains high, and very few migrants make investments in Sri Lanka until their future abroad is more secure.

4.6 Gender-Specific Challenges in Female Migration

A combination of high migration costs, traditional gender roles, and widespread economic inactivity among women in Sri Lanka constrains female participation in Sri Lankan labour migration to Romania. Family resistance or lack of approval further limits women's decision-making, reducing access to potentially beneficial employment opportunities abroad.

Women migrants are often employed in low-skilled, low-paid roles, such as garment factories, warehouses, or domestic work, with limited scope for career advancement or economic independence. Some roles are physically demanding, while domestic workers frequently experience overwork, long hours, no holidays, and restricted privacy, increasing vulnerability to exploitation and burnout. Despite these challenges, women report feeling relatively secure in open workplaces and communal environments, highlighting the nuanced nature of occupational risk. Limited knowledge, shared accommodations, and unfamiliar cultural environments exacerbate sexual and reproductive health challenges. These factors contribute to unwanted pregnancies, miscarriages, and emotional distress, including stress arising from unsolicited sexual propositions by male migrants. Dependence on male networks for guidance, emotional support, and job leads can also expose women to coercion or exploitation, particularly during sudden job losses or eviction. Recruitment agencies' reluctance to deploy women to demanding roles reinforces these gendered barriers, limiting access to overseas employment despite women's capacity to contribute effectively to the labour market. Additional challenges include homesickness, loneliness, and the difficulty of adapting to unfamiliar work and social environments, which agencies often cite as reasons to avoid female placements. As reported by one female migrant

"I migrated to Romania in 2018 and currently work as a machine operator in a garment factory. Before migration, I was also employed in the garment industry in Sri Lanka. Since arriving

in Romania, I have worked in three different garment factories. Although I faced several difficulties in my previous workplaces, my current working conditions are comparatively better. There is greater personal freedom, and accommodation is shared between two workers per room.

Workers receive a monthly food allowance of approximately 630 lei, and health insurance is provided. However, accessing medical services can be challenging, as doctors are often unavailable when needed. In urgent situations, workers sometimes rely on ambulance services. Employers occasionally advise workers to report that illnesses are not work-related, which appears to be intended to limit employer responsibility.

I have also witnessed challenging personal and social situations among migrant workers. For example, a Sri Lankan female worker who lived in my accommodation experienced serious difficulties related to a relationship, including two unintended pregnancies, which caused significant emotional distress and a medical emergency. Fortunately, timely intervention helped save her. Challenges related to drug use and excessive alcohol consumption were observed among both male and female migrants".

Such experiences highlight the social and emotional vulnerabilities faced by migrant workers living abroad. While Romania offers considerable personal freedom compared to Sri Lanka, some migrants struggle to adapt responsibly to this new environment. This underscores the importance of better preparation, awareness, and support systems for migrants adjusting to different social contexts.

Overall, the combined effects of structural, social, and institutional factors amplify the vulnerabilities of female migrants, emphasizing the need for gender-sensitive recruitment practices, targeted support mechanisms, and protective measures to enhance women's safety, well-being, and economic participation abroad.

5. Conclusion

This study highlights the complex and multifaceted nature of Sri Lankan labour migration to Romania. Migration decisions are shaped by a combination of structural, economic, and sociopolitical factors, including internal crises in Sri Lanka, accessible opportunities in Romania, and the influence of family, community networks, and intermediaries. While Romania offers certain welfare benefits, relative safety, and avenues for employment, migrants encounter significant financial, social, and occupational challenges, including high migration costs, precarious working conditions, language barriers, and limited legal protection.

Female migrants face additional vulnerabilities stemming from gendered constraints, including traditional family expectations, restricted employment opportunities, overwork, and exposure to sexual and reproductive health risks. The role of recruitment agencies and intermediaries is ambivalent; while they facilitate migration, they also create economic and legal vulnerabilities through opaque practices, misleading information, and high fees.Despite these challenges, migrants demonstrate resilience, relying on social networks, prior migration experience, and community support to navigate work and life in Romania. Remittances remain a critical economic lifeline for households in Sri Lanka, though they contribute to ongoing financial

pressure and stress for migrants. Decisions about long-term residence, remigration, or return are influenced by both opportunities abroad and persistent economic uncertainties at home, reflecting cautious and strategic planning among migrants.

Overall, the findings underscore the need for enhanced regulatory oversight of recruitment practices, gender-sensitive support mechanisms, targeted training programs, and policies that address financial, legal, and social vulnerabilities. Strengthening these measures would improve migrant well-being, facilitate successful adaptation, and optimize the socio-economic benefits of overseas labour migration for both individuals and their families.

Relevance of the Selected Theories

The findings of this study align closely with the analytical framework based on Push–Pull Theory, Migration Systems Theory, and Dual Labour Market Theory. The structural crises in Sri Lanka—including the 2022 economic collapse, COVID-19 disruptions, and socio-political instability act as push factors, compelling individuals to seek employment abroad, while Romania's accessible work permits, welfare incentives, and perceived safety function as pull factors, consistent with the Push–Pull Theory. The role of migration networks, including family contacts, social media, and intermediaries, illustrates Migration Systems Theory, showing how institutional, social, and economic linkages facilitate migration, reduce uncertainty, and support settlement and employment in Romania. Finally, the prevalence of low- and semi-skilled employment among Sri Lankan migrants, despite varying educational levels, reflects the Dual Labour Market Theory. Migrants fill labour shortages in sectors that are less attractive to local workers, often under precarious conditions, while contributing to Romania's economic demands.

Overall, these theories collectively explain the drivers, pathways, and vulnerabilities observed in Sri Lankan migration to Romania, linking structural, social, and economic factors in a coherent analytical framework.

Policy Implications

The findings of this study highlight several areas where policy interventions can improve the well-being and protection of Sri Lankan migrants in Romania. First, stronger regulation and oversight of recruitment agencies and intermediaries are essential to ensure transparency in fees, accurate contract provision, and accountability, thereby reducing the financial and legal vulnerabilities that many migrants currently face.

Second, migration policies should adopt a gender-sensitive approach. Expanding safe employment opportunities for women, coupled with pre-departure and on-site training tailored to address gender-specific risks, can mitigate exploitation, overwork, and occupational burnout. This includes attention to workplace conditions, privacy, and support networks for female migrants. Third, the development of targeted training and integration programs is critical. Providing migrants with practical knowledge about workplace rights, language proficiency, cultural adaptation, and financial management can enhance both professional and social integration, particularly for those with limited prior international experience. Fourth, improving workplace and welfare standards is vital. Enforcement of minimum conditions for accommodation, sanitation, occupational safety, and fair pay, alongside accessible grievance mechanisms, can strengthen migrant well-being and reduce instances of labour turnover, unpaid overtime, and contract substitution.

Finally, policies that address financial stability and support family networks are necessary. Regulating migration costs, facilitating low-interest loans, and promoting mechanisms that sustain communication and remittances to households in Sri Lanka can help reduce economic stress, emotional strain, and the pressures of family obligations. Collectively, these measures can enhance the overall safety, integration, and economic contribution of Sri Lankan migrants abroad while reducing the vulnerabilities identified in this study.

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A Nonlinear Legislative Trajectory and its Market Implications in Multi-Pillar Pension Reform in Romania

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Abstract: *Pension reform in Romania has unfolded within a context marked by legislative discontinuities and inconsistent policy commitment, reflecting broader instabilities at the level of the political decision-making process. The initial phase of reform was characterized by the adoption of two legislative acts that were never effectively implemented, followed by a more comprehensive and ambitious reform package that established the foundations of a multi-pillar pension system and introduced supervisory mechanisms for this segment of the financial market. Despite this promising institutional framework, the continuity of reform efforts weakened considerably. The early momentum was replaced by delays and partial implementation, most notably in the case of the pension guarantee fund, whose regulatory framework was significantly postponed, and the persistent lack of a fully operational system governing pension payments. These shortcomings illustrate the fragmented and non-sequential nature of the legislative process in this domain. A renewed phase of regulatory development emerged only after 2020, with the formal introduction of occupational pension schemes and the alignment of national legislation with European Union requirements through the adoption of provisions concerning the Pan-European Personal Pension Product (PEPP).*

These developments signal a gradual re-engagement with the objectives of pension system diversification and market consolidation. Against this background, the present study investigates the impact of Romania's evolving and often inconsistent legislative trajectory – including both primary and secondary regulations—on the structure and functioning of the private pension market. The analysis is further extended to incorporate the broader structural determinants shaping the system, including demographic trends, labour market participation, and fiscal constraints. In addition, the paper examines key systemic challenges, such as the persistence of early retirement mechanisms, the limited inclusion of low-contributory population groups, and the effects of informal economic activity on contribution levels. These demand-side limitations are analysed in conjunction with supply-side developments, including public pensions, mandatory privately managed funds, voluntary schemes, and occupational pensions. The study also assesses the potential role of the PEPP framework in fostering greater integration and flexibility within the pension market, while addressing the financial and institutional implications associated with transitioning toward a more sustainable system. By providing a comprehensive and critically grounded analysis, the paper contributes to a deeper understanding of the Romanian pension reform process and outlines directions for enhancing its long-term effectiveness and resilience

Key words: pension legislation, public policy, multi-pillar pension system, social contributions, adjustment mechanisms, private pensions, guarantee fund, Pan-European Personal Pension Product (PEPP), voluntary pensions, occupational pensions.

JEL: G23, G28

Institutional Discontinuities and the Foundations of Private Pension Reform in Romania

The reconfiguration of pension systems in post-socialist economies has been shaped by a combination of structural pressures and institutional constraints, often resulting in uneven and non-linear reform trajectories. Romania represents a particularly illustrative case, where the transition from a state-dominated pension model to a multi-pillar architecture was marked by legislative instability, administrative fragmentation, and fluctuating political commitment.

The initial phase of pension reform unfolded against the backdrop of broader economic and institutional transformation during the late 1990s and early 2000s. In this context, efforts to establish a private pension sector were not only intended to diversify retirement income sources but also to contribute to the development of domestic financial markets. However, these objectives were pursued in the absence of sufficient regulatory experience and institutional preparedness, leading to a series of incomplete or reversed policy initiatives.

A first formal step in this direction was undertaken in 1999, when a draft law on the organization and functioning of universal pension funds was registered with the Chamber of Deputies (no. 9/28.01.1999) (Guvernul României, 1999). Although the proposal aimed to introduce a new institutional framework for private pension provision, its legislative trajectory revealed significant shortcomings in both procedural design and political coordination. The allocation of the draft to the Committee on Labour and Social Protection as the primary reporting body, with the Committee on Budget, Finance and Banking assigned only an advisory role, reflected a limited understanding of the financial implications of the proposed reform.

Subsequent developments further exposed the fragility of the legislative process. Divergent positions between parliamentary committees, coupled with inconsistent support from the initiators, resulted in procedural delays and ultimately in a legislative deadlock. The situation was further complicated by concerns regarding the mandatory nature of participation in pension funds and its potential implications for the sustainability of the public pension system.

In an attempt to overcome these obstacles, the government led by Mugur Isărescu intervened in 2000 by adopting an emergency ordinance that largely replicated the content of the initial draft law. However, this executive approach did not ensure policy continuity. Following the parliamentary elections and the subsequent change in political majority, Emergency Ordinance no. 230/24 November 2000 on the organization and functioning of universal pension funds was repealed within a month, through legislative measures aimed at aligning existing regulations with the government programme endorsed by Parliament on 28 December 2000. This repeal was carried out through Government Emergency Ordinance no. 295 of 30 December 2000, which suspended the application or repealed certain government ordinances and emergency ordinances, as published by the Government of Romania and available (Guvernul României, 2000).

These early failures did not entirely halt the reform process but rather contributed to a gradual accumulation of legislative experience. Notably, approximately four years later, many of the provisions contained in the initial draft law and the subsequent emergency ordinance were incorporated – albeit with modifications – into the legal framework governing privately administered pension funds (Pillar II). This continuity suggests that, despite their lack of immediate implementation, early legislative initiatives played a formative role in shaping the architecture of the multi-pillar pension system.

At the same time, the period was marked by further attempts to regulate complementary components of the pension system. A relevant example is Law no. 249/2004 on occupational pensions (Parlamentul României, 2004), which sought to establish a legal basis for employer-sponsored pension schemes. While the law introduced a relatively comprehensive regulatory framework, its implementation was hindered by institutional inconsistencies and overlapping supervisory arrangements. The allocation of regulatory responsibilities to the Insurance Supervisory Commission, alongside subsequent references to a future Pension Fund Supervisory Commission, reflected a lack of coherence in institutional design.

These legislative inconsistencies, combined with political tensions within governing coalitions, ultimately led to the suspension and subsequent repeal of the law. As such, the early 2000s can be characterized as a period of institutional experimentation, in which multiple reform initiatives were introduced but few achieved operational status.

Against this background, the present study examines the structural implications of this fragmented legislative trajectory for the development of the private pension system in Romania. By situating legislative dynamics within a broader socio-economic and institutional context, the analysis seeks to provide a deeper understanding of the factors that have shaped the evolution of pension reform and to identify the conditions necessary for ensuring its long-term sustainability.

Early Legislative Initiatives and the Limits of Institutional Capacity (1999 – 2004)

The period between 1999 and 2004 represents a formative stage in the development of Romania's private pension system, characterized by repeated legislative initiatives, institutional uncertainty, and limited implementation capacity. This phase illustrates the challenges associated with introducing complex financial and social policy instruments in a transitional economic environment.

The first significant legislative attempt occurred in January 1999, when the Government submitted to Parliament a draft law concerning the establishment and operation of universal pension funds (Chamber of Deputies registration no. 9/28.01.1999). The proposed legislation aimed to create a new institutional framework that would facilitate the emergence of privately managed pension funds, thereby complementing the public pension system and contributing to the diversification of retirement income sources.

Despite its strategic importance, the legislative process was marked by procedural inefficiencies and institutional misalignment. The assignment of the draft law to the Committee on Labour and Social Protection, rather than to a committee with primary expertise in financial markets, limited the depth of technical evaluation. Although the Committee on Budget, Finance and Banking was consulted, its role remained secondary, reducing its capacity to influence the final outcome.

As the legislative process unfolded, disagreements between parliamentary committees became increasingly pronounced. These divergences were not limited to technical aspects but also reflected broader differences in political and ideological perspectives regarding the role of private pensions within the social security system. The lack of a coordinated approach, combined with sporadic engagement from government representatives, contributed to a protracted decision-making process.

Faced with this impasse, the executive sought to accelerate reform through the adoption of an emergency ordinance in 2000, under the government led by Mugur Isărescu. This ordinance largely reproduced the provisions of the initial draft law, including key elements such as mandatory participation, the institutional structure of pension funds (comprising administrators, custodians, and distribution agents), investment regulations, and mechanisms for benefit payment in the form of annuities.

However, the reliance on emergency legislation did not ensure stability. Following the parliamentary elections of 2000, the newly established political majority initiated a review of existing normative acts. As part of this process, Emergency Ordinance no. 230/24 November 2000 was repealed shortly after its adoption, in line with the government programme approved by Parliament on 28 December 2000. This episode underscores the vulnerability of reform initiatives to political turnover and the absence of cross-party consensus.

Despite these setbacks, the early legislative efforts had a lasting impact on the design of subsequent reforms. Many of the concepts and regulatory mechanisms initially proposed were later incorporated into the legal framework governing privately administered pension funds. Among these were the compulsory nature of participation, differentiated contribution schemes based on proximity to retirement age, detailed provisions regarding institutional actors, and rules governing investment strategies and member protection.

Nevertheless, important adjustments were introduced in later legislation. Notably, the contribution rates envisaged in the initial proposals—approximately 10% of gross salary, shared equally between employer and employee—were significantly reduced in subsequent reforms, where contributions ranged between 2% and 6%. Similarly, the high administrative fees initially proposed (up to 12% of contributions) were revised downward, reflecting concerns regarding affordability and market attractiveness.

A further legislative initiative during this period was the adoption of Law no. 249/2004 on occupational pensions, which aimed to establish a framework for employer-sponsored pension schemes. The law introduced detailed provisions regarding fund establishment, governance, and investment, reflecting a cautious regulatory approach influenced by prior financial market crises, including investment fund failures and banking sector instability. However, the application of this law was subsequently suspended through Law no. 141 of 17 May 2005 on the suspension of the application of the provisions of Law no. 249/2004 on occupational pensions, as adopted by the Parliament of Romania and available (Parlamentul României, 2005).

However, the implementation of this law was hindered by institutional ambiguities. The designation of the Insurance Supervisory Commission as the regulatory authority, combined with subsequent references to the creation of a dedicated Pension Fund Supervisory Commission, created uncertainty regarding supervisory responsibilities. This lack of clarity undermined the effectiveness of the regulatory framework and contributed to delays in implementation.

Moreover, political dynamics played a decisive role in shaping the fate of the legislation. Divergent positions within the governing coalition, coupled with limited administrative capacity, led initially to the suspension of the law (Parlamentul României, 2005) and subsequently to its repeal, coinciding with the adoption of new legislation on voluntary pensions.

In retrospect, the period 1999–2004 can be interpreted as a phase of institutional learning, during which policymakers experimented with different regulatory models without achieving immediate success. While these efforts did not result in the immediate establishment of a functional private pension system, they provided a conceptual and legislative foundation for subsequent reforms.

The analysis of this period highlights the critical importance of institutional coherence, political stability, and technical expertise in the successful implementation of complex policy reforms. It also underscores the long-term impact of early legislative choices, even when these do not produce immediate outcomes, as they shape the trajectory of future policy development.

Institutional Consolidation and the Architecture of Private Pension Regulation in Romania (2004–2007)

The establishment of a functional legal framework for private pensions in Romania must be understood against the backdrop of earlier legislative discontinuities and institutional experimentation. Despite the repeated failures that characterized the pre-2004 period, the persistence of reform-oriented actors within both the policy and expert communities ultimately led to the articulation of a more coherent regulatory structure between 2004 and 2006. This phase marked

a transition from legislative uncertainty to a relatively stable framework governing the organization, administration, and supervision of private pension funds (Parlamentul României, 2005).

A defining milestone in this process was the adoption of Law no. 411/2004 on privately managed pension funds, which laid the foundation for the second pillar of the Romanian pension system. Although the title of the law suggests a broader scope, its substantive provisions are primarily concerned with mandatory pension funds, corresponding to Pillar II. Nevertheless, the act incorporates several general definitions and regulatory principles applicable across the private pension sector, thereby serving as a cornerstone for subsequent legislative developments.

The structure of the law reflects a comprehensive attempt to regulate the key institutional components of the system. It establishes detailed provisions concerning pension funds, including their financial resources, cost structures, participant eligibility, organizational requirements, and authorization procedures. In addition, the legislation defines permissible investment strategies, alongside reporting and transparency obligations intended to enhance market discipline and protect participants interests.

Equally significant is the regulatory framework governing pension fund administrators. The law specifies stringent conditions for authorization, including minimum capital requirements, governance structures, and operational constraints. It also addresses issues related to contractual arrangements, revenue models, and the prevention of conflicts of interest, thereby seeking to ensure the integrity and stability of fund management. Complementary provisions regulate the role of custodians and financial auditors, as well as the marketing and distribution of pension products.

The law further introduces mechanisms for special supervision and special administration, designed to address situations of financial distress or regulatory non-compliance. In addition, it establishes rules concerning technical provisions, guarantees, and sanctions, thereby creating a multi-layered system of prudential oversight. These elements collectively reflect an effort to align the Romanian regulatory framework with international standards in the field of pension fund governance. This framework was further complemented by Government Emergency Ordinance no. 50 of 9 June 2005 (Guvernul României, 2005) on the establishment, organisation and functioning of the Private Pension Supervisory Commission, subsequently approved with amendments and additions by Law no. 313 of 10 November 2005 (Guvernul României, 2005), as adopted by the Romanian authorities and available.

The institutional dimension of supervision was further clarified in 2005, through the adoption of legislation establishing the Private Pension Supervisory Commission. This authority was entrusted with the regulation and oversight of the private pension sector, with its organizational structure, competencies, and financial arrangements explicitly defined in the relevant legal act. The Commission was governed by a board composed of five members, including a president and a vice-president, appointed by Parliament, thereby ensuring a degree of institutional independence.

The financing model of the Commission was based on a combination of authorization fees, ongoing operational contributions from supervised entities, and supplementary revenues derived from publications, donations, and other lawful sources. This arrangement was intended to

ensure both financial sustainability and functional autonomy, while minimizing reliance on state budget allocations.

The consolidation of the legislative framework continued with the adoption of Law no. 204/2006 on voluntary pensions (Parlamentul României, 2006), which introduced the third pillar of the pension system. Similar in structure to Law no. 411/2004, this act regulates voluntary pension funds, albeit within a more flexible and permissive framework. Notably, the law expands the category of eligible administrators to include not only specialized pension management companies but also investment management companies and insurance undertakings, thereby enhancing market competition and diversification.

The provisions of Law no. 204/2006 address a wide range of regulatory aspects, including the authorization of pension schemes, the establishment and dissolution of funds, participant rights and obligations, contribution mechanisms, and asset valuation procedures. Additional provisions govern investment policies, prudential requirements, custodial arrangements, and transparency obligations. The law also establishes a legal framework for pension payments and defines the scope of legal liability for market participants.

Taken together, these legislative acts represent a significant step forward in the institutionalization of Romania's private pension system. They provide a structured and comprehensive regulatory environment, encompassing both mandatory and voluntary pension schemes, and establish the institutional foundations necessary for market development. However, as the subsequent evolution of the system demonstrates, the existence of a formal legal framework does not necessarily guarantee effective implementation or institutional coherence.

Regulatory Gaps, Delayed Implementation, and Emerging European Influences

Despite the apparent consolidation achieved through the adoption of Laws no. 411/2004 and no. 204/2006, the Romanian private pension system continued to face significant challenges related to regulatory completeness and implementation delays. One of the most notable examples in this regard is the protracted establishment of the Guarantee Fund, a key institutional mechanism intended to protect participants against financial losses arising from the inability of pension fund administrators or providers to meet their obligations.

Although the creation of the Guarantee Fund was explicitly provided in Law no. 411/2004, and subsequently reiterated in Law no. 204/2006, the actual legal framework governing its operation was adopted only after a delay of approximately five years (Parlamentul României, 2011). This discrepancy between legislative intent and implementation highlights the persistent difficulties in translating regulatory provisions into functional institutional arrangements.

The role of the Guarantee Fund is of critical importance within the architecture of the private pension system. Its primary function is to compensate participants and beneficiaries for losses incurred during both the accumulation phase and the payout phase, in situations where pension fund administrators or providers are unable to fulfil their contractual obligations. In addition, the Fund is designed to ensure the continuity of pension payments, thereby contributing to the overall stability and credibility of the system.

A similarly illustrative case of delayed implementation is the Law on the payment of private pensions, which, despite being provided for in the primary legislation, remained in draft

form for more than twelve years. Although the draft was made available for public consultation, it did not progress to formal parliamentary debate. In the absence of a dedicated legal framework, pension payments within the private system have been governed by a combination of fragmented and partially adapted provisions derived from existing legislation, resulting in a lack of coherence and predictability.

In contrast to these delays, the legislator demonstrated a more proactive approach in the field of occupational pensions, adopting a dedicated regulatory framework for this segment (Parlamentul României, 2020). However, the practical impact of this legislation has been limited. Since its entry into force, the market has recorded only a small number of authorization requests - primarily from entities already active in the pension system, along with a limited number of custodians and auditors - without the establishment of any fully operational occupational pension funds.

This outcome raises important questions regarding the necessity and timing of the legislation. Furthermore, financial literacy remains a key determinant of individuals' capacity to access and effectively use financial products and services (Oprea, 2025). From a conceptual perspective, occupational pensions can be regarded as a subset of voluntary pension arrangements, suggesting that their regulation could have been integrated into the existing legal framework established by Law no. 204/2006. The decision to create a separate regulatory regime may therefore be interpreted as an instance of legislative overextension, rather than a response to concrete market demand.

Nevertheless, the law on occupational pensions introduces several innovative elements, including detailed provisions on fund prospectuses, the calculation and coverage of technical provisions (analogous to insurance reserves), and the regulation of cross-border activities. It also incorporates advanced corporate governance requirements, reflecting the influence of European regulatory standards, in accordance with Directive 2016/2341/EC of the European Parliament and of the Council of 14 December 2016 on the activities and supervision of institutions for occupational retirement provision (IORPs), published in the Official Journal of the European Union (OJEU), L 354 of 23 December 2016 (European Union, 2016)

An important operational feature of this framework is the obligation imposed on employers to withhold and transfer both their own contributions and those of participating employees, alongside mandatory social security contributions. This mechanism is intended to streamline the contribution process and to enhance compliance, although its practical effectiveness remains contingent on broader administrative capacity.

The influence of European integration on the Romanian pension system is further illustrated by the adoption of Law no. 65 of 27 March 2023, which implements Regulation (EU) 2019/1. 238 of the European Parliament and of the Council of 20 June 2019 on a pan-European personal pension product (PEPP), of certain provisions of Regulation (EU) 2020/852 of the European Parliament and of the Council of 18 June 2020 establishing a framework to facilitate sustainable investments and amending Regulation (EU) 2019/2.088, as well as amending and supplementing certain regulatory acts in the field of private pensions (Parlamentul României, 2023). This legislative development reflects Romania's commitment to aligning its regulatory framework with the evolving Acquis Communautaire in the field of financial services and sustainable finance.

At the time of adoption, however, the practical implications of this legislation remain limited, as the institutional and market conditions necessary for the effective deployment of PEPP products are still in the process of development. Nonetheless, the introduction of this framework signals a shift toward greater integration with European financial markets and a diversification of pension products.

Finally, it is important to note that the legislative core of the Romanian private pension system has undergone continuous adaptation over time. These modifications have been driven by multiple factors, including the accumulation of practical experience, the need to ensure consistency with other areas of national legislation, and the requirements of European integration. A key institutional development in this regard was the establishment of the Financial Supervisory Authority through Emergency Ordinance no. 93 of 18 December 2012 (Guvernul României, 2012) on the establishment, organisation and functioning of the Financial Supervisory Authority, as amended and supplemented, which assumed the responsibilities previously held by the Private Pension Supervisory Commission, thereby contributing to the consolidation of financial sector oversight.

In conclusion, while the period following 2004 witnessed significant progress in the formal structuring of private pension legislation, it also revealed persistent challenges related to implementation, institutional coherence, and market development. The interplay between legislative ambition and practical constraints continues to shape the evolution of the system, underscoring the need for a more integrated and forward-looking approach to pension reform.

The Role and Limits of Secondary Legislation in Romania's Private Pension Framework

The establishment of the private pension system in Romania, characterized by the innovative nature of its primary legislation, necessitated the subsequent development of an extensive body of secondary legislation. This regulatory layer has played a critical role in operationalizing the legal framework governing both Pillar II (mandatory private pensions) and Pillar III (voluntary pensions), reflecting both the complexity of the system and the specificities of the Romanian legislative tradition.

In the case of Pillar II, a comprehensive set of rules, norms, and decisions has been adopted initially by the Private Pension Supervisory Commission and, following institutional restructuring, by the Financial Supervisory Authority (ASF). These regulatory instruments primarily address the authorization and ongoing supervision of participating entities. Key provisions relate to the minimum share capital requirements of pension fund administrators, the evaluation and approval of individuals occupying management and key positions, as well as the prudential assessment of acquisitions and increases in shareholdings within regulated entities.

Furthermore, the secondary regulatory framework extends to the outsourcing of specific activities, particularly those concerning the administration and investment of pension fund assets. The authorization and content of the prospectus of the private pension scheme also fall within the scope of these regulations, ensuring a standardized and transparent communication of rights and obligations to participants.

Additional regulatory provisions govern essential operational aspects of the system,

including the registration and record-keeping of participants, the collection and allocation of contributions, and the protection of participants in situations such as fund mergers. Specific rules address the use of net personal assets in cases of disability or death, as well as the procedures governing the transfer of participants between pension funds.

From a prudential perspective, the regulatory framework incorporates detailed provisions concerning technical provisions, minimum rates of return, and the approval of advertising materials. Transparency is reinforced through extensive reporting obligations, designed to ensure the continuous disclosure of relevant financial and operational information. Moreover, corporate governance requirements – covering internal control systems, internal audit functions, and risk management frameworks – constitute a central component of the supervisory architecture.

The scope of secondary legislation also encompasses special regulatory measures, including special supervision and special administration, as well as detailed rules governing pension fund investments, accounting practices, and system control mechanisms. Particular attention is given to compliance with regulations aimed at preventing and combating money laundering, reflecting broader international regulatory standards.

Comparable regulatory structures have been developed for Pillar III (voluntary pensions) and, more recently, for occupational pensions, thereby ensuring a degree of consistency across the different components of the private pension system.

Despite its breadth and functional importance, secondary legislation remains inherently limited in scope, as it cannot substitute or compensate for deficiencies in primary legislation. This limitation becomes particularly evident in the context of the absence of a comprehensive legal framework governing the private pension payment system.

In practical terms, this legislative gap has led to a significant divergence between the theoretical design of the pension system and its actual functioning. Although private pensions—both within Pillar II and Pillar III - are conceptually intended to provide long-term retirement income, the absence of specific legislation regulating pension payouts has resulted in a system that operates, in effect, in a manner analogous to investment funds. Rather than delivering life annuities, pension funds primarily facilitate the withdrawal of accumulated assets.

Under the current regulatory arrangements, participants in the private pension system may access their benefits through two principal mechanisms. The first consists of a lump sum payment, corresponding to the total value of the participant's net personal assets accumulated over the contribution period. The second option involves the payment of accumulated assets in equal monthly instalments, distributed over a maximum period of five years.

These instalments are subject to a minimum threshold of 500 lei per month, with the exception of the final payment, from which administrative fees associated with the disbursement process are deducted. While these arrangements provide a degree of flexibility for participants, they fall short of fulfilling the fundamental objective of pension systems, namely the provision of stable, long-term income streams during retirement.

This situation underscores the structural dependency of the private pension system on the completeness and coherence of its legislative framework. In the absence of a dedicated law on pension payments, the effectiveness of both primary and secondary legislation remains constrained, highlighting the need for a more integrated and comprehensive approach to regulatory design.

Conclusions

The evolution of the private pension system, particularly regarding Pillar II pension funds, cannot be fully understood in the absence of an analysis of the political and institutional environment that has shaped its development. In this context, recurrent public statements by representatives of the Ministry of Finance – recognized as the primary initiator of primary legislation in the financial sector – regarding the potential nationalisation of Pillar II pension funds have contributed to a climate of uncertainty. Such positions, even when not materialized into concrete legislative measures, have generated instability, and have influenced both market expectations and regulatory continuity.

This environment reflects a broader structural issue, namely the limited consistency of political commitment to pension reform. The combination of fluctuating political priorities and the insufficient technical expertise of decision-makers across various levels of public administration has resulted in a legislative trajectory characterized by discontinuities and delays. The development of the regulatory framework has thus followed a non-linear pattern, marked by procedural bottlenecks, partially implemented initiatives, and postponed reforms. Despite these shortcomings, the cumulative effect of successive legislative efforts has contributed to the gradual construction of a functional regulatory matrix governing the private pension sector.

A notable exception within this framework remains the absence of a comprehensive legal act regulating the payment of private pensions. This legislative gap continues to limit the system's capacity to deliver its core function, namely the provision of long-term retirement income in the form of life annuities, ideally coordinated with benefits from the public pension system. As a result, the private pension system remains incomplete in structural terms, with its accumulation phase more developed than its payout mechanisms.

Another defining feature of the Romanian regulatory approach is the tendency toward overregulation, particularly in the early stages of system development. This inclination can be traced to the legacy of financial instability experienced in the late 1990s, including episodes such as bank failures and the investment fund crisis. In response, both primary legislation and secondary legislation incorporated extensive prudential safeguards, governance requirements, and supervisory mechanisms aimed at preventing systemic risks and protecting participants.

Over time, however, these regulatory provisions have required recalibration. Market developments, along with the need for alignment with broader domestic legal frameworks and Community legislation, have necessitated a process of gradual adaptation and simplification. This dynamic adjustment reflects the ongoing tension between regulatory rigor and market efficiency, as policymakers seek to balance the objectives of financial stability, competitiveness, and accessibility.

At present, the legislative framework governing the private pension system can be considered, in general terms, sufficiently developed to support the effective functioning of the market. Nevertheless, the system remains exposed to a range of political and regulatory risks, which have the potential to undermine investor confidence and generate significant reputational risk. In this sense, the sustainability of the private pension system depends not only on the quality of its legal architecture but also on the predictability and consistency of the policy environment in which it operates

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Community Cooperation and Social Resilience in a Low-Trust Wartime Context: Evidence from Ukraine

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Abstract: *Ukraine entered the 2022 war with relatively low levels of institutional trust, raising an important question about how communities remain socially functional during extended crisis conditions. This article examines the role of community cooperation in sustaining social resilience during the 2022–2024 war period. Drawing on polycentric governance and antifragility frameworks, the paper analyzes social cohesion indicators from institutional reports alongside documented cooperation practices to assess how cooperation developed at the local level during the conflict. The analysis focuses on interactions between local authorities, civil society organizations, and volunteer networks engaged in community support and recovery initiatives. The findings suggest a functional decoupling between institutional trust and community cooperation: while trust in public authorities fluctuated during the war, community cooperation remained relatively stable. Informal local networks played an important role in organizing support activities and maintaining basic services when formal institutions were under pressure. These findings suggest that community-level cooperation can remain stable even in low-trust wartime environments, highlighting the importance of local coordination for sustaining social resilience.*

Keywords*:* social resilience, civil society, volunteer networks, Ukraine, institutional trust

JEL: H12; H83; F22

1. Introduction

The 2022 Russian invasion placed local communities in Ukraine under sustained pressure. Millions of people were displaced, and local systems were forced to operate under prolonged uncertainty. Estimates indicate that around 3.6 million individuals remain internally displaced inside Ukraine, creating long-term strain on communities and public services (IOM, 2025). Research on crisis response suggests that social resilience often depends on civic participation and local cooperation, particularly when institutional capacity is under strain (Revtiuk and Ivanova, 2024; Volacu and Aligică, 2023). Despite this, many communities adapted through civic cooperation and volunteer action, rather than solely through formal institutional planning. This matters because community mobilization occurred in a context where institutional trust had historically been fragile.

The Ukrainian case shows how adaptive capacity works in continuous high-intensity crisis conditions. Wartime conditions often generate extended uncertainty and institutional pressure. In these environments, community-level cooperation becomes a practical mechanism to preserve basic social functioning.

This paper studies how social resilience developed at the community level in Ukraine between 2022 and 2024. The focus is on the interaction between local authorities, civil society organizations, and volunteer networks formed during the crisis. Also, this paper combines trust indicators with documented cooperation practices to explain how community resilience emerged in a wartime context characterized by low institutional trust. The main research question is: What forms of cooperation helped communities remain socially functional during armed conflict? A secondary question explores whether social resilience can emerge in contexts characterized by historically low institutional trust. While existing studies often examine institutional coordination during the war, this article focuses on the relationship between institutional trust and community-level cooperation.

This article makes two contributions to the literature on crisis governance and social resilience. First, it provides an exploratory empirical account of the divergence between institutional trust and community-level cooperation during the 2022-2024 war period in Ukraine. Second, it interprets this divergence through the lenses of polycentric governance and antifragility, suggesting that community cooperation may remain stable even in low-trust wartime environments.

2. Literature review

Social resilience is commonly defined as the ability of societies to adjust and maintain cohesion during crises (UNDP, 2024). Community resilience research emphasizes resilience as a continuous process grounded in collaboration, civic participation, and trust between members of society (Revtiuk and Ivanova, 2024). Social resilience is commonly defined as the ability of societies to maintain cohesion and adapt during crises (UNDP, 2024).

The concept of resilience has been expanded in recent literature beyond simple recovery from shocks. Antifragility perspectives suggest that social systems can adapt and sometimes strengthen when exposed to disruption and stress (Vâlsan, Druică, and Aligică, 2025). From this

perspective, crises may generate new forms of cooperation and social solidarity, not only facilitating recovery but also strengthening adaptive capacity beyond pre-crisis levels. This interpretation is particularly relevant in wartime conditions, where communities must reorganize everyday life under persistent uncertainty.

Trust is an important component of social resilience. The literature on social cohesion distinguishes between horizontal trust and vertical trust. Horizontal trust refers to trust between members of a community. Vertical trust refers to trust in public institutions and authorities. Horizontal trust is linked to cooperation, mutual support, and everyday interactions between citizens. Vertical trust reflects the relationship between society and the state. Frameworks such as reSCORE analyze social cohesion through these two types of relations, looking at both people-to-people and people-to-state interactions (UNDP, 2024).

Decentralized decision-making and multi-level coordination have received growing attention in governance research. Polycentric governance approaches explain how decision-making can be shared across institutions, organizations, and communities rather than concentrated in a single center of authority (Lofthouse and Kral, 2025). Recent empirical work has applied polycentric frameworks to the Ukrainian wartime context, identifying mechanisms such as local knowledge facilitation, resource mobilization, and policy experimentation at the community level (Keudel and Huss, 2024; 2025). While Keudel and Huss focus on governance mechanisms from the perspective of local authorities, the present article takes a complementary approach: rather than examining how institutions coordinate, it examines how society-level trust and cooperation indicators evolve in relation to each other, drawing on secondary survey data rather than primary fieldwork with local governments.

Democratic resilience research, similarly, emphasizes the importance of citizen participation and civic engagement for maintaining system stability under pressure (Volacu and Aligică, 2023). Cooperation among public institutions, civil society organizations, and other actors often generates structural tensions over authority, resources, and coordination. These tensions are not necessarily dysfunctional. They are often part of complex crisis governance arrangements in which different actors operate simultaneously. Previous collaboration experience and existing coordination mechanisms influence how effectively such partnerships function during emergencies (Foss et al., 2025).

Pre-existing systemic capacity also shapes crisis outcomes. Crisis response capacity is strongly influenced by institutional infrastructure, organizational routines, and pre-crisis coordination mechanisms. Emergency reception systems and humanitarian response structures are often part of broader contingency planning rather than exceptional arrangements created only during crises. Resilience outcomes depend partly on institutional capacities that exist before the onset of crisis (Breivik-Khan, 2025).

Despite these developments, the existing literature pays less attention to how these dynamics interact in real time during high-intensity wartime conditions. The Ukrainian case provides an opportunity to observe resilience as an ongoing social process. Resilience becomes visible through everyday cooperation practices, local coordination, and informal support mechanisms that operate alongside formal institutional responses.

This article examines these dynamics through the case of Ukraine during the 2022–2024 war period. These perspectives, polycentric governance, antifragility, and democratic resilience guide the analysis that follows.

3. Research methodology

This study is based on a qualitative document analysis of secondary sources published between 2022 and 2025. Two types of sources were used. The first consists of institutional reports. The primary source is the UNDP reSCORE report (UNDP, 2024), selected because it provides structured, survey-based indicators of social cohesion and trust across multiple measurement waves. Additional data was drawn from IOM displacement reports, selected for their coverage of the wartime period under study. The second type consists of academic literature on social resilience, crisis management, and polycentric governance. In total, the analysis draws on a small set of institutional reports and recent academic studies directly addressing wartime cooperation, social cohesion, and crisis governance in Ukraine. These were identified through a citation snowballing procedure, starting from keywords on the topic and expanding through their reference lists.

The analysis focused on three dimensions across the selected sources: how trust and social cohesion indicators changed over time, what forms of cooperation between local authorities, civil society, and international organizations were documented during the war, and what conditions shaped these cooperation patterns. For each source, relevant indicators and cooperation examples were extracted and organized around these dimensions. The aim was to identify recurring patterns rather than to test causal relationships.

Particular attention was given to reSCORE indicators measuring trust in public authorities, such as accountability of authorities and authority care, and indicators measuring community-level dynamics, such as community cooperation and sense of civic duty. Comparing these two groups allowed a contrast between how institutional trust and community cooperation evolved during the wartime period.

Given the exploratory nature of the study, no formal coding procedure was used; instead, the analysis focused on identifying recurring patterns across sources. The analysis draws on polycentric governance and antifragility frameworks as interpretive lenses rather than formal analytical categories.

4. Results

This section presents the empirical findings, organized around two dimensions: documented cooperation patterns at the community level, and social cohesion and trust indicators drawn from the reSCORE framework.

The evidence indicates that social resilience in Ukraine during the war was closely linked to community-level cooperation and civic mobilization. Much of the recovery effort relied on local partnerships rather than exclusively on centralised coordination. Institutional reports describe locally organized initiatives, including shelters for internally displaced persons, psychological

support services, educational programs for children, and assistance networks for vulnerable populations (UNDP, 2024; UN Ukraine, 2024).

Volunteer networks and NGOs often handled rapid delivery and last-mile distribution, while local administrations coordinated access to facilities and basic registration procedures. This division of labor reduced pressure on formal institutions and helped maintain service continuity at the local level.

4.1 Cooperation patterns during the war

Reports and field studies describe several examples of cooperation at the local level during the war. Local administrations, international organizations, civil society groups, and volunteer networks worked together to restore services and support affected communities. One example is the Ivankiv community, which suffered extensive destruction during the 2022 invasion.

Reconstruction activities included repairing the local high school and cultural center, restoring more than 250 private homes, and installing 18 prefabricated houses. Local administrations coordinated reconstruction priorities and access to municipal infrastructure, while international organizations provided financial and technical support (UN Ukraine, 2024).

Similar patterns were reported in Markariv, Drohobych, and Mykolaiv, where recovery focused on restoring public buildings, repairing infrastructure, and supporting displaced individuals (UN Ukraine, 2024). At a broader scale, recovery programs reached 236,355 people across 19 "hromadas" (local municipalities) in 11 "oblasts" (administrative regions) through 25 local projects. These projects focused on rebuilding housing, restoring community services, and repairing public infrastructure damaged during the war (UN Ukraine, 2024).

Educational infrastructure illustrates the same cooperation pattern. Reconstruction programs helped restore learning environments for students in Chernihiv and Mykolaiv, while additional support was provided to schools in Cherkasy, Kirovohrad, and Poltava regions. These initiatives involved cooperation between local administrations, education authorities, and international organizations (UN Ukraine, 2024).

Community initiatives also played an important role when infrastructure systems were disrupted. Field studies describe residents organizing alternative water sources, installing generators, and coordinating local food distribution when supply systems were interrupted (Revtiuk and Ivanova, 2024).

Local administrations, civil society groups, volunteer networks, and international organizations each addressed different aspects of the crisis. This distributed pattern of cooperation provides the empirical basis for the analysis in the discussion section.

4.2 Social cohesion and trust indicators

Table 1 presents selected reSCORE indicators for Ukraine across three measurement points: before the war, the wartime peak, and the most recent wave in 2024. The pre-war values reported in the reSCORE dataset are based on retrospective survey questions collected in 2023. While this limits strict longitudinal comparability, the indicators still provide a useful approximation of how perceptions of trust and cooperation evolved during the wartime period.

Table 1: Selected Social Cohesion and Trust Indicators in Ukraine (reSCORE Framework)

Indicator	2021	(2023) Wartime peak	2024
Accountability of authorities	2.7	4.1	3.1
Authorities care	2.6	4.6	3.0
Community cooperation	5.1	5.5	5.2
Generalized trust	3.4	3.8	3.6
Intergroup trust	3.2	3.7	3.5
Sense of civic duty	5.4	6.6	6.2

Source: Author's compilation based on reSCORE indicators reported in UNDP (2024).
Note: The column '2021 (2023)' refers to the baseline measurement conducted in 2023 using retrospective questions about the pre-war period (2021), as reported in UNDP (2024). 'Wartime peak' refers to the highest value recorded across the 2022-2024 measurement waves.
All indicators are measured on a 0-10 scale based on the reSCORE methodology.

The reSCORE framework distinguishes between vertical cohesion, which captures relations between citizens and public authorities, and horizontal cohesion, which captures relations within society (UNDP, 2024). This distinction is central to interpreting the data. Indicators such as accountability of authorities and authority care measure the vertical dimension. Community cooperation, generalized trust, intergroup trust, and sense of civic duty measure the horizontal dimension.

The data show a clear divergence between the two dimensions. All vertical indicators declined significantly between their wartime peak and 2024, returning close to pre-war levels. Accountability of authorities dropped from 4.1 to 3.1, and authorities' care dropped from 4.6 to 3.0. At the same time, all horizontal indicators remained relatively stable or declined only marginally. Community cooperation stayed at 5.2, sense of civic duty at 6.2, and intergroup trust at 3.5. The consistency of this pattern across multiple indicators suggests that the divergence between institutional trust and community cooperation may represent a recurring feature of wartime social dynamics.

When formal institutions face overload, citizens tend to rely more heavily on community networks rather than disengaging (Revtiuk and Ivanova, 2024). The stability of horizontal cohesion indicators is consistent with this observation. The community cooperation score can also be read through an antifragility lens (Vâlsan et al., 2025): rather than simply returning to pre-war levels after initial disruption, community cooperation remained functionally stable throughout a sustained period of external stress.

Taken together, the data suggest that community-level cooperation remained relatively stable even when trust in public authorities fluctuated during the wartime period.

4.3 Pre-crisis capacity and resilience outcomes

The cooperation patterns documented in section 4.1 did not emerge from nothing. They developed within institutional structures, coordination routines, and civil society networks that

existed before the war began. Emergency reception and humanitarian infrastructures are better understood as part of broader contingency planning rather than exceptional crisis arrangements (Breivik-Khan, 2025).

The relative stability of horizontal cohesion indicators shown in Table 1 reflects not only the adaptive responses of communities during the war, but also the organizational capacity that was already in place beforehand. Communities where civil society organizations were active and where local administrations had prior experience coordinating with external partners were better positioned to maintain basic services under pressure (Breivik-Khan, 2025). Local resilience is therefore more likely to be sustained when coordination structures, networks, and emergency routines already exist or can be rapidly activated.

This does not reduce the significance of the wartime mobilization observed. It does suggest that resilience outcomes are partly path-dependent: what communities were able to do during the war was shaped by what already existed before it started.

5. Limitations and Future Research

This study relies primarily on secondary data from institutional reports, which may emphasize institutional perspectives more strongly than informal community dynamics. The analysis focuses on pattern identification rather than causal relationship testing and covers the 2022-2024 period specifically.

A potential geographic bias should also be considered. The reports analyzed may not fully capture developments in all regions of Ukraine, particularly in areas affected by occupation or active hostilities where data collection remains difficult (UNDP, 2024; IOM, 2025).

Future research could expand through field research, including interviews with local actors, quantitative analysis of trust and cooperation dynamics over extended timeframes, and comparative studies across conflict-affected societies.

6. Conclusions

The findings are consistent with research showing that resilience can emerge through decentralized cooperation and local adaptive capacity during crises (Volacu and Aligică, 2023; Lofthouse and Kral, 2025). They are also consistent with antifragility perspectives, which suggest that crises can strengthen adaptive capacity rather than simply disrupt it (Vâlsan, Druică, and Aligică, 2025).

Three observations stand out. First, the data show a consistent divergence between vertical and horizontal social cohesion indicators throughout the wartime period. While trust in public authorities declined significantly, community-level cooperation, civic duty, and intergroup trust remained relatively stable. This pattern, consistent across multiple indicators, supports the interpretation that community cooperation may have functioned as a partial substitute for institutional trust. Second, the stability of horizontal cohesion indicators across measurement waves suggests a sustained pattern rather than a temporary spike. Third, the distributed character of the observed cooperation, with local authorities, civil society, volunteer networks, and international

organizations each addressing different aspects of the crisis, is consistent with polycentric governance dynamics.

For public administration, the main implication is that pre-crisis capacity matters. Volunteer networks and civil society organizations function better as crisis partners when they are already embedded in coordination structures before a crisis begins, rather than mobilized as a last resort. In this sense, strengthening community-level cooperation should be considered a central component of long-term resilience strategies in conflict-affected societies.

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The Role of Renewable Sources and Emerging Energy Technologies in Supporting Sustainable Economic Growth: Case Study on Energy Communities

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Abstract: *The energy transition based on renewable sources and emerging energy technologies became an important element of contemporary sustainable development strategies in the context of increasing environmental pressures and the need to limit the link between economic growth and resource-intensive consumption. The paper examines how renewable sources and emerging energy technologies can support sustainable economic growth through the contribution of a pilot energy community project in relation to SDG indicator 7.1, SDG indicator 8.1.1 and SDG indicator 9.4.1. The topic is motivated by the difference between the macro level of defining the SDGs and the need to understand the micro mechanisms through which local initiatives can contribute directly or indirectly to their achievement. The research methodology combines qualitative analysis of the specialized literature with the case study method. The results show that the project contributes to the improvement of the access quality to energy through local renewable production; it partially reduces energy costs and also reduces emissions associated with electricity consumption from the grid. The analysis also highlights the limits of using SDG indicators at a micro scale, especially in the case of macroeconomic indicators. The contribution of the paper is to propose a cautious approach in appliance of SDG indicators at the local level and uses them as interpretative tools and not as direct causal measures. The recommendations aim to strengthen the legislative and economic framework for energy communities, stimulate self-consumption and energy sharing, and integrate these initiatives into national energy transition and sustainable development strategies.*

Key words: Energy communities, Renewable energy transition, SDG indicators, Sustainable economic growth

JEL: Q42, Q48, O13, O33

Introduction

In recent decades, at a global level, progress was recorded in all economic areas, which led to high pressures on natural resources, environmental degradation, and social imbalances. Thus, it became evident that development approaches focused predominantly on economic growth do not consistently integrate the ecological and social spheres. In this situation, sustainable development highlighted that public policies and long-term development strategies need to be reoriented (United Nations, 2015). The emphasis is on economic performance analysed in relation to the capacity of ecosystems to support human activity and the impact on social well-being. Given the global context marked by climate change, economic volatility and structural inequalities, this perspective is important because the implementation of resilient solutions is required (Hopwood et al., 2005). Institutional quality and macroeconomic conditions shape poverty dynamics across European countries and highlight the structural role of governance in socio-economic resilience (Jula et al., 2025). In the aforementioned transition, the energy sector has a direct influence on the level of emissions, resource security and economic competitiveness. The transformation of energy systems is main in sustainable development strategies as the modality energy is produced and consumed has effects on all dimensions of development (International Energy Agency, 2021). In this way, renewable sources and emerging energy technologies are associated with environmental benefits and opportunities for economic modernization and strengthening socio-economic resilience.

The international community recognized the need to implement a sustainable development model. In 2015, the United Nations adopted the 2030 Agenda for Sustainable Development. It is a commitment that guides states towards transformation and towards a more environmentally friendly, equitable and prosperous place and targets developed and developing countries alike.

The 2030 Agenda is based on 17 Sustainable Development Goals which cover a wide range of economic, social, and environmental issues: decrease of poverty and inequalities, improve access to education, health and basic services, and protect ecosystems. These are treated as interlinked objectives, where economic progress cannot be separated from social inclusion and environmental protection.

The interdependencies can generate both synergies and trade-offs. For example, investments in industrialization, infrastructure and economic growth can support poverty reduction and job creation, but at the same time can have negative environmental impacts if clean technologies are not used and appropriate regulatory frameworks are not applied. Similarly, environmental protection policies may entail short-term economic costs, but can contribute to increasing economic resilience and reduce vulnerabilities in the long term (Nilsson et al., 2016).

In September 2015, Romania joined the other 192 UN Member States and adopted the 2030 Agenda for Sustainable Development. Our country committed to implementing the Sustainable Development Goals at the national level and revised the National Sustainable Development Strategy to integrate the Sustainable Development Goals.

Emerging energy technologies accelerate the process towards achieving the SDGs. The development of renewable sources, energy storage solutions, smart grids and the digitalization

of energy systems contribute to increased efficiency, flexibility, and resilience of energy infrastructures (International Renewable Energy Agency, 2022). Their integration strengthens the link between the energy transition and sustainable economic growth by generating green jobs and the emergence of new business models. Emerging energy technologies reduce environmental impact and can transform potential constraints into long-term competitive advantages (Intergovernmental Panel on Climate Change, 2023). The European energy transition is closely linked to the objective of reducing carbon emissions, but its efficiency depends on the mix of policies, technologies, and economic structure of the member states (Apostu et al., 2022).

The objective of the research is to assess the contribution of a pilot project of a local energy community based on photovoltaic production on indicator 7.1 of SDG 7, indicator 8.1.1 of SDG 8, and indicator 9.4.1 of SDG 9. The analysis is carried out at the micro level through the case study implemented in a local community in the Alps, but without generalizing the results at the macroeconomic or national level.

In this context, the research aims to answer the following questions:

1) Does the local energy community project contribute to improving access to clean energy according to SDG indicator 7.1?

2) What is the relationship between the functioning of the energy community and the local economic performance reflected by SDG indicator 8.1.1 in the context of a micro-level case study?

3) Does the local energy community project support the reduction of emissions intensity according to SDG indicator 9.4.1?

4) Under which legislative, economic and sustainability conditions can the analysed model be replicated in Romania?

1. Literature review

The academic literature addresses energy sustainability because of the interaction between the transition to renewable sources, energy efficiency and socio-institutional transformations of energy systems. Simply substitute of fossil fuels with renewable energy sources is not enough to achieve sustainability. A reorganization of the way energy is produced, distributed, and governed is needed (Bridge et al., 2013; Jenkins et al., 2016). Oprea and Nicula (2026) highlight the rapid expansion of research on digitalization in emerging economies, indicating a structural shift toward technology-driven intermediation. Decentralized energy systems and green energy production result in reduced greenhouse gas emissions and increased energy resilience at local and regional levels (Parag & Ainspan, 2019; IEA, 2023). Renewable energy is associated with environmental benefits and economic and social impacts, such as cost stabilization and reduced consumer vulnerability to global market volatility (Sovacool et al., 2020). The social dimension of energy sustainability is becoming increasingly important because social acceptance, participation of local actors and equitable distribution of benefits determine the long-term success of the energy transition (Dall'Orsoletta et al., 2022).

Regarding sustainable development, the literature moved from general formulations to operational frameworks focused on the integration of economic, social, and environmental

dimensions, since 2000. A useful contribution to positioning is the typology of sustainable development approaches. There are tensions between paradigms oriented towards the status quo, reforms, and transformation, including in the way public policy manages the link between economic growth, equity, and ecological limits (Hopwood et al., 2005). Due to this evolution, the 2030 Agenda for Sustainable Development introduced an analytical, normative framework and a common language structured around the 17 SDGs, which reflect the connection between economy, society, and environment (United Nations, 2015).

Independent analysis of the Sustainable Development Goals is rarely done in practice. Nilsson et al. (2016) propose the mapping of the interactions between these goals to avoid policies "in silos", and Weitz et al. (2018) create tools for contextual and systemic assessment of these interactions, which are very useful in design and prioritization (Nilsson et al., 2016; Weitz et al., 2018). Quantitative research that analysed SDG indicators shown that synergies and trade-offs are statistically detectable and vary between countries. This supports the need for context-dependent approaches (Pradhan et al., 2017). Along the same lines, in their paper, Kroll et al. (2019) discuss whether policies manage to transform trade-offs into synergies and which institutional conditions favour integration (Kroll et al., 2019). Regional competitiveness analysis highlights the role of structural variables of the local economy in differentiating territorial performance in periods of economic convergence and divergence (Jula & Jula, 2000). Energy is a cross-cutting "node" in these works because it influences competitiveness, production costs, employment structure and emissions. From the perspective of SDG 7, recent research argues that the transition to renewables and energy efficiency is a necessity to reduce energy intensity and decarbonization, but, at the same time, performance depends on investments in networks, flexibility and governance (IEA, 2021; IRENA, 2022). The Intergovernmental Panel on Climate Change directly connects the transformation of energy systems with limiting global warming, which makes SDG 7 an anchor goal for the rest of the agenda (IPCC, 2023). The connection between SDG 7 and SDG 8 is analysed in the specialized literature as "green growth", just transition and the labour market. OECD analyses show that investments in low-carbon technologies and modern infrastructure can generate long-term productivity and competitiveness, but, of course, provided that coherent innovation and human capital policies are implemented (OECD et al., 2015). At the same time, the green transition can create jobs, but without retraining and social protection policies, concentrated regional and sectoral losses occur (ILO, 2018).

Research addresses SDG 9 in relation to technological development and change and the capacity of infrastructures to integrate distributed generation, digitalization, and new market models. In their paper, Bridge et al. (2013) analyse the energy transition and observe that the shift from centralized systems to more decentralized architectures requires investments in networks, metering, flexibility, and governance (Bridge et al., 2013). Oprea and Draghici (2024) show that digitalization strengthening access and effective participation in modern financial services. Regarding energy communities, the literature places them at the intersection of energy transition and social innovation. The first community initiatives in the field of energy emerged in the context of the environmental movements of the 1960s and the oil crises of the 1970s. They were motivated by the need for energy autonomy, civic participation, and reduced dependence on

centralized energy structures (Hewitt et al., 2019) and emphasized the direct involvement of citizens as active actors in energy production and management. The report by the Joint Research Centre of the European Commission shows that these new structures contribute to the democratisation of access to renewable energy and the distribution of economic benefits at the local level, independent of individual income levels (Caramizaru & Uihlein, 2020). Although energy communities are studied in specific local contexts, their emergence and development were supported by a set of common factors, independent of location, such as the existence of appropriate policy schemes (Lode et al., 2022).

The conceptual framework was strengthened by Directive (EU) 2018/2001 (RED II), which formally introduced the concepts of citizens' energy communities and renewable energy communities (European Parliament & Council, 2018). Thus, energy communities appear in the specialist literature after 2010 as a mechanism for accelerating renewable energy systems, civic engagement, and local value retention. A landmark study presents the plurality of objectives of community initiatives: economic, social, environmental, infrastructural and the role of networks in strengthening the energy sector (Seyfang et al., 2013). Other empirical and comparative studies show that the good development of community energy systems is influenced by support frameworks, ownership models and institutional conditions (Bauwens et al., 2016).

Recent literature analyses this area in two directions. The first direction is represented by the analysis of energy communities as a social innovation and the effects on civic empowerment, local governance and social objectives are discussed (Dall-Orsoletta et al., 2022). The second direction focuses on energy and economic performance and the technical conditions of collective self-consumption and virtual sharing. The Magliano Alpi case study, the first pilot project in Italy, is a directly relevant example. The alternative of joining the energy community and the performances after one year of piloting are analysed and empirical arguments are provided about the role of the overlap between PV production curves and consumption profiles (De Santi et al., 2022; Ghiani et al., 2022).

In the same vein, recent review papers support the positioning of the architecture and systemic impact of energy communities as a policy tool for transition objectives (Barabino et al., 2023).

2. Methodology

The paper adopts a qualitative research based on the analysis of specialized literature and the case study method and aims to investigate the role of renewable sources and emerging energy technologies in supporting sustainable economic growth in relation to indicator 7.1 of SDG 7, indicator 8.1.1 of SDG 8 and indicator 9.4.1 of SDG 9. The selection of this research method is justified by the exploratory nature of the topic and the need to analyse the mechanisms through which local energy initiatives contribute to achieving sustainability objectives.

The literature review was used to present the main theoretical and empirical contributions related to a very current topic in the energy sector and sustainable development. This method was selected because it favours the recognition and understanding of what is currently known

and what needs to be known about this topic (Webster & Watson, 2002; Oprea, 2024). The search for specialized works was carried out in the Web of Science, Scopus, Springer and Google Scholar databases. The search terms were: "Sustainable Development Goals", "SDG indicators", "renewable energy transition", "energy access", "energy communities", "distributed energy systems", "economic growth sustainability", "real GDP per capita growth", "infrastructure modernization", "CO_2 emissions reduction" and "low-carbon energy systems". The Boolean operator "AND (and/or OR)" was applied in the search process to expand and narrow the search accordingly. The analysis of titles, abstracts and keywords followed to verify whether the works research the subject of study of this paper.

The reports of important institutions in the energy field were also analysed: The International Energy Agency, the International Renewable Energy Agency, the Organization for Economic Cooperation and Development, the International Labor Organization, the European Commission, and the Intergovernmental Panel on Climate Change. This stage helped to outline the conceptual framework of the research and to demonstrate the selection of indicators of SDG 7, SDG 8 and SDG 9 as the objectives of the analysis.

Both standard academic literature and grey literature were analysed with the aim of exposing the relationships between renewable energy, energy security, economic growth, and infrastructure innovation. In addition to the theoretical analysis, the research uses the case study method in which the energy community of Magliano Alpi (Italy) is examined. The paper analyses this community since it was one of the first initiatives of its kind in Europe and the first pilot project in Italy. Thus, the case study allows for the detailed analysis of a real pilot project created in a specific context, to examine the interaction between project participants, green energy technologies and institutional frameworks. Data from the public documentation of the project, from official institutional sources and from academic articles analysing the energy and economic performance of the community were used for the case study. The case study analysis is carried out by relating the project characteristics to the selected indicators of SDGs 7, 8 and 9 (7.1, 8.1.1 and 9.4.1) and aims to identify qualitative contributions complemented by quantitative estimates at the case study level, where data allow.

The selection of indicators 7.1, 8.1.1 and 9.4.1 was carried out to ensure the link between the research objectives, the nature of the case study and the level of analysis allowed by the available data. The indicators were chosen due to the possibility of being operationalized at the micro level through indirect indicators for the functioning of an energy community. Indicator 7.1 allows the analysis of the functional aspect of access to energy, by assessing the quality of the energy service and the use of renewable sources. Indicator 8.1.1 is used as a framework indicator of SDG 8, with a contextual role, to anchor the study in a macroeconomic framework of sustainable growth, without assuming direct causal relationships. Indicator 9.4 is relevant for assessing the modernization of energy infrastructure and the reduction of climate impact, being supported by quantitative estimates of CO_2 emissions.

3. Case study

Today's technology allows the creation and implementation of innovative energy management models. European legislation focuses on the consumer and producer, who must be guaranteed fairer and more sustainable access to the electricity market. At the heart of this evolution are "energy communities". Currently, there are several definitions of energy communities, each with its own history and different legislative and regulatory references, in a regulatory framework that is constantly evolving. The objective of this entity, beyond the terms used is to help citizens to create innovative forms of aggregation and governance in the field of energy, in order to generate benefits for individuals and the community, both economic and in terms of quality of life and to provide services in the local area (CER Magliano Alpi, 2021). In November 2016, the European Commission presented a package of proposals, called the "Clean Energy for All Europeans Package" (CEP), with the aim of contributing to the EU's commitments under the Paris Agreement. The proposal led to the adoption of eight pieces of legislation between 2018 and the first half of 2019, through which the EU reformed its energy policy framework. Of particular importance are Directives 2018/2001 (which introduced "renewable energy communities") and 944/2019 (which defined "citizens' energy communities"), which are currently being transposed by the Member States.

The creation of the Magliano Alpi energy community must be seen in the light of the energy transition processes at European level and how these have been felt in small communities. The literature (Ghiani et al., 2022) argues that, in Italy, Renewable Energy Community (REC) projects emerged as a necessity to reduce dependence on the centralized energy system.

In Magliano Alpi, from a socio-economic point of view, public administration, households, and small businesses coexist in an economic ecosystem vulnerable to the volatility of energy prices. Subsequent analyses of the project implementation show that it resulted in a reduction in energy expenses and the retention of economic value at the local level, important aspects for the public budget and small businesses (Ghiani et al., 2022; De Santi et al., 2022). The energy context was influenced by the introduction of the Italian experimental legislative framework in 2020, which allowed the development of the first energy communities based on distributed generation. Thus, opportunities were created to test alternative models of energy production and consumption through utilization of local renewable resources and by distributing the benefits among the participants.

The Magliano Alpi energy community was created as a pilot project, in a period characterized by still incipient regulations. The literature also highlights the importance of social factors in the configuration of this project, in addition to the economic and technical dimensions. Magliacani et al. (2025) highlight that the emergence of the first energy community in Italy was the result of the aspiration of local authorities to promote new forms of energy governance, based on cooperation, transparency, and collective responsibility. Energy was treated as an asset for local development and for strengthening relations between public institutions and citizens.

3.1. Description of the energy community in Magliano Alpi (Italy)

The Magliano Alpi energy community is one of the first European projects to implement a model for collective production and consumption of renewable energy. The energy community was developed in 2020, as a direct response to the changes introduced by Italian legislation that allowed the testing of energy communities. The project was designed to assess the technical, economic, and organizational feasibility of this type of initiative under real operating conditions (De Santi et al., 2022; Ghiani et al., 2022). The town of Magliano has approximately 2200 inhabitants and is in the Piedmont region of northern Italy, close to the French border. In the pilot phase, the Magliano Alpi energy community included three public institutions, three households and one small economic consumer, all connected to the same branch of the low-voltage network (Ghiani et al., 2022).

3.2. Actors involved in the energy community in Magliano Alpi

The structure of the energy community is built around the Magliano Alpi town hall, which initiated the pilot project and provided the necessary infrastructure for energy production. The local government participates as a prosumer and institutional coordinator and facilitates the relationship with the distribution operator and regulatory authorities (Comunità Energetica Rinnovabile Magliano Alpi, 2021). The community also includes residential consumers and a small economic consumer. Participation was voluntary and did not involve the modification of individual energy supply contracts. The literature highlights that this mixed architecture was important for the social acceptance of the project and for its stable operation during the pilot phase (De Santi et al., 2022). The municipality has also signed the "Manifesto of energy communities for an active central role of citizens in the new energy market", promoted by the Energy Center of the Polytechnic University of Turin. Thus, the project was also technically supported by this institution. The energy community is a member of the Italian Forum of Energy Communities (IFEC), but it did not have an operational role in the implementation of the Magliano Alpi energy community. The institution only contributed to disseminate the project as an example of good practice and facilitate the exchange of knowledge between the actors involved in the development of energy communities in Italy.

3.3. Technologies used and their emerging character used in the energy community of Magliano Alpi

From a technological point of view, the Magliano Alpi energy community is based on a photovoltaic system connected to the distribution network, installed on a public building. The system has an installed power of approximately 19.8 kWh, which was sized in relation to the consumption profiles of the community members and with the objective to maximize the local use of the energy produced (Ghiani et al., 2022). Photovoltaic technology is already mature. The emerging character of the project is given by the way in which renewable energy is integrated into an energy community model. Virtual energy sharing is an emerging element of the functioning of energy communities, consisting in the accounting allocation of locally produced energy to several members of the community, without direct physical transfer of energy. In the case of

the Magliano Alpi energy community, this mechanism is implemented by calculating the shared energy based on production and consumption data, which is used to determine the economic benefits of the members (Ghiani et al., 2022; De Santi et al., 2022).

Based on the project, smart meters were installed at the premises of the end users. According to Barai et al. (2015), smart meters record energy consumption and production and thus concentrate information for the energy market (Barai et al., 2015). These systems respond immediately to demand and connect users, network operators and the energy market (Kochański et al., 2020). They are used to continuously save bidirectional information on active and reactive power in both single-phase and three-phase mode (Ghiani et al., 2022).

The Magliano Alpi energy community project used an energy community management system through digital energy management platform to collect, process and analyse the production and consumption data needed to calculate shared energy and performance indicators. This system, mentioned in the community's technical and economic analysis, was developed as part of scientific collaboration with specialised research laboratories and research infrastructure projects for energy communities (ERIGrid 2.0, 2022), supporting the planning, optimisation and estimation of the economic impact of energy operations.

The community does not use energy storage systems, and the optimisation of self-consumption is achieved exclusively by correlating photovoltaic production with the consumption profiles of the users. Jula et al. (2023) show that electricity consumption patterns exhibit significant structural changes under systemic shocks, emphasizing the sensitivity of demand profiles to economic and social disruptions. This aspect is important, as it highlights the technical limitations of the first generation of energy communities and the importance of digital energy management in the absence of storage (De Santi et al., 2022). The project included limits on the location of consumers and producers, who had to be connected to the same medium/low voltage substation. The maximum production power of 200 kW of the installations serving the community was also set as a constraint.

3.4. Energy and economic performance of the Magliano Alpi energy community

Given that the Magliano Alpi project was a conceptual one, without annual reporting, the energy performance analysis of the Magliano Alpi energy community was carried out based on data obtained by Ghiani et al. (2022). Raw data was collected between March 2021 and February 2022 for the first full year of operation of the project. The community recorded a total electricity consumption of 49,288 kWh, while the total energy production from photovoltaic sources was 27,137 kWh, indicating that, from a technical point of view, the local production system would have the capability to cover over half of the community's annual energy needs, under conditions of better synchronization between production and consumption.

Of the energy produced, 9,642 kWh (35%) were consumed instantly by the public building on which the photovoltaic system is installed, and 7,797 kWh (approx. 15% of total consumption) were identified as shared energy between community members, according to the rules established by the national operator GSE. The rest of the energy produced, namely 17,495 kWh, was injected into the public grid, highlighting the existence of local value losses caused by the limited use of renewable energy within the community.

From an economic point of view, the analysis shows that the operation of the energy community generated financial benefits, although these are still below the maximum potential. During the period analysed, the community obtained 2,326 euros from the mechanism for capitalizing on energy injected into the grid (Ritiro Dedicato – RID) and 927 euros from the incentive granted for shared energy, calculated at a value of 0.119 euros/kWh.

The total electricity expenditure for community members was estimated at 11,130 euros, which leads to a negative economic balance of –7,875 euros in the initial configuration. The negative balance shows the pilot nature of the project and the lack of operational optimization. However, the authors demonstrate that, through behavioral optimization measures, in particular through load shifting, the shared energy could increase to 17,000 kWh/year, which would lead to an increase in economic incentives by 118% and an improvement in total economic performance by 13.9%, without additional infrastructure investments (Ghiani et al., 2022).

The energy and economic performance of the Magliano Alpi energy community is summarized according to Ghiani et al. (2022) in Table 1.

Table 1. Energy and economic performance of the Magliano Alpi energy community

Category	Indicator	Value	U.M.	Description
Energy Performance	Total annual electricity consumption	49,288	kWh/year	Aggregate consumption of all community members in the first year of operation
	Total photovoltaic energy production	27,137	kWh/year	Energy produced by the community photovoltaic system
	Physical self-consumed energy	9,642	kWh/year	Energy instantaneously consumed by the public building
	Energy shared within the community	7,797	kWh/year	Energy recognized as shared according to GSE rules
	Energy injected into the grid	17,495	kWh/year	Surplus energy delivered to the public grid
	Self-Consumption Ratio (SCP)	35	%	Share of self-consumption in total production
	Shared-to-Consumption Ratio (STC)	15	%	Share of shared energy in total consumption
	Energy from Energy Transition (EFET)	44	%	Share of renewable energy used locally
	Shared-to-Self-Consumption Ratio (SCSTC)	35	%	Degree of local utilization of produced energy

Economic Performance	Revenues from Ritiro Dedicato (RID)	2,326	€ / year	Revenues from energy injected into the grid
	Incentives for shared energy	927	€ / year	Revenues obtained from the GSE support scheme
	Total annual electricity cost	11,130	€ / year	Total community expenditure
	Annual economic balance	–7,875	€ / year	Difference between costs and revenues
	Potential increase in shared energy (optimized scenario)	~17,000	kWh/year	Estimated value through load shifting
	Estimated increase in economic incentives	+118	%	Increase in revenues from shared energy
	Estimated improvement in economic performance	+13.9	%	Impact of optimization without additional investments

Source: author's processing based on data from Ghiani et al. (2022).

The table highlights both the renewable energy use indicators and the economic impact of the project in the first year of operation.

3.5. Relevance of the project in relation to selected SDG indicators

From a sustainability perspective, the Magliano Alpi pilot project integrates energy, economic and institutional dimensions at the same time. Local production of renewable energy reduces emissions associated with electricity consumption, and sharing mechanisms allow the economic value generated by energy to be retained at local level (Ghiani et al., 2022). In institutional and social terms, the project is based on cooperation between public administration and citizens and promotes a participatory governance model. Magliacani et al. (2025) underline that this multi-component organizational and accounting dimension transforms the energy community into an instrument of technical and social innovation. Thus, the Magliano Alpi energy community can be interpreted as a demonstration project that highlights the potential of emerging energy technologies to support the transition to more sustainable energy systems by integrating distributed generation, digitalization, and local governance.

a. Project relevance for indicator 7.1 on access to secure, modern, and affordable energy services

SDG 7 indicator 7.1 (proportion of population with access to electricity) aims to ensure universal access to modern energy services (United Nations, 2015). In developed economies, of which Italy is a part, formal access to electricity is almost universal. In this case, an adapted analytical approach is required, since the relevance of indicator 7.1 no longer lies in the existence of a connection to the grid, but in the quality of access to it, the stability of energy supply and the economic affordability of energy.

The case study of the energy community of Magliano Alpi highlights how local initiatives can strengthen the qualitative dimension of energy access. In the first full year of operation, the community recorded a total consumption of 49,288 kWh and a photovoltaic production of 27,137 kWh, of which 9,642 kWh were self-consumed by the public institution and 7,797 kWh were shared among community members (Ghiani et al., 2022). In this way, approximately 17,439 kWh, which constitutes over a third of the annual energy needs, were covered by locally produced renewable energy. This performance has direct implications for the interpretation of SDG indicator 7.1. Local renewable energy production reduces dependence on the centralized grid and limits consumers' exposure to energy price volatility. Therefore, it contributes to increase energy security at the community level. For public institutions, households and small businesses, access to electricity becomes more predictable and economically affordable (International Energy Agency, 2021).

In this respect, the Magliano Alpi energy community functions as a mechanism to deepen SDG 7.1 in countries with universal access to electricity, by improving the quality of access and by democratizing energy use. The contribution of the project is indirect and qualitative. It has no effects that impact national statistics but provides empirical evidence regarding the role of energy communities to achieve the goals of the 2030 Agenda.

b. Project relevance for indicator 8.1.1 regarding the growth rate of real GDP per capita

SDG 8 indicator 8.1 aims to promote sustained economic growth and is operationalized through indicator 8.1.1: real GDP growth rate per capita (United Nations, 2015). By its nature, this indicator is strictly macroeconomic in nature and cannot be directly influenced by small-scale local initiatives. However, its use in the analysis of the Magliano Alpi case study is justified from a conceptual perspective, as it allows the assessment of the structural compatibility between energy transition projects and the objective of sustainable economic growth. The Magliano Alpi energy community does not generate measurable effects on GDP at national or regional level, but it indirectly contributes to the mechanisms that support the premises of stable economic growth. The economic performance analysis shows that the project has partially reduced energy costs for community members and retained economic value at the local level, through self-consumption and shared energy (Ghiani et al., 2022). In the first year of operation, locally used renewable energy covered approximately 35% of the community's energy needs and reduced dependence on energy purchased from the market.

From the perspective of SDG 8.1.1, the results are important because energy costs are the most important for local economic activities, especially for small businesses and for public budgets. Reducing exposure to energy price volatility contributes to increasing economic predictability and stabilizing productive activities (OECD, 2017). The literature also shows that investments in renewable energy and local infrastructure can have multiplier effects on local economies, even if their impact on macroeconomic indicators is diffuse and long-lasting (International Energy Agency, 2021). Oprea et al. (2025) argue that digital banking and capital market development contribute to economic growth when supported by coherent public–private partnerships and financial education policies.

Energy communities contribute to reduce energy costs, stabilize local economic activities and increase economic resilience. Jula et al. (2026) provide evidence that investment–output

relationships are nonlinear and adjustment dynamics are asymmetric, suggesting that structural transformation processes require sustained capital allocation and institutional support. At the aggregate level, these mechanisms are consistent with the assumptions of a favourable evolution of real GDP per capita. The approach avoids the attribution of unjustified causal effects and emphasizes the role of local initiatives as complementary elements to macroeconomic policies aimed at sustainable development.

In this sense, the Magliano Alpi energy community can be interpreted as a complementary instrument to macroeconomic policies aimed at SDG 8.1.1. The project illustrates how local energy transition initiatives can support the micro-level conditions necessary for sustainable economic growth, without unjustifiably attributing direct causal effects on the evolution of real GDP per capita.

c. Project relevance for indicator 9.4.1 on resilient infrastructure

SDG 9 indicator 9.4 aims to modernise infrastructure and increase industrial sustainability, operationalised through indicator 9.4.1 – CO_2 emissions per unit of value added (United Nations, 2015). This indicator reflects efforts to decouple economic activity from carbon emissions, through technological modernisation and the adoption of low-emission solutions. Emissions indicators are representative to assess the relationship between economic activity and climate impact (Vasile & Balan, 2008). Although the indicator has a macroeconomic dimension, its analysis at the case study level is relevant for identifying the micro mechanisms that support this trajectory. The energy community of Magliano Alpi is an example of modernising local energy infrastructure by integrating photovoltaic production, smart metering, and digital energy management.

The calculation below was made based on data from Ghiani et al. (2022). In the first year of operation, the community produced 27,137 kWh of electricity from renewable sources, of which 9,642 kWh were self-consumed and 7,797 kWh were shared among community members (Ghiani et al., 2022). The locally utilized renewable energy thus amounts to 17,439 kWh (≈17.44 MWh/year).

Based on these data, the project's contribution to reducing CO_2 emissions can be estimated as follows:

Avoided CO_2 emissions (t) = Erenewable (MWh) × EFelectricity mix (t CO_2/MWh)

where: Erenewable = renewable energy self-consumed + shared and EFelectricity mix means average emission factor of the national electricity mix.

An average emission factor of the Italian electricity mix of approximately 0.30 t CO_2/MWh was applied, frequently used in the European literature for the period 2021–2022 (IEA, 2021; IPCC, 2023), resulting in an estimated annual reduction of:

Avoided CO_2 emissions (t) = 17.44 MWh × 0.30 t CO_2/MWh = 5.2 t CO_2/year avoided.

The result shows the indirect contribution of the energy community to the decrease of the carbon intensity associated with the electricity consumption. From the perspective of SDG indicator 9.4.1, the project demonstrates how the modernization of the local energy infrastructure and the use of green technologies can reduce emissions without affecting the functioning of local economic activities. The energy community of Magliano Alpi is a demonstration project that illustrates at a micro scale the objectives of SDG 9.4.1. Although the impact on the national indicators is limited, the observed mechanisms are aligned with the decarbonization and modernization strategies promoted at European and global level.

4. Discussions

The paper analyses the indicators associated with SDG 7, SDG 8 and SDG 9 as they represent the operational tools through which the contribution of a local demonstration project can be interpreted. The analysis targets indicators 7.1, 8.1.1 and 9.4.1 and aims to highlight the synergies, limitations, and replication potential of the project without extending macroeconomic impacts that cannot be empirically supported.

4.1. Synergies between indicators 7.1, 8.1.1 and 9.4.1

Indicator 7.1 is directly influenced by increasing the quality of access to energy, in terms of cost stability and the use of locally produced renewable energy. The Magliano Alpi energy community does not expand physical access to electricity because it is already connected to a low-voltage grid. It strengthens the level of permissiveness of access through decrease of exposure to price volatility and increase the predictability of energy consumption.

Indicator 9.4.1, which aims to modernize the infrastructure and reduce the intensity of CO_2 emissions per unit of value added, is important by integrating distributed renewable energy production into the existing infrastructure. Although the energy community is not an industrial facility in the strict sense, the mechanisms of local production, self-consumption and virtual sharing lead to the reduction of emissions associated with electricity consumption and to the increase of the efficiency of the use of energy infrastructure.

Infrastructure modernization creates premises for synergies with indicator 8.1.1. The decrease in energy costs and increase in local energy resilience can support existing economic activities and improve the capacity of public administration and small consumers to allocate resources to productive activities. The impact on real GDP growth per capita is indirect and cumulative but is part of the logic of more resource-efficient economic growth.

4.2. Limitations and constraints in relation to the analysed indicators

The main limitation of the analysis is related to the scale of application of the indicators. In the case of indicator 7.1, the limitation is that it does not explicitly capture dimensions such as local energy autonomy or participatory governance, which are central to the functioning of energy communities. For indicator 8.1.1, the major constraint is the lack of a direct causal link between a local project and the dynamics of GDP per capita. The indicator is used exclusively to place the analysis in a broader macroeconomic context and to discuss indirect and cumulative contributions. It is used exclusively as a reference for economic compatibility.

The limitation results from the local scale of the case study, which does not allow the identification of causal effects on the dynamics of real GDP per capita.

4.3. Project replication potential in Romania

The replication in Romania of the pilot energy community project analysed in the Alps must be assessed with caution because its implementation and proper functioning were conditioned by a specific legislative and institutional context, in an experimental phase and supported by mechanisms to stimulate shared energy. The European framework offers common principles,

but the degree of replicability is determined by the application of the rules at national level. From a legislative perspective, Romania took an important step and introduced energy communities into national legislation (Government of Romania, 2025), in the context of the transposition of the provisions of Directives (EU) 2018/2001 and 944/2019. The Magliano Alpi pilot project benefited from the accounting recognition of shared energy and a specific financial incentive for collective self-consumption. On the other hand, the Romanian framework remains incomplete from an operational point of view. In Romania, secondary regulations have not yet been implemented regarding registration procedures, energy allocation between members, settlement, or access to metering data. This generates legal uncertainty and discourages local initiatives (Lowitzsch et al., 2019).

From an economic point of view, the analysis of the pilot project in the Alps shows that the longevity of small-scale energy communities depends on a favourable price for locally shared energy. Even if incentives are granted, part of the photovoltaic energy production is injected into the grid with a low economic value. Thus, the financial performance of the project is limited. In Romania, there is no similar mechanism to stimulate shared energy, and replication would have to rely almost exclusively on individual savings of prosumers, which reduces the accessibility for lower-income households and local economic actors (Caramizaru & Uihlein, 2020). Also, the non-technical costs associated with community administration and governance can become disproportionately high on a small scale, which affects economic sustainability in the medium term.

An additional risk is the possibility that the energy community model could be taken over by large players with superior financial and legal capacity, which could transform these initiatives into a commercial instrument with limited citizen participation. This scenario would contradict the objectives of energy democratization and social cohesion promoted at European level and illustrated by the case study analysed, where the role of the local authority was central to the legitimacy and social acceptance of the project.

From a sustainability perspective, the replication of the project is a complex socio-technical process. From a technical point of view, the Alpine energy community operates without storage systems, which limits the degree of local valorisation. The replicability of the project may increase the pressures on the distribution networks, especially in areas with undersized electricity infrastructure. Socially, the success of the implementation of such a project depends on the existence of transparent governance and the capacity of the communities to include vulnerable consumers. From an environmental perspective, reducing CO_2 emissions is very important, but it must be assessed in relation to the emission factors specific to the national energy mix and the effective degree of substitution of conventional production to avoid overestimating the climate impact (IRENA, 2023). In conclusion, the replicability of the pilot project in the Alps in Romania may represent a strategic direction, but it cannot be seen as an automatic result. The potential is maximum in communities where local authorities are involved in the implementation of such projects. In the absence of complete and clear legislation, dedicated economic mechanisms and an integrated approach to sustainability, energy communities risk remaining one-off initiatives, with limited impact on the energy transition and social inclusion.

Conclusions

The paper analysed, through a community-level case study, how energy community projects can contribute to achieving selected sustainable development goals. The research highlighted both the potential and the limits of using SDG indicators at the micro-scale.

In the analysis, for SDG 7, indicator 7.1 was interpreted qualitatively and the fact that the case study is carried out in a context with universal access to electricity was considered. The results show that the project contributes to improvement of the quality of energy access by increasing local energy autonomy and reducing grid dependency. The annual production of 27,137 kWh and self-consumption of 9,642 kWh show that local use is high, even if the self-consumption and sharing rate (17,439 kWh cumulated) remains below the maximum technical potential. The result supports the relevance of indicator 7.1 as a proxy indicator for the security and quality of energy access at the community level. Regarding SDG 8, the analysis used indicator 8.1.1 in a cautious manner, as an indirect indicator. The project does not generate measurable economic growth in terms of local GDP, but creates favourable conditions by reducing energy costs, stabilizing expenditures, and retaining part of the economic value in the community. The contribution is not directly quantifiable, which confirms the complementary nature of indicator 8.1.1 in relation to the case study. For SDG 9, the assessment focused on indicator 9.4.1, and the results show that the project contributes to the decarbonization of local infrastructure, by reducing emissions associated with grid consumption and by integrating a photovoltaic capacity that exceeds 50% of the annual consumption of the community. The decarbonization effect is supported by an estimated reduction in CO_2 emissions associated with grid consumption, calculated based on renewable energy produced and used locally.

Public policies on energy communities should go beyond the strictly installed capacity-oriented approach and also focus on maximization of the local use of the energy produced through incentives for self-consumption, sharing and demand flexibility. Explicit integration of energy communities into national energy transition strategies can strengthen the link between the objectives of decarbonization, local energy security and sustainable economic development, especially in transition economies such as Romania.

The contribution of the paper is to create an interpretative framework for the synergies between selected indicators of SDGs 7, 8 and 9 in the case of energy communities. It explicitly shows where global indicators are appropriate (SDGs 7.1 and 9.4, in a qualitative sense) and where they should be used with caution (SDG 8.1.1, strictly contextual).

The limitation of the research is that there is a difference in scale between the SDG indicators (designed macro) and the case study (micro), which restricts the causal interpretation, especially for SDG 8.1.1. Also, the lack of storage may limit the generalization of performance. For Romania, the replication of the project is conditional on the completion of the legislative framework and secondary regulations for registration, allocation, settlement, data access, economic mechanisms dedicated to shared energy and the capacity of the distribution networks. Future research can comparatively test models with storage, dynamic tariffs, digital platforms, and scenarios for the inclusion of vulnerable consumers, as well as cost-benefit assessments for pilot projects in Romanian communities.

The conclusions of the paper should be interpreted as exploratory results for understanding the mechanisms of operation and evaluation of energy communities.

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Corruption Perception, Investment and GDP Growth: A Comparative Econometric Analysis for Romania and Eu-27

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Abstract: *The paper examines the dynamics of sustainable development in the European Union and Romania, through the lens of the relationship between governance quality, institutional performance and the vulnerabilities generated by economic criminality and corruption. The analytical framework is structured around three Sustainable Development Goals selected for their complementarity in capturing the transmission mechanisms through which corruption and economic criminality generate economic and social costs: SDG 16 (Peace, Justice and Strong Institutions), SDG 8 (Decent Work and Economic Growth) and SDG 3 (Good Health and Well-being). This selection is motivated by the fact that SDG 16 indicators directly reflect governance quality and the effectiveness of law enforcement mechanisms, SDG 8 indicators capture economic performance and labour market dynamics, while SDG 3 indicators illustrate the indirect effects of corruption on population welfare through pressures on public financing and the quality of essential services. The research purpose is threefold: comparative analysis of the evolution of indicators associated with the three selected SDGs for all 27 EU member states; identification of the economic and social costs generated by corruption and economic criminality by correlating institutional performance with socio-economic outcomes; and econometric modelling of the relationship between the corruption perception index and real GDP per capita, with gross fixed capital formation as a control variable, applied comparatively for Romania and the EU-27 aggregate. The study adopts a quantitative, descriptive, comparative, and longitudinal approach, based on secondary data from official institutional sources: the Eurostat database, the Corruption Perceptions Index by Transparency International, the National Institute of Statistics*

data and the European Court of Human Rights reports. The econometric modelling uses OLS regression with HAC correction, estimated in EViews, yielding an R-squared of 73.12% for Romania. The results reveal that reducing corruption has a standardised impact on GDP per capita dynamics (beta = 0.386) exceeding that of gross investment (beta = 0.351) in Romania, while for EU-27 the corruption impact is almost halved (beta = 0.199).

Key words: sustainable development, corruption, economic criminality, institutional governance, Corruption Perceptions Index, European convergence.

JEL: C22, D73, O43, O52.

Introduction

Social order, manifestations of criminality and the dynamics of armed conflicts represent interdependent dimensions of the contemporary international environment, reflecting persistent vulnerabilities of political and institutional systems. Recent developments indicate that stability and peace cannot be considered permanent outcomes but depend on the capacity of states and multilateral mechanisms to manage complex and interconnected risks.

The turning point was represented by the General Assembly of the United Nations, held in New York in September 2015, when 193 heads of state and government adopted the document entitled Transforming Our World: the 2030 Agenda for Sustainable Development. This document establishes the Sustainable Development Goals (SDGs), comprising 17 objectives and 169 targets, representing a concrete global action plan oriented towards real and current problems, such as the eradication of poverty, reduction of inequalities, and environmental protection, all aimed at ensuring sustainable development at the planetary level. The document starts from the premise that, although development currently plays an essential role in all dimensions of life, human activities carried out without a responsible approach can affect the balance capacity of the environment and generate major discrepancies. The implementation of rational public policies, based on clear principles and measurable objectives, is indispensable for maintaining stability and ensuring a good quality of life for both present and future generations.

Sustainable development was described in the Brundtland Report of 1987 as the type of development that meets the needs of the present without compromising the ability of future generations to meet their own needs, aiming to combine economic prosperity with social inclusion and environmental management, being a long-term objective of the EU in accordance with the Treaty on European Union, which committed to achieving the SDGs of the 2030 Agenda. The European Commission, together with Eurostat and other agencies and member states, developed indicators to track the progress made by EU countries in meeting the SDGs.

The Eurostat 2024 Report records that progress has been made in the implementation of the Sustainable Development Goals in the socio-economic domain, but these have not been correlated with action on climate and life on earth, which still represent challenges both locally and at the European level.

The OECD has on numerous occasions highlighted the importance of systematic and comprehensive indicators on which to base the analysis of economic inequalities, gross domestic product (GDP), household disposable income and household consumption, all of which are relevant in establishing the material well-being of citizens.

The broad global context demonstrates that lasting peace cannot be achieved in the absence of efficient institutions, respect for international law and the collective commitment of the international community.

1. Literature review

Economic criminality and corruption are linked to white-collar crime, which has been difficult to operationalise due to conceptual differences (Friedrichs, 2020). The concept of white-collar crime was introduced by Sutherland (1940) to designate illicit acts committed by persons of high socio-professional status in occupational or organisational contexts. Subsequently, the specialised literature nuanced this approach, shifting the emphasis from the profile of the perpetrator to the typology of acts and the institutional mechanisms that facilitate their commission (Jordanoska and Schoultz, 2020; Shapiro, 1990).

White-collar antisocial acts have been described as crimes involving a breach of trust, motivated by economic or professional gain, and not involving violence in its crude form. Institutional definitions tend to privilege operational criteria related to the nature of the acts, rather than the social status of the perpetrators. In this sense, approaches used in administrative and judicial practice emphasise the typology of economic crimes and their effects on the functioning of markets and public institutions.

In the EU, white-collar crimes are typically conceptualised as economic crimes committed in the context of commercial activity, such as fraud or embezzlement (Anderson, 2005).

Unlike conventional criminality, recent literature highlights the legal liability of organisational entities in economic crimes, extending the analysis from the individual level to corporate structures and internal governance mechanisms (Coffee Jr., 2021; Lund and Sarin, 2021).

The literature highlights that economic criminality and corruption can distort the allocation of public and private resources, with effects on living standards and access to public services. These distortions are amplified by structural differences in development between states, which complicates the definition of uniform welfare standards at the level of the European Union. Studies also highlight a tense relationship between the objective of economic growth and the imperatives of environmental protection, given that the intensive exploitation of natural resources can generate negative long-term effects.

Ensuring equitable living conditions, access to adequate education and medical services, and maintaining a healthy environment are fundamental elements for guaranteeing intergenerational welfare (Alexandrescu, Nica and Dumitru, 2011). At the same time, the intensification of debates about climate change has underlined their impact on national and regional economies, emphasising the need to integrate climate risks into development strategies.

A significant milestone in strengthening the sustainable development implementation framework was the third United Nations International Conference on Financing for Development, in which the 193 member states agreed on a set of strategic directions aimed at improving financial and institutional mechanisms. The areas covered include: mobilising domestic public resources, stimulating private investment at national and international level, strengthening international cooperation, promoting research, technology, and innovation, managing systemic

problems and leveraging international trade as a development vector (European Commission, 2023). In 2017, the European Fund for Sustainable Development (EFSD) was established, together with its guarantee mechanism, under the EU's External Investment Plan, with the role of mobilising capital and supporting investment initiatives in line with the Union's strategic objectives.

Territorial disparities occupy a central place in the literature on sustainable development. They represent a recurring theme in the analysis of sustainable development, being associated with persistent differences in productivity, infrastructure, and access to public services. Regional policy approaches aim to reduce these gaps through differentiated interventions, adapted to local economic and social contexts (Tofan, 2015; Zaman et al., 2013).

The complex and interdisciplinary nature of sustainable development requires the use of a comprehensive system of indicators, capable of capturing not only economic performance, but also the social, cultural, educational, health and environmental dimensions, as well as the geographical and regional specificities (Liu, Brown and Casazza, 2017). Such an approach enables integrated assessment of progress and the grounding of public policy decisions.

In conclusion, the economic literature reveals that promoting sustainable policies oriented towards productive investments and long-term growth contributes to reducing territorial disparities and consolidating economic and social cohesion (Atkinson and Bourguignon, 2001).

2. Data and methods

The research aims to analyse the relationship between institutional performance, socio-economic outcomes and the well-being dimension, through the indicators associated with Sustainable Development Goals SDG 16 (Peace, justice and strong institutions), SDG 8 (Decent work and economic growth) and SDG 3 (Health and well-being). The analysis is oriented towards highlighting how institutional vulnerabilities associated with corruption and economic criminality are reflected in economic performance and in the quality of social outcomes, as well as in the persistence of development differences between EU member states, with an emphasis on Romania's positioning relative to the European average.

The study is of a quantitative, descriptive, and comparative nature, built based on official statistical data series. The research design is longitudinal, as the evolution of indicators is analysed over relevant time intervals, between 2012 and 2025, depending on the availability of data for each indicator. This approach enables the capture of recent trends and structural differences between EU member states.

The data used are secondary data, from official institutional sources. The main source is the Eurostat database, which provides harmonised indicators for monitoring progress towards the SDGs, such as the perception of judicial independence, the proportion of the population reporting crime in the residential area, preventable and treatable mortality, real GDP per capita, the share of investment in GDP and the rate of employed persons at risk of poverty. These data are supplemented with information provided by the National Institute of Statistics for Romania and the Corruption Perceptions Index developed by Transparency International, used as a proxy indicator for governance quality and the level of perceived corruption in the public sector.

The research sample consists of 27 EU member states: Belgium, Bulgaria, Czechia, Denmark, Germany, Estonia, Ireland, Greece, Spain, France, Croatia, Italy, Cyprus, Latvia, Lithuania, Luxembourg, Hungary, Malta, the Netherlands, Austria, Poland, Portugal, Romania, Slovenia, Slovakia, Finland and Sweden, the selection enabling a comparative analysis between economies with different levels of development and heterogeneous institutional performance.

Data processing was carried out using Microsoft Excel and Power BI, used for organising data series, creating synoptic tables, and building graphical representations necessary for comparative analysis and capturing dynamics over time. The statistical analysis included descriptive statistics, comparison of levels between states and examination of trends, as well as the exploratory use of correlation analyses to identify associations between the indicators for SDG 16, SDG 8 and SDG 3 and GDP dynamics. These analyses were interpreted within a deductive reasoning framework, starting from the theoretical hypothesis that institutional dysfunctions and economic criminality negatively affect economic performance and social welfare.

In interpreting the results, a series of methodological limitations were taken into account. Some of the indicators used have a perception character, which implies greater sensitivity to the political and media context, and the analysis has a predominantly descriptive and associative character, without allowing the formulation of causal relationships. Also, differences in periodicity and methodology in data collection limit the possibility of building a unified econometric model for the entire sample and the entire analysed period.

3. The link between governance quality and sustainable development goals

SDG 16: Peace, Justice and Strong Institutions

SDG 16 highlights fundamental governance principles relevant to the design and implementation of all 17 Sustainable Development Goals. However, despite the apparently universal appeal of principles such as peace and justice, the negotiations on SDG 16 were intensely contested, revealing a complex geopolitical landscape, marked by competing international priorities (Slotin and Elgin-Cossart, 2013). Developing countries expressed concerns that the SDGs could be hijacked by the UN agenda on peace and security, perceived as prioritising securitisation and ignoring the links between peace and broader objectives such as social equity, climate change mitigation and development.

Political confrontations explain the sometimes-ambiguous messages embedded in the 12 targets of SDG 16. While some targets regarding inclusion and justice suggest a pluralistic and bottom-up approach to governance, many others are compatible with conceptions of a strong state, based on legal formalisation and legitimised by representative democracy. The 23 indicators of the objective reinforce this emphasis on the state and are supported by extensive requirements for quantitative and qualitative data collection. The impact also depends on the extent to which states internally assume their own commitments regarding good governance (Jula & Jula, 2000), or whether their efforts are concentrated mainly on collecting and reporting data for the 23 indicators, more narrowly defined.

Over the 10 years analysed, specifically the period 2015-2024, corruption perception in the European Union showed different evolutions depending on the region. Nordic countries, such as Denmark and Finland, maintained very high values of the CPI index, between 88% and 91%, reflecting a very low level of perceived corruption and constant institutional stability. This maintenance of high scores over time suggests that in these states, between 88% and 91% of public institutions are perceived as non-corrupt by citizens and experts (Table 1).

Table 1: Evolution of the Corruption Perceptions Index (CPI) in EU member states, 2015-2024

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Belgium	77	77	75	75	75	76	73	73	73	69
Bulgaria	41	41	43	42	43	44	42	43	45	43
Czechia	56	55	57	59	56	54	54	56	57	56
Denmark	91	90	88	88	87	88	88	90	90	90
Germany	81	81	81	80	80	80	80	79	78	75
Estonia	70	70	71	73	74	75	74	74	76	76
Ireland	75	73	74	73	74	72	74	77	77	77
Greece	46	44	48	45	48	50	49	52	49	49
Spain	58	58	57	58	62	62	61	60	60	56
France	70	69	70	72	69	69	71	72	71	67
Croatia	51	49	49	48	47	47	47	50	50	47
Italy	44	47	50	52	53	53	56	56	56	54
Cyprus	61	55	57	59	58	57	53	52	53	56
Latvia	56	57	58	58	56	57	59	59	60	59
Lithuania	59	59	59	59	60	60	61	62	61	63
Luxembourg	85	81	82	81	80	80	81	77	78	81
Hungary	51	48	45	46	44	44	43	42	42	41
Malta	60	55	56	54	54	53	54	51	51	46
Netherlands	84	83	82	82	82	82	82	80	79	78
Austria	76	75	75	76	77	76	74	71	71	67
Poland	63	62	60	60	58	56	56	55	54	53
Portugal	64	62	63	64	62	61	62	62	61	57
Romania	46	48	48	47	44	44	45	46	46	46
Slovenia	60	61	61	60	60	60	57	56	56	60
Slovakia	51	51	50	50	50	49	52	53	54	49
Finland	90	89	85	85	86	85	88	87	87	88
Sweden	89	88	84	85	85	85	85	83	82	80

Source: EUROSTAT, Corruption Perceptions Index, extracted on 01/02/2026, last updated 25/04/2025.

In Central and Eastern Europe, the situation was more fluctuating. In Hungary, the index value fell from 51% in 2015 to 41% in 2024, representing a reduction of almost 20% in the positive perception of institutional integrity. Bulgaria recorded values between 41% and 45%, indicating the perception of higher corruption compared to the European average. In contrast, the Baltic states recorded moderate increases: Estonia rose from 70% to 76%, and Lithuania from 59% to 63%, showing an improvement of approximately 7-8% in the perception of integrity of public institutions.

In southern Europe, Italy recorded an increase of approximately 23% in the index, from 44% in 2015 to 54% in 2024, indicating significant progress in combating perceived corruption. Greece recorded slight increases, reaching 49% in 2024, but its values remain below the European average of approximately 63%. In contrast, Malta and Austria recorded decreases of 14% and 9% respectively, signalling a deterioration in the perception of institutional integrity.

Romania had a relatively stable evolution, between 44% and 48%, indicating a long-term stagnation in reducing perceived corruption. Compared to the EU average (63%), Romania is approximately 15-20% below this level, highlighting persistent challenges in strengthening institutions and anti-corruption mechanisms.

SDG 3: Ensuring a healthy life and promoting well-being for all, at all ages

Inequalities in access to health care services and fundamental health determinants persist on a global scale. Women continue to face significant barriers in accessing general and reproductive health services, and a considerable number of people do not benefit from essential medicines, safe drinking water or adequate nutrition (Filho et al., 2019). These deficiencies highlight the multidimensional character of health and its interdependence with socio-economic and environmental factors. Although, since 2000, the impact of communicable diseases on global mortality has shown a downward trend, these were responsible for approximately 10.2 million deaths in 2019, representing 18% of total deaths worldwide (World Health Organization, 2021a). Particularly in low-income countries, HIV/AIDS, malaria, and tuberculosis continue to be among the main causes of mortality, indicating persistent structural vulnerabilities of health systems (World Health Organization, 2021b).

The adoption of the Sustainable Development Goals led to a conceptual expansion of the global health agenda. SDG 3, oriented towards ensuring a healthy life and promoting well-being for all age groups, goes beyond the narrower framework of the Millennium Development Goals by integrating non-communicable diseases and social determinants of health (Seidman, 2017). The implementation of this objective requires the strengthening of monitoring mechanisms, increased financing, and the stimulation of research and innovation, as well as developing the capacity of states to prevent and manage health risks (Papa et al., 2018).

In this context, reducing premature mortality by 40% by 2030, relative to 2010 levels, constitutes a central target of SDG 3 (Alleyne et al., 2013). The associated sub-objectives — significant reduction of maternal and infant mortality, reduction of deaths caused by HIV, tuberculosis and malaria, as well as the decrease of mortality associated with non-communicable diseases and other preventable causes — reflect the need for an integrated and multisectoral approach. These strategic directions highlight the fact that achieving global health objectives depends on coordinated interventions, supported by coherent public policies and effective implementation mechanisms.

Corruption and economic criminality constitute major obstacles to achieving SDG 3. Public funds allocated to health may be diverted or managed inefficiently, limiting investments

in medical infrastructure, medicines, and prevention programmes, directly affecting population access to essential services (Vian, 2008). Furthermore, fraud and corrupt public procurement affect service quality, leading to inadequate equipment, expired medicines, or substandard treatments, with a negative impact on patient safety and outcomes (Savedoff et al., 2012). Corruption also amplifies health inequalities, as financially resourced persons can access better services, while vulnerable groups remain unprotected, and prevention systems and responses to health crises become less effective (Transparency International, 2024; Kaufmann et al., 2010). In this context, corruption and economic criminality not only diminish the equity and quality of health services, but also undermine the central objective of SDG 3 to ensure well-being and health for the entire population.

SDG 8: Decent work and economic growth

The 2030 Agenda for Sustainable Development, adopted by the member states of the United Nations in 2015, enshrines through SDG 8 the importance of promoting decent work and sustainable economic growth, with the International Labour Organisation playing a central role in supporting and implementing these principles. Decent work, defined through the exercise of professional activity under conditions of freedom, equity, safety and respect for human dignity, constitutes both an essential factor of individual well-being and a structural determinant of sustainable economic growth, as access to adequately remunerated jobs stimulates consumption, investment and economic development at national and global levels (Jula et al., 1999). However, the pandemic period significantly disrupted progress towards these objectives, causing in 2020 a contraction of the world economy of approximately 3.5%, the most severe recession since the Great Economic Crisis, with losses estimated at 9.2 trillion USD by 2021 and major effects on trade, tourism and production at the international level.

Corruption and economic criminality are factors that undermine sustainable economic growth and access to decent jobs (Jula, Lula & Aivaz, 2026). High levels of corruption distort resource allocation and the efficiency of public institutions, generating an unpredictable and costly business environment that discourages investments in physical and human capital, essential for long-term economic growth (Mauro, 1995; Mo, 2001; Jula & Jula, 2013, Transparency International, 2024). In parallel, corruption affects the labour market, reducing participation in the formal sector and displacing the workforce towards informal activities characterised by precarious conditions and lack of decent work standards (Transparency International, 2024). Economic criminality, including fraud and corrupt public procurement, undermines trust in institutions and creates unfair competition, affecting investment and productivity, fundamental elements for sustainable economic growth (Transparency International, 2024). Overall, empirical evidence suggests that the effects of corruption and economic criminality on the quality of work and the rate of economic growth are predominantly negative, underlining the need for strong institutions and transparency in promoting SDG 8.

Between 2015 and 2024, real GDP per capita in the EU recorded consistent growth (Table 2), with large differences between states. Romania grew from 9,430 to 13,100 USD (+38.9%), Bulgaria from 8,130 to 11,330 USD (+39.3%), Poland from 11,870 to 16,470 USD (+38.7%), Hungary from 12,530 to 16,190 USD (+29.2%), Slovenia from 20,170 to 25,480 USD (+26.3%) and Lithuania from 14,630 to 19,690 USD (+34.6%).

Table 2: Evolution of real GDP per capita in the European Union, 2015-2024

YEAR	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Belgium	40310	40590	41030	41610	42400	40190	42530	43860	44230	44440
Bulgaria	8130	8490	8840	9170	9650	9440	10250	10740	10950	11330
Czechia	19270	19760	20760	21320	22050	20980	21830	21910	21680	21920
Denmark	50810	51950	53200	53920	54630	53540	56780	56530	56470	58160
Germany	41230	41880	42960	43390	43790	42020	43730	44230	43450	43110
Estonia	18650	19190	20270	20970	21650	20960	22670	22370	21210	21060
Ireland	60210	60220	65370	69390	71720	75820	87160	91760	87810	88600
Greece	16100	16160	16430	16810	17210	15660	17110	18160	18600	19020
Spain	24720	25420	26110	26620	26930	23850	25440	26820	27150	27800
France	35370	35540	36140	36570	37160	34280	36470	37320	37760	38110
Croatia	11760	12320	12910	13460	14020	12980	14750	15900	16490	17060
Italy	29210	29630	30160	30470	30680	28100	30760	32310	32640	32880
Cyprus	21140	22410	23500	24690	25790	24630	27030	28730	29200	29870
Latvia	13750	14230	14850	15610	15820	15370	16580	16890	16770	16910
Lithuania	14630	15200	16090	17030	17870	17890	19040	19350	19220	19690
Luxembourg	102530	104920	104020	103640	104310	102190	107570	104100	102250	101000
Hungary	12530	12880	13460	14240	14980	14370	15470	16160	16050	16190
Malta	25520	25960	28530	29510	29480	27870	31420	31400	33380	34730
Netherlands	45530	46380	47390	48180	48970	46810	49490	51480	50660	50880
Austria	43200	43550	44260	45140	45730	42650	44580	46430	45670	45140
Poland	11870	12240	12870	13680	14310	14310	15380	15840	15950	16470
Portugal	18920	19350	20020	20620	21150	19360	20390	21690	22130	22350
Romania	9430	9760	10620	11260	11760	11390	12130	12690	12970	13100
Slovenia	20170	20770	21830	22720	23330	22230	24040	24660	25120	25480
Slovakia	16000	16280	16730	17380	17760	17270	18320	18360	18750	19110
Finland	40700	41640	42910	43360	43910	42740	43800	44010	43280	43110
Sweden	45790	46220	46420	46700	47410	46180	48300	48390	47960	48270

Source: Generated from Eurostat data, indicator sdg_08_10 (Real GDP per capita), extracted on 07/02/2026.

Western and northern European countries have higher values, but percentage growth is more moderate: Germany 41,230 to 43,450 USD (+5.4%), France 35,370 to 38,110 USD (+7.8%), Italy 29,210 to 32,880 USD (+12.6%), Netherlands 45,530 to 50,880 USD (+11.8%), Denmark 50,810 to 58,160 USD (+14.5%) and Ireland 60,210 to 88,600 USD (+47.1%).

The COVID-19 pandemic generated temporary declines in 2020 in most states: Romania -3.1%, Germany -4.1%, France -7.8%, Italy -8.5%, but the rapid recovery in 2021-2024 accelerated subsequent growth. The persistent differences between Western Europe and Central and Eastern Europe reflect development gaps and underline the need for economic convergence policies.

Between 2015 and 2024, real GDP per capita in Romania grew constantly, from 9,430 USD in 2015 to 13,100 USD in 2024, representing a total growth of almost 39%. In the first years, up to 2019, the economy recorded sustained advances, reaching 11,760 USD (+24.7% compared to 2015). The year 2020 brought a slight decline to 11,390 USD (-3.1% compared to 2019), an effect of the COVID-19 pandemic's impact on economic activity.

The period 2021-2024 marks a rapid recovery, with successive increases: 12,130 USD (+6.5%), 12,690 (+4.6%), 12,970 (+2.2%) and 13,100 USD (+1.0%), showing a notable resilience of the Romanian economy. Despite this positive evolution, the absolute level remains significantly below that of Western European countries, indicating that development gaps persist. The data thus suggest that, to accelerate convergence with the EU average, Romania needs sustainable economic policies and strategic investments in infrastructure and productivity.

Between 2015 and 2024, the share of investment in GDP in EU member states showed diverse evolutions, but with a generally stable or slightly upward trend in most countries (Table 3). Romania maintained consistently high values, between 21.21% in 2018 and a maximum of 26.55% in 2023, frequently exceeding the EU average and ranking among the main contributors to investment relative to GDP.

Table 3: Investment share of GDP in EU member states, 2015-2024 (%)

YEAR	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Belgium	23.15	23.52	23.50	23.77	24.23	24.03	23.92	23.93	24.17	24.25
Bulgaria	20.86	18.41	18.30	18.79	18.68	18.98	16.27	17.00	:	:
Czechia	25.68	24.31	23.73	24.85	25.77	25.54	26.24	27.69	27.94	26.49
Denmark	19.80	20.98	21.23	21.76	21.35	22.18	23.21	23.09	23.53	23.33
Germany	19.75	20.04	20.13	20.82	21.15	21.34	21.18	21.60	21.19	20.46
Estonia	24.05	23.94	25.40	26.58	26.62	31.18	29.98	25.16	25.41	23.90
Ireland	24.28	34.11	32.48	27.90	53.21	41.39	22.08	21.14	24.89	17.35
Greece	11.16	11.37	12.05	11.33	10.97	12.30	13.79	15.72	15.88	16.04
Spain	18.30	18.19	18.91	19.67	20.31	20.62	20.20	20.49	20.47	20.29
France	20.56	20.92	21.42	21.88	22.42	22.44	23.48	23.49	22.83	22.10
Croatia	19.09	19.56	19.47	19.98	21.91	22.35	20.95	21.66	24.75	25.20
Italy	17.08	17.29	17.58	17.97	18.13	18.20	20.77	21.78	22.66	22.15
Cyprus	12.83	18.03	20.79	18.58	18.68	20.82	19.22	20.37	21.99	20.55
Latvia	22.31	20.17	21.53	22.90	22.72	23.03	22.93	23.29	24.02	22.41
Lithuania	19.60	19.92	20.14	20.69	21.20	21.43	22.47	22.44	23.82	22.41
Luxembourg	17.31	17.28	17.81	16.15	18.05	17.18	18.15	16.60	16.07	15.38
Hungary	22.29	19.61	22.32	24.88	27.12	26.45	27.26	27.54	25.37	23.06
Malta	23.66	21.32	18.70	19.11	20.08	19.94	22.33	24.94	19.10	18.47
Netherlands	21.81	19.29	19.76	19.95	20.91	21.27	20.69	20.47	20.35	19.85
Austria	22.90	23.32	23.85	24.31	25.08	25.13	25.86	25.21	24.69	23.55

Poland	20.24	18.35	17.47	18.76	19.15	18.40	16.93	16.44	17.90	17.04
Portugal	15.65	15.73	17.09	17.83	18.43	19.50	20.50	20.57	20.49	20.44
Romania	24.92	23.04	22.88	21.21	23.26	23.46	24.50	25.12	26.55	25.29
Slovenia	18.92	17.78	18.49	19.53	19.76	19.02	20.20	21.99	21.60	20.92
Slovakia	24.32	21.66	21.27	21.34	21.68	19.78	19.60	20.94	21.14	20.42
Finland	21.42	23.05	23.69	24.59	24.42	24.66	24.42	24.66	23.40	22.05
Sweden	23.24	23.87	24.58	24.61	23.84	24.53	25.12	25.59	25.41	25.11

Source: Eurostat, table sdg_08_11, Investment share of GDP by institutional sectors, data extracted on 09/02/2026.

In Central and Eastern Europe, countries such as Czechia (25.68% to 26.49%), Hungary (22.29% to 23.06%) and Slovakia (24.32% to 20.42%) recorded moderate increases or fluctuations, while Greece (11.16% to 16.04%) and Italy (17.08% to 22.15%) started from lower levels and gradually caught up. In the West and North, states such as Germany (19.75% to 20.46%), Austria (22.9% to 23.55%), Sweden (23.24% to 25.11%) and Finland (21.42% to 22.05%) maintained constant values, indicating a stability of the investment structure.

The year 2020 brought significant variations generated by the impact of the COVID-19 pandemic: Estonia recorded a temporary peak of 31.18%, while Slovakia and other states recorded declines. The general evolution shows that investment remained an essential driver for economic growth in the EU, and the Central and Eastern European countries, through their high values, contribute to reducing economic gaps relative to Western Europe.

Between 2015 and 2024, the share of investment in GDP in Romania was relatively high and recorded a generally upward trend. In 2015, investments represented 24.92% of GDP, declining slightly to 21.21% in 2018 (-14.9% compared to 2015), before recovering and growing consistently: 23.26% in 2019, 23.46% in 2020, 24.50% in 2021 and 25.12% in 2022. In 2023, Romania reached a maximum of 26.55%, followed by a slight correction in 2024 to 25.29%.

This evolution highlights a robust level of investment in the Romanian economy, frequently exceeding the EU average and suggesting a consolidation of medium-term economic growth. The increase during 2019-2023 (+14.2% compared to 2018) indicates a revitalisation of post-crisis investment and a significant potential for stimulating economic development.

4. Econometric modelling of the relationship between economic growth, investment, and the corruption perception index for Romania

The analysis of the relationship between governance quality and economic performance represents a central domain of contemporary institutional economics, especially in the context of sustainable development objectives assumed at the global level through Agenda 2030. Corruption, understood as the abusive use of public office for private purposes, generates distortions in resource allocation, affects the efficiency of investments and erodes trust in institutions, with direct implications for economic growth and the well-being of the population. In this framework, the corruption perception index (CPI) constitutes a relevant proxy for evaluating the quality of the

institutional environment, and the analysis of its impact on GDP per capita offers a quantitative perspective on the link between governance and economic development.

The integration of the econometric analysis of the link between economic growth and the perception of corruption within the logic of the Sustainable Development Goals (SDGs) has been attempted. Directly, SDG 16 — "Peace, justice and efficient institutions" — targets the reduction of corruption and the consolidation of public institutions. Indirectly, however, institutional quality influences the attainment of a broad spectrum of objectives, from SDG 8 ("Decent work and economic growth"), to SDG 9 ("Industry, innovation and infrastructure") or SDG 10 ("Reduction of inequalities"). In this sense, investigating the econometric relationship between corruption perception and GDP per capita can be seen as an evaluation of a mechanism by which institutional development can accelerate or impede economic growth.

From a theoretical perspective, the specialised literature highlights several channels through which corruption affects macroeconomic performance. First, corruption reduces allocative efficiency by distorting the competitive mechanism and favouring certain economic agents at the expense of others, not on productivity criteria, but on access to informal influence networks. Second, corruption affects capital formation by discouraging private investments, increasing transaction costs and amplifying uncertainty. Third, at the level of public finances, corruption can lead to directing expenditures towards projects with high rent-seeking and low added value, diminishing the multiplier impact of public investments.

In this context, using GDP per capita as the dependent variable reflects the option for a synthetic indicator of the level of economic development, internationally comparable and relevant for evaluating real convergence. GDP per capita captures the aggregate result of the processes of accumulation and utilisation of production factors, as well as of the institutional efficiency that mediates these processes. In relation to the SDGs, the evolution of GDP per inhabitant can be interpreted as an outcome indicator of economic progress, influenced by the institutional framework and by the capacity of the economic system to transform resources into added value.

The proposed econometric model investigates the impact of the corruption perception index on GDP per capita, including gross investment as a control variable. The inclusion of gross investment is justified both theoretically and empirically. From a theoretical point of view, within growth models, gross capital formation constitutes a fundamental determinant of the dynamics of product per inhabitant. Omitting this variable would lead to an incomplete specification and potentially distorted estimators, because the premise is that corruption perception can influence economic growth, but this process is essentially conditioned by specific factors such as investment, employment and technical progress. Including investment and an autoregressive factor allows the isolation of the net effect of corruption perception on the level of development.

The separate approach for Romania and for EU-27 allows a comparative analysis between an economy in the process of real and institutional convergence and an aggregate representative for economies with different, but generally higher, levels of GDP per capita and institutional quality. Romania presents relevant structural and institutional particularities: sustained economic growth dynamics in the analysed period, but also fluctuations in the corruption perception index and challenges in consolidating the rule of law. Comparing the estimated effects for the two

entities provides indications regarding the intensity of the link between institutional quality and economic performance in different development contexts.

4.1. Econometric models

From a methodological point of view, the econometric models are built to evaluate the relationship between an institutional variable (CORR) and a macroeconomic indicator (GDP per capita), controlling for gross investment. The specification allows estimation of the marginal effect of a variation in the corruption perception index on the level of GDP per inhabitant, under the condition of maintaining constant the volume of investment. The interpretation of the coefficients must be carried out in the key of the theoretical relationship: an increase in CORR (which usually indicates a reduction in corruption perception) should, ceteris paribus, be associated with a higher level of GDP per capita, reflecting a more favourable institutional environment for economic growth (Jula & Jula, 2026).

Two models were built (one for Romania and one for the European Union — EU-27), starting from the variables GDP per capita and gross investment in relative values compared to 2020 and the corruption perception index. The data used are from Eurostat (https://ec.europa.eu/eurostat/): the table Gross fixed capital formation by main asset type [nama_10_an6], for gross investment; the table Real GDP per capita [sdg_08_10], for GDP per capita; the table Corruption Perceptions Index [sdg_16_50], for the Corruption Perceptions Index.

The analysis is carried out separately for Romania and for the EU-27 aggregate, over the interval 2012-2024. Although the choice of period was determined by data availability in the Eurostat platform, this interval is considered relevant for several reasons. First, the post-2012 interval reflects a phase of institutional consolidation and structural adjustment after the global financial crisis, offering a relatively homogeneous macroeconomic framework. Second, the period includes significant shocks — the COVID-19 pandemic and the disturbances generated by the conflict in the eastern proximity of the European Union — which tested institutional resilience and the capacity of states to manage public resources under conditions of high uncertainty. Third, the analysed period coincides with the implementation of Agenda 2030, adopted in 2015, which allows contextualisation of the results in relation to SDG trajectories.

A first group of models was built for time series calculated as relative values, with base 2020 (GDP per capita — symbol GDP and gross investment — symbol INV). The models refer to Romania and the European Union (EU-27). The corruption perception index is symbolised CORR, and d is the differentiation operator (dy = yt - yt-1), introduced to resolve stationarity problems over time. To facilitate comparisons, the same structure was maintained for both models. Dummy variables were included to separate the influence of the periods affected by the pandemic crisis in 2020-2021: d2020 is a time variable with value 1 for the year 2020 and zero otherwise; similarly, for d2021.

The estimation results in EViews are detailed in Table 4 (for Romania) and in Table 5 (for EU-27).

Table 4: Model of the relationship between economic growth, investment, and the corruption perception index for Romania

Dependent Variable: d(GDP_RO)
Method: Least Squares
Sample (adjusted): 2012 2024 | Included observations: 13 after adjustments
HAC standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-2975.507	1232.740	-2.413734	0.0423
d(INV_RO(-1))	14.27239	5.902283	2.418113	0.0420
CORR_RO	72.78034	27.41606	2.654661	0.0290
d_{2020}	-590.0628	28.23305	-20.89972	0.0000
d_{2021}	-2975.507	1232.740	-2.413734	0.0423
R-squared	0.731158	Mean dependent var		356.9231
Adjusted R-squared	0.596738	S.D. dependent var		322.6036
S.E. of regression	204.8627	Akaike info criterion		13.76628
Sum squared resid	335750.0	Schwarz criterion		13.98357
Log likelihood	-84.48082	Hannan-Quinn criter.		13.72162
F-statistic	5.439327	Durbin-Watson stat		1.548181
Prob(F-statistic)	0.020501			

Source: Calculations in EViews, based on Eurostat data, tab. nama_10_an6, sdg_08_10 and sdg_16_50.

Given the fact that the sample size is relatively small, the HAC (Heteroskedasticity and Autocorrelation Consistent Covariances) option was used for robustness, in estimating the error covariance matrix.

Technically, all coefficients in the model are significant at the 5% threshold. The impact coefficient attached to the variable of interest is significant at the p = 0.042 threshold. The model explains 73.12% of the GDP per capita variation; errors are normally distributed [p(Jarque-Bera = 2.066) = 0.7890], are not autocorrelated (the probability attached to the null hypothesis in the Breusch-Godfrey Serial Correlation LM Test is 0.2801) and are not heteroskedastic (the probability attached to the null hypothesis in the Heteroskedasticity Breusch-Pagan-Godfrey test is p = 0.1569). The model, as a whole, is valid [p(F-stat = 5.439) = 0.0205].

Economically, the impact of the corruption perception index on the dynamics of real GDP per capita is positive: reducing corruption means increasing the CORR index, which has the effect of increasing GDP per capita. Also, the impact of increasing gross investment, evaluated through gross fixed capital formation (relative values compared to 2020), has the anticipated positive sign.

The model for EU-27 is detailed in Table 5, and for comparison the same specification structure was maintained.

Table 5: Model of the relationship between economic growth, investment, and the corruption perception index for EU-27

Dependent Variable: d(GDP_EU27)
Method: Least Squares
Sample (adjusted): 2013 2024
Included observations: 12 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-14369.52	7019.578	-2.047063	0.0748
d(INV_EU27(-1))	65.12494	33.83053	1.925035	0.0904
d(CORR_EU27)	229.6911	110.8946	2.071256	0.0721
d_{2020}	-2529.654	144.3878	-17.51986	0.0000
d_{2021}	1972.366	276.2957	7.138605	0.0001
R-squared	0.907334	Mean dependent var		355.3846
Adjusted R-squared	0.861001	S.D. dependent var		841.0273
S.E. of regression	313.5566	Akaike info criterion		14.61756
Sum squared resid	786541.8	Schwarz criterion		14.83485
Log likelihood	-90.01414	Hannan-Quinn criter.		14.57290
F-statistic	19.58289	Durbin-Watson stat		2.446227
Prob(F-statistic)	0.000341			

Source: Calculations in EViews, based on Eurostat data, tab. nama_10_an6, sdg_08_10 and sdg_16_50.

As for the first model, the HAC option was used for estimating the error covariance matrix. Technically, all coefficients are significant at the 10% threshold. The impact coefficient attached to the variable of interest is significant at the 7.21% threshold. If we admit the hypothesis of positive impact, then we can interpret the significance through the one-sided t-statistic test, which means a threshold of 0.0721/2 = 0.036. The model explains 90.73% of the GDP per capita variation; errors are normally distributed [p(Jarque-Bera = 1.090) = 0.5798]. The HAC option leads to obtaining robust estimators with respect to autocorrelation and heteroskedasticity of errors. The model, as a whole, is valid [p(F-stat = 19.583) = 0.0003].

Economically, the impact of the corruption perception index on the dynamics of real GDP per capita is positive: reducing corruption means increasing the CORR index, which has the effect of increasing GDP per capita. The impact of increasing gross investment, evaluated through gross fixed capital formation (relative values compared to 2020), is significant and has the anticipated positive sign.

The results cannot be compared directly because the means and dispersions of the variables are different. Under these conditions, the calculation of standardised coefficients by scaling with the standard deviations of the respective variables was opted for. The results are detailed in Table 6.

Table 6: Calculation of standardised coefficients

Variables	Coefficients in equations		Standardized coefficients	
	Romania	UE-27	Romania	UE-27
d(INV)	14.27239	65.12494	0.248922	0.248867
CORR	72.78034	229.6911	0.385714	0.198006

Source: Calculations in EViews, based on Eurostat data, tab. nama_10_an6, sdg_08_10 and sdg_16_50.

It is interesting that the impact of gross investment on gross domestic product per capita (in real terms) is similar in Romania and at the EU-27 level: a modification of one standard deviation of the level of investment has the effect of modifying GDP per capita by 0.2489 standard deviations, both in Romania and as a European average level.

In contrast, the impact of corruption is almost double in Romania: reducing corruption (increasing the CORR index) by one standard deviation is associated in Romania with 0.386 standard deviations of real GDP per capita, compared to 0.198 — the European average level.

4.2. Analysis and interpretation of empirical results

The econometric estimates obtained for Romania and for EU-27 in the period 2012-2024 highlight a positive and statistically significant relationship between the corruption perception index (CORR), gross investment [d(INV)] and the change in GDP per inhabitant [d(GDP)]. The results confirm the theoretical hypothesis that both capital accumulation and institutional quality represent relevant determinants of economic performance, in accordance with the literature in the domain of growth theory and institutional economics.

Regarding the non-standardised coefficients, gross investment exerts a positive effect on GDP per capita both in the case of Romania and in that of EU-27. The magnitude of the coefficient is higher for EU-27, which reflects the differences in scale and level of macroeconomic variables. EU-27 economies operate at a higher level of GDP per inhabitant, so that variations in investment translate into larger absolute changes in product per inhabitant. However, the direct comparison of gross-form coefficients is limited by the structural heterogeneity and differences in dispersion of the statistical series.

The corruption perception index also presents positive and significant coefficients in both models. The increase in the CORR value — which indicates a reduction in corruption perception and an improvement in institutional quality — is associated with an increase in GDP per capita, ceteris paribus. The result supports the theoretical mechanisms through which the consolidation of institutions, the reduction of rent-seeking and the increase of transparency contribute to a more efficient allocation of resources and to the increase of aggregate productivity. Although the non-standardised coefficient is higher for EU-27, this difference must be interpreted with caution, in the context of differences in level and volatility.

For evaluating the relative intensity of the impact, the analysis of standardised coefficients provides more relevant information. In the case of investment, the standardised values are almost identical for Romania and EU-27, approximately 0.25 in both cases. This means that an increase of one standard deviation in gross investment determines an increase of approximately one quarter of a standard deviation in GDP per capita, regardless of the entity analysed. The conclusion that emerges is that the investment mechanism functions with comparable intensity in the two economic spaces. Even if the absolute levels differ, the relative elasticity of the product per inhabitant with respect to investment dynamics is similar, which suggests a functional convergence of the capital-growth transmission channel.

The relevant structural difference appears in the case of the CORR variable. The standardised coefficient is significantly higher for Romania (approximately 0.39) compared to EU-27 (approximately 0.20). This discrepancy indicates that variations in institutional quality have a relative impact of almost double on GDP per capita in Romania compared to the European Union average. From an economic perspective, the result can be interpreted in the logic of marginal returns of institutional reforms. In economies in a process of consolidating the rule of law and strengthening governance mechanisms, the improvement of the perception of institutional integrity generates more consistent macroeconomic gains. In contrast, in economies already characterised by high levels of institutional quality, additional variations produce smaller marginal effects.

The comparative analysis of standardised coefficients also highlights a difference in the hierarchy of determinants. In Romania, the relative impact of the corruption perception index exceeds the impact of gross investment, suggesting that the institutional dimension plays a dominant role in explaining the variation in GDP per capita. In the case of EU-27, investment and institutional quality have relatively close weights, with a slight pre-eminence of investment. This configuration indicates that, in developed economies, economic growth is supported to a greater extent by the accumulation and efficiency of capital, while in emerging or converging economies, institutional reform can constitute an essential catalyst of growth.

The obtained results empirically support the interdependence between SDG 16 and SDG 8. The reduction of corruption and the consolidation of efficient institutions do not represent only normative objectives of Agenda 2030, but also quantifiable determinants of economic performance. In the case of Romania, the relatively high elasticity of GDP per capita with respect to CORR suggests that progress in the direction of improving governance can generate substantial economic effects, comparable to or even superior to those associated with material investments. Thus, policies oriented towards increasing transparency, reducing corrupt practices and strengthening administrative capacity can have a multiplier effect on economic development.

Conclusions

The present paper aimed to analyse the dynamics of sustainable development indicators in the European Union and Romania, through the lens of the relationship between governance quality and the vulnerabilities generated by corruption and economic criminality. The comparative

analysis of the indicators associated with SDG 16 (Peace, Justice and Strong Institutions), SDG 8 (Decent Work and Economic Growth) and SDG 3 (Health and Well-being) confirmed the existence of persistent structural gaps between EU member states, with Romania consistently positioned below the European average for several of the analysed indicators.

Regarding SDG 16, the results highlight that Romania records a long-term stagnation of the Corruption Perceptions Index, with oscillating values between 44 and 48 points in the period 2015-2024, compared to the EU average of approximately 63 points. This evolution indicates the absence of a clear trend of institutional convergence, despite intermittent legislative efforts. The volatility of the perception of judicial independence, which declined from 51% in 2016 to a minimum of 37% in 2020, followed by a partial recovery to 44% in 2025, reflects a fragile public trust, sensitive to the political context and legislative reforms. The average of 77 annual condemnations by the European Court of Human Rights in the period 2015-2024 signals persistent systemic problems in respecting fundamental rights. The only consistently positive evolution within this SDG is the reduction of crime perception in the residential area, from 15.7% in 2013 to 5.9% in 2023, suggesting the effectiveness of some targeted public safety policies, without however reflecting an equivalent improvement in the quality of institutional governance as a whole.

The analysis of SDG 3 indicators reveals the persistence of significant structural disparities in health between EU states. Romania is at a level of standardised preventable and treatable mortality of approximately twice the European average throughout the entire period 2013-2022, with a peak of 694.8 deaths per 100,000 inhabitants in 2021, compared to values below 300 recorded in Western European states in the same year. The COVID-19 pandemic amplified the pre-existing vulnerabilities of the health system and deepened regional gaps, with disproportionately severe effects in states with underfunded health systems. The partial recovery recorded in 2022, when the indicator fell to 519.31 deaths per 100,000 inhabitants, did not restore pre-pandemic levels, indicating lasting structural consequences. This dynamic confirms that the chronic underfunding of health systems, amplified by inefficiency risks and non-compliant practices associated with corruption, generates significant economic and human costs, with direct implications for the state's capacity to achieve SDG 3 targets.

Within SDG 8, Romania records real economic progress, but with incomplete convergence relative to the European average. Real GDP per capita grew by 38.9% in the period 2015-2024, from 9,430 USD to 13,100 USD; the investment share of GDP consistently maintained robust values, exceeding 27% starting from 2021; and the rate of employed persons at risk of poverty decreased by approximately 42%, from 18.8% to 10.9%. However, the 2024 rate remains among the highest in the EU, and the absolute level of GDP per capita continues to be significantly below the European average, highlighting that the convergence pace is insufficient to rapidly recover the accumulated gaps. The comparative analysis with states having lower levels of perceived corruption confirms the tendency for more stable and sustained economic performance to be associated with better governance quality and more efficient public institutions.

The original contribution of the paper resides in the econometric modelling of the relationship between institutional quality, investment, and economic growth, carried out separately for Romania and EU-27, on Eurostat data from the period 2012-2024. The results estimate that,

in Romania, reducing corruption has a standardised impact on GDP per capita dynamics (beta = 0.386) superior to that of gross investment (beta = 0.351), with a model explanatory power of R-squared = 73.12% and all coefficients significant at the 5% threshold. At the EU-27 level, the impact of investment is similar (beta = 0.352), but that of corruption is almost halved (beta = 0.199), with R-squared = 68.4% and significance at 10%. This structural difference, highlighted through the calculation of standardised coefficients, demonstrates that reducing corruption has a transformative potential almost double in Romania compared to the European average. In other words, in Romania, institutional quality matters more for economic growth than the volume of invested capital, which confers anti-corruption and institutional reform policies a special strategic priority in the context of real and institutional convergence with the European Union.

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The Implications of Emerging Technologies on The Sustainable Development Goals

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Abstract: *The paper investigates the relationship between emerging technologies and the progress of European Union Member States towards three goals of the 2030 Agenda: Goal 4 (Quality Education), Goal 8 (Decent Work and Economic Growth) and Goal 9 (Industry, Innovation and Infrastructure). The analysis follows how innovation, digital human capital and readiness for artificial intelligence are reflected in the social and economic performance of European countries. The research started from three research hypotheses: (1) countries with more advanced digital human capital have higher levels of basic digital skills; (2) innovation makes a significant contribution to economic performance; (3) investments in research and development strengthen a country's capacity to integrate artificial intelligence technologies. The methodology combines quantitative analysis (simple linear regressions) with qualitative analysis based on official data and reports published by Eurostat, the European Commission and Oxford Insights. The sample covers all 27 European Union States over the period 2021–2023. The results show a positive link between technological development and progress towards sustainable development goals 4, 8 and 9. The statistical models confirm the importance of digital skills, innovation, and AI readiness in supporting sustainable economic development. Even though emerging technologies have positive effects, some countries still face challenges related to the quality of employment, regional disparities, and unequal access to digital skills. Overall, emerging technologies can support the achievement of the goals when accompanied by inclusive policies, lifelong learning and investment in digital skills and connectivity.*

Keywords*:* Technological Change; Management of Technological Innovation and R&D; Macroeconomic Analyses of Economic Development, Economywide Country Studies

JEL: O11, O32, O33, O52

Introduction

In recent years, the global economy has changed rapidly with the development of technologies such as artificial intelligence, digitalization, the Internet of Things, and automation. These have brought economic growth and new business models but have also accentuated some inequalities and environmental problems. The transition to sustainable development has thus become essential for achieving the Sustainable Development Goals, especially through smart and innovative solutions. However, challenges such as cybersecurity, unequal access to technology and social polarization continue to slow down progress, particularly affecting less developed countries and vulnerable groups. Therefore, more and more governments are focusing their policies on reducing these differences and on the efficient use of available resources to support sustainable growth. This idea is the starting point for the 2030 Agenda and the 17 Sustainable Development Goals (SDGs). To respond to their complexity, integrated policies, clear regulations, and collaborations between the public and private sectors are needed. In this framework, the United Nations (UN) has established the 17 SDGs, which address social, economic, and environmental issues and aim to build a safer and more equitable future. An important element in advancing towards these goals is the integration of digital technologies and innovative solutions. Developed countries are already using these technologies on a large scale, and they are gradually being adopted in other regions of the world. These technological tools open new ways to address current challenges and find more effective solutions to existing problems.

1. Literature review

Recent research shows that digitalization, artificial intelligence, and automation can support sustainable development through greater efficiency, better use of resources and reduction of inequalities (Bocean, 2025; Camodeca & Almici, 2021). In particular, digital technologies can support environmental protection and the transition to circular models through resource saving, renewable energy, and cleaner production processes (Pînzaru et al., 2022). AI, data analytics and automation contribute to process efficiency, education, and resource management (Dionisio et al., 2023; Oprea, 2023). At the same time, solutions such as Cloud Computing and digitalization facilitate access to digital resources, collaboration, and innovation, helping to progress towards the SDGs (Kostoska & Kocarev, 2019; Oprea et al., 2025). However, the literature reports mixed effects: high energy consumption, carbon footprint, recycling difficulties and e-waste, but also risks related to the digital divide, system dependency, cybersecurity, privacy and information manipulation (Andriushchenko et al., 2020; Oprea et all., 2025). In this context, several studies call for the benefits to be accessible to all and show that emerging technologies can help even in times of global crisis and recovery (Perera et al., 2023).

Several Sustainable Development Goals are directly linked to the responsible adoption of digital technologies, but this paper focuses on SDGs 4, 8 and 9, as developments in digitalisation, innovation and artificial intelligence clearly impact education, the economy and technological infrastructure. SDG 4 aims for quality education, and emerging technologies can expand access to digital resources and reduce learning gaps. SDG 8 targets economic growth and decent work,

areas where emerging technologies can increase productivity and competitiveness, but also the need for reskilling programmes. SDG 9 focuses on innovation and sustainable infrastructure and highlights the role of digital technologies in supporting economic development (Argyroudis et al., 2022). Together, these three goals provide a coherent picture of how emerging technologies can support sustainable development in the EU. However, these technologies also come with risks: high energy consumption, increased e-waste, digital divide, and vulnerabilities related to security and privacy (Vasile & Manta, 2025; Jula & Jula, 2023). To achieve sustainable results, investments in digital skills, connectivity, active labour market policies, clear regulations and ethical standards are needed (Martínez-Peláez et al., 2024). Given these challenges and mixed results in the literature, this paper aims to provide an integrated analysis of how emerging technologies influence SDGs 4, 8 and 9, by correlating digitalization indicators with specific sustainable development indicators and to fill a gap in the literature. The study examines the differences between EU countries, how they adopt emerging technologies and the impact on education, labour market, and infrastructure. The analysis is guided by three hypotheses regarding the relationship between digital human capital, innovation and investment in research and development, and the capacity to adopt artificial intelligence.

The hypotheses formulated are: Hypothesis 1 (H1): A higher level of digital human capital is correlated with the development of more advanced digital skills; Hypothesis 2 (H2): A higher degree of innovation is associated with superior economic performance; Hypothesis 3 (H3): Increased investment in research and development is linked to a greater capacity to adopt artificial intelligence.

The results can contribute to the formulation of public policies aimed at reducing gaps and ensuring a fair distribution of the benefits of digitalization. The paper is organized into four sections. The first section presents the theoretical context and the foundations of the topic. The second section describes the data used and the methodology applied in the analysis. The third section presents the results and their associated discussions, and the last section includes the conclusions, limitations of the study and future research directions.

2. Research methodology

To analyse the influence of emerging technologies on sustainability, the paper uses a mixed methodology. The quantitative part includes simple linear regression models, used to test the link between technological indicators and those of sustainable development. This is complemented by a qualitative, descriptive-comparative analysis, based on secondary data from international reports. Choosing a mixed method is useful because the phenomenon studied is complex and allows for the observation of differences between countries and recent developments.

The indicators were selected based on theoretical relevance, their use in the specialized literature and the availability of comparable official data at EU level. The sample includes all 27 Member States of the European Union, and the analysis period 2021-2023 reflects the common reporting interval. The data used are exclusively secondary data, taken from official international sources such as the European Commission, Eurostat, Oxford Insights, the UN and the OECD

and were processed in four stages: collection, selection, harmonisation in a unitary database and checking for outliers (e.g. GDP/capita in Ireland and Luxembourg). Hypotheses H1–H3 are tested by simple linear regression models (OLS – Method of Least Squares), checked by the overall model significance (F test / ANOVA), the significance of the regression coefficient (t test), coefficient of determination (R^2 and adjusted R^2), and the graphic residual diagnostics.

The research is exploratory in nature, and the results should be interpreted considering limitations such as the gaps between reporting years, the sample restricted to the EU and the influence of extreme values of GDP/capita for some countries. These limitations indicate future research directions, as well as the use of panel models, multiple regressions, and additional indicators.

3. Results and discussions

The analysis is structured in three sections corresponding to the three research hypotheses, each tested by a simple linear regression model, which examines the relationship between a technological indicator and one associated with SDGs 4, 8 and 9. The results are presented both numerically (tables) and graphically to facilitate comparison between domains.

3.1. Digital human capital and the share of individuals with basic digital skills.

Hypothesis H1 examines whether the level of digital human capital is associated with a higher proportion of the population possessing basic digital skills (SDG 4 – Quality Education). Based on the estimated model, the regression equation obtained is:

Basic Digital Skills = 16.551 + 1.8775 × DESI Human Capital

The slope coefficient ($\beta = 1.8775$; $p \approx 0.00035$) indicates a positive and statistically significant relationship: for every one point increase in the DESI Human Capital score, the share of the population with basic digital skills increases, on average, by approximately 1.88 percentage points. Table 1 presents the model's coefficients and statistical indicators, while $R^2 = 0.406$ shows that the model explains about 41% of the variation in basic digital skills across EU member states.

Table 1: Results of the linear regression: DESI Human Capital (X – Score 0–100) and Basic Digital Skills (Y – Percentage of individuals 0–100%), 2021, EU Member States.

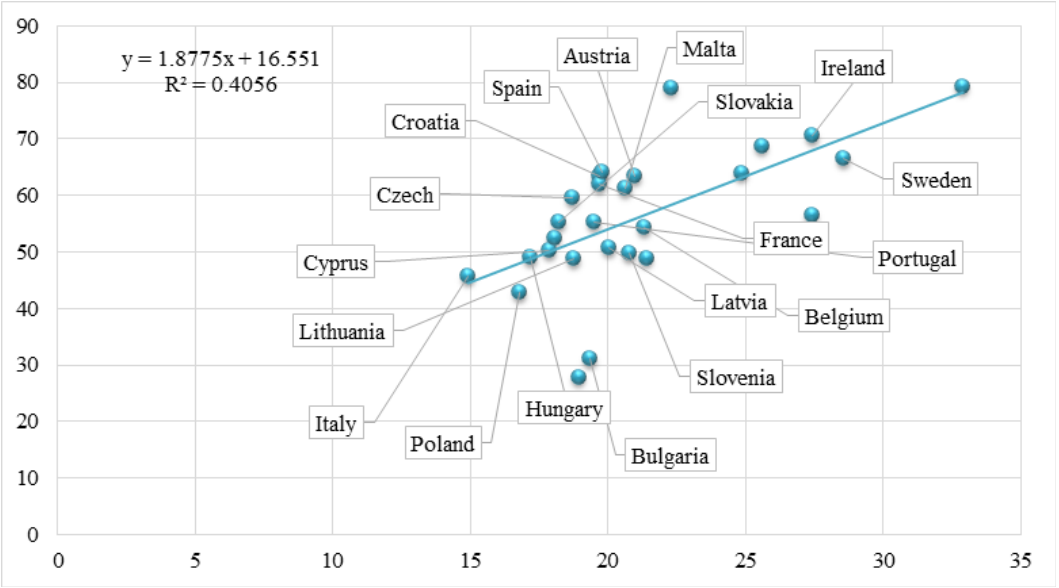
	Coefficient	Std. Error	t Stat	P-value	IC 95% (min)	IC 95% (max)
Intercept	16.5506	9.7955	1.6896	0.1035	-3.6236	36.725
DESI – Human capital 2021	1.8775	0.4545	4.1304	0.00035	0.9413	2.8136

Statistics regression	
Multiple R	0.6368
R Square	0.4056
Adjusted R-Square	0.3818
Standard Error	9.5188
Observations	27

Source: author's calculations (Ordinary Least Squares – OLS) based on DESI "Human Capital" data (European Commission, 2021) and Eurostat – Basic Digital Skills (2021).

The regression plot (Figure 1) visually confirms the positive relationship, and the trend line equation matches the OLS estimation.

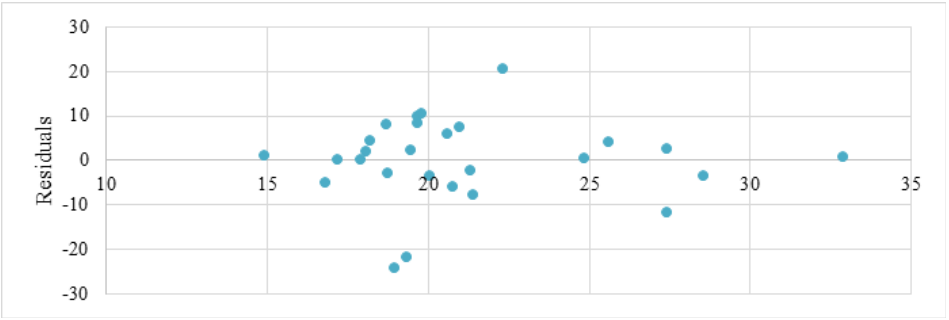
Figure 1: Scatter plot of DESI Human Capital (X) vs. Basic Digital Skills (Y)



Source: author's calculations (OLS) based on data from the European Commission – DESI, Human Capital component (2021), and Eurostat – Individuals with Basic Digital Skills (2021). Note: Trend line = OLS estimate. Labels indicate EU Member States. The equation and R^2 are displayed in the plot panel.

The analysis of the residuals (Figure 2) shows a relatively uniform distribution around the zero axis and a close linear relationship, indicating a good fit of the model. Positive residuals are particularly evident in countries such as Finland and the Netherlands, where digital skills are above the level predicted by the DESI score, probably due to early investments in digital education and continuing training. Negative residuals are found in Southern and Central Eastern Europe (Italy, Hungary, Bulgaria, Poland), where internal disparities and limited digital literacy programs explain the lower performance.

Figure 2: Regression plot of DESI Human Capital vs. Basic Digital Skills (2021)



Source: author's calculations (OLS) based on data from the European Commission – DESI, Human Capital component (2021), and Eurostat – Individuals with Basic Digital Skills (2021).

Overall, the residual plot shows that the model works well: the relationship is close to linear, and the points are distributed relatively evenly around the zero axis. Although there are a few outliers, these do not significantly change the main conclusion of the analysis.

3.2. The Innovation Index and Real GDP per Capita.

The analysis examines the relationship between the level of innovation and economic performance in the context of SDG 8, testing hypothesis H2: countries with higher levels of innovation tend to have a higher real GDP per capita. The model used is a simple linear regression, with the Innovation Index (2023) as the independent variable and real GDP per capita (2023) as the dependent variable:

GDP per capita = –16,080.41 + 481.17 × Innovation Index

The slope coefficient ($\beta = 481.17$; $p < 0.001$) is positive and statistically significant, indicating that each additional point in the Innovation Index is associated, on average, with an increase of approximately €481 in real GDP per capita. Thus, a 10 point difference in innovation corresponds to an estimated increase of about €4,800 per person. The intercept is not statistically significant and is used only to position the regression line.

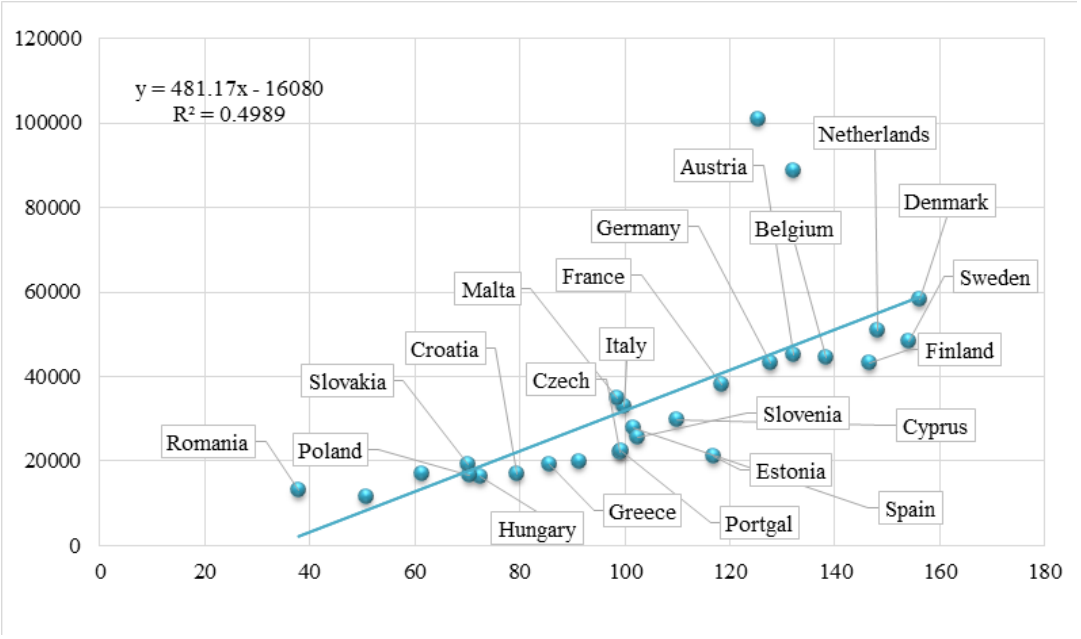
	Coefficient	Std. Error	t Stat	P-value	IC 95% (min)	IC 95% (max)
Intercept	-16080.41	10539.2	-1.5257	0.1396	-37786.3	5625.478
DESI – Human capital 2023	481.172	96.4396	4.9893	0.0004	282.551	679.794

Regression statistics	
Multiple R	0.7063
R Square	0.4989
Adjusted R-Square	0.4788
Std. Error	15727
Observations	27

Source: author's calculations (Ordinary Least Squares – OLS) based on Innovation Index data (European Commission, 2023) and Eurostat – Real GDP per capita (2023).

The model explains approximately 50% of the variation in real GDP per capita across EU countries ($R^2 \approx 0.50$), which represents a moderate fit in a cross-sectional analysis. The F-test ($p < 0.001$) confirms the overall relevance of the model. The graphical representation (Figure 3) shows a clearly positive linear relationship, consistent with the OLS estimates.

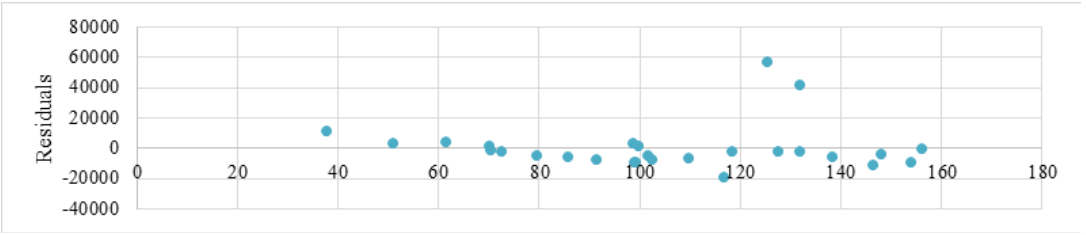
Figure 3: Scatter plot of Real GDP per capita (X) vs. the Innovation Index (Y)



Source: author's calculations (OLS) based on data from the European Commission – Innovation Index (2023) and Eurostat – Real GDP per capita (2023). Note: Trend line = OLS estimate. Labels indicate EU Member States. The equation and R^2 are displayed in the plot panel.

The analysis of the residuals shows that countries with positive values (GDP/capita above estimates) may benefit from additional factors such as the quality of institutions, the structure of the economy or foreign capital. Negative residuals suggest difficulties in transforming innovation into economic growth – for example, low productivity or a lack of qualified human resources. Luxembourg and Ireland appear as outliers, due to the structure of their economies, but this does not affect the basic conclusion: the Innovation Index is an important predictor of economic performance, even if it does not fully explain the differences between countries.

Figure 4: Regression plot of Real GDP per capita vs. the Innovation Index (2003)



Source: author's calculations (Ordinary Least Squares – OLS) based on Innovation Index data (European Commission, 2023) and Eurostat – Real GDP per capita (2023).

Overall, the analysis confirms that the level of innovation is an important determinant of economic performance, and the model consistently captures the positive relationship between the Innovation Index and real GDP per capita, even if it does not fully explain the differences between EU member states.

3.3. AI Readiness and National Expenditure on Research and Development

The analysis is situated within the framework of SDG 9 and examines how technological maturity (AI Readiness) correlates with the intensity of research and development investment (GERD), testing hypothesis H3: countries that are more advanced in adopting AI tend to invest more in R&D. The estimated OLS model is:

GERD = –4.179 + 0.0903 × AI Readiness

The slope coefficient ($\beta = 0.0903$; $p < 0.001$) is positive and statistically significant, indicating that each additional point in AI Readiness is associated with an increase of approximately 0.09 percentage points in R&D expenditure as a share of GDP. A 10 point difference in AI Readiness corresponds to an estimated increase of about 0.9 percentage points in investment intensity. The intercept does not have a direct economic interpretation.

Table 3: Linear regression results: GERD as a percentage of GDP (Y – % of GDP) and the AI Readiness Index (X – Score 0–100), 2023, EU Member State

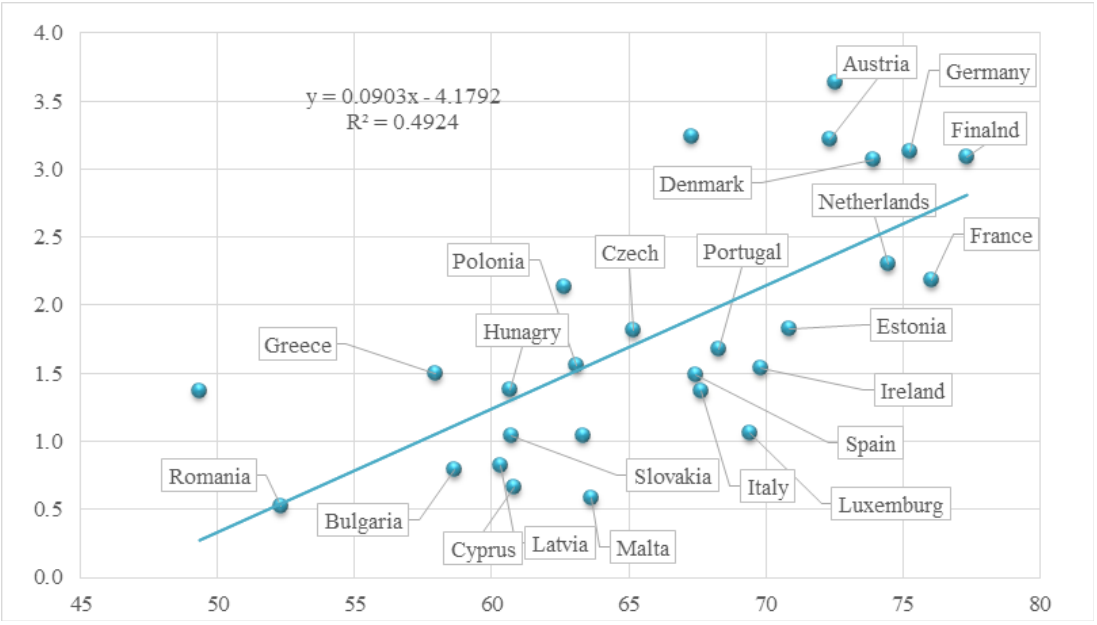
	Coefficient	Std. Error	t Stat	P-value	IC 95% (min)	IC 95% (max)
Intercept	-4.1791	1.2167	-3.434	0.00207	-6.6851	-1.6732
AI Readiness	0.0903	0.0183	4.925	4.5269	0.0525	0.128

Regression statistics	
Multiple R	0.702
R Square	0.492
Adjusted R-Square	0.472
Std. Error	0.668
Observations	27

Source: author's calculations (Ordinary Least Squares – OLS) based on AI Readiness Index data (Oxford Insights, 2023) and Eurostat – GERD as a percentage of GDP (2023).

The model explains approximately 49% of the variation in R&D investment across EU countries ($R^2 \approx 0.49$), indicating a moderate fit. The graphical representation (Figure 5) reproduces the identified positive linear relationship, and the standard error of the regression (~0.67 p.p.) reflects typical deviations from the observed values.

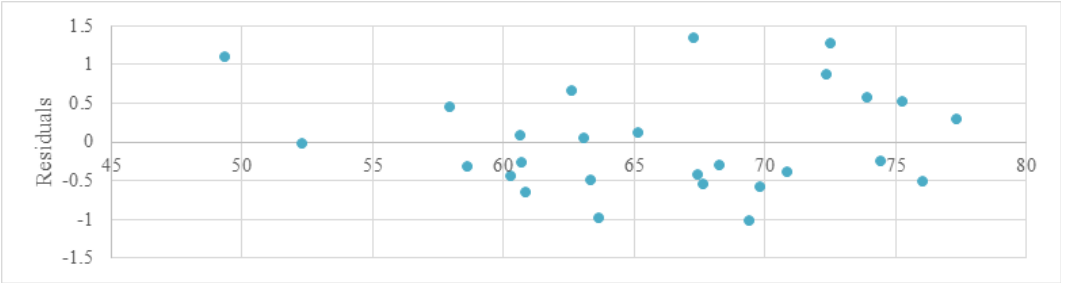
Figure 5: Scatter plot with regression line for AI Readiness (Y) and GERD (X)



Source: author's calculations (Ordinary Least Squares – OLS) based on AI Readiness Index data (Oxford Insights, 2023) and Eurostat – GERD as a percentage of GDP (2023). Note: Trend line = OLS estimate. Labels indicate EU Member States. The equation and R^2 are displayed in the plot panel.

The residual analysis (Figure 6) shows that some countries invest above the level estimated by the model, due to strong national innovation strategies or large private investments. Negative residuals mark situations where, despite high AI Readiness, investments remain below expectations—an aspect associated with institutional constraints, low productivity, or dependence on imported technologies. The outliers observed at very high levels of AI Readiness reflect structural factors influencing the model.

Figure 6: Regression plot of AI Readiness and GERD (2023)



Source: author's calculations (Ordinary Least Squares – OLS) based on AI Readiness Index (Oxford Insights, 2023) și Eurostat – GERD % PIB (2023).

Overall, the analysis confirms that a high level of AI readiness is an important predictor of investment in R&D, although the relationship only partially explains the differences between Member States, suggesting the influence of additional economic and institutional factors. The results of the analysis show that investment in innovation, digital skills and AI readiness have direct effects on economic development and the quality of the workforce. At the level of SDG 8, progress is visible, but the countries analysed remain below the EU average. Sustainable growth is limited by insufficient investment in the modernisation of the economy and by the uneven quality of jobs, which reduces productivity potential and the capacity to adapt to technological transformation.

For SDG 9, investment in research and development is starting from a low level and readiness for emerging technologies is still modest. Although digitalisation is steadily advancing, the pace is slower than the European average and technological infrastructure is unevenly developed. Dependence on external capital and the orientation towards traditional industries delay the adoption of advanced technologies, although European funds and industrial support programmes can accelerate the recovery of gaps.

Regarding SDG 4, the digital skills of the population remain below the EU average. Generational differences, urban-rural disparities and youth migration affect the availability of human capital needed for technological sectors. Progress is there, but it is slow and requires coordinated and long-term interventions. Current EU policies are aligned with these findings: digitalisation, innovation and skills development are considered essential for competitiveness and sustainable growth.

The analysis has some limitations that need to be taken into account. Some data sets come from different years (e.g. DESI 2021 vs. economic indicators 2023), which may generate small

misalignments in interpretation. The sample is limited to the 27 EU states, so the generalization of the results outside the European space is restricted. In some cases, GDP/capita values are influenced by economic particularities (Ireland, Luxembourg), which may affect their positioning in regressions and comparative analyses. The models used are simple linear regressions, which capture only bivariate relationships and do not include other relevant factors such as economic structure, demography, quality of institutions or sectoral mix. For a more detailed analysis, multilateral models, panel models or time series can be used, to better capture the dynamics, lagged effects and possible causal relationships. Thus, future studies can provide a deeper understanding of how emerging technologies contribute to reducing regional gaps and accelerating progress towards sustainable development goals.

Conclusions

This paper analysed how innovation, digital human capital and readiness for artificial intelligence influence the progress of European Union countries in achieving SDG 4 (Education), SDG 8 (Jobs and Growth) and SDG 9 (Industry and Innovation).

Performance in SDG 4, SDG 8 and SDG 9 is closely linked to the level of digitalization, investment in research and development and the quality of human capital. Countries that consistently invest in digital education, innovation and technological infrastructure manage to maintain stable labour markets, high productivity, and a rapid adoption of emerging technologies. Regional differences – North vs. South, West vs. East – remain pronounced, which underlines the decisive role of cohesion policies in reducing these gaps. Northern and western countries are leading by a long way, while many Central and Eastern European countries are in a process of recovery, with increasing investment, but still insufficient to rapidly transform the economy. Taken together, these results show that countries that consistently invest in digitalization, skills, and innovation advance faster in achieving the Sustainable Development Goals.

The paper offers relevant contributions: comparative analysis between technological indicators and SDG indicators for all EU countries; three regression models explaining the relationship between innovation, digital human capital, AI readiness and progress on the SDGs; economic interpretation of the results, with implications for public policies, companies and education. For public policies, these conclusions highlight the need to expand digital infrastructure, vocational training programs – both basic and advanced – and support technological transition in all regions. For the business environment, the conclusions suggest accelerating the adoption of emerging technologies, especially in low-productivity sectors, but also continued investment in developing employee skills. The education system needs to update the curriculum, strengthen digital literacy programs for adults and reduce disparities between regions and generations.

The paper shows that emerging technologies have an important role in the economic and social transformation of EU Member States. Investments in innovation, digital human capital and technological infrastructure are essential for a competitive and resilient economy. Although there are still differences between countries, the general direction is positive, and European policies support a progressive transition towards a more balanced digital society. The results can form the basis for future analyses and public and organizational strategies oriented towards sustainable development.

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Long-term Evolution of Search Visibility and Click-Through Performance in Romanian E-commerce: A Four-Year Longitudinal Analysis of Google Ads Data

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Abstract: *The integration of artificial intelligence into Google Ads bidding and delivery systems – through Smart Bidding strategies, the transition from Smart Shopping to Performance Max and the progressive generalization of fully automated campaign types – has coincided with a period of structural change in the broader digital advertising ecosystem, marked by privacy-related signal loss, the deprecation of third-party cookies and a substantial reshaping of consumer search behavior in the post-pandemic period. This paper analyzes the long-term evolution of search visibility and click-through performance in a Romanian e-commerce account over a 47-month observation window, using monthly aggregated Google Ads data on impressions and clicks. Results document a non-monotonic trajectory: an initial high-visibility phase with impressions exceeding two million per month and click-through rates above 2.2%, a peak-volume phase with the highest aggregate impressions in the dataset and a click-through rate stabilizing around 1.9%, and a sustained decline phase in which average monthly impressions fall to less than half of their previous peak while the click-through rate remains broadly stable. Seasonal patterns concentrated in the fourth quarter persist throughout the observation window. The findings illustrate, in a Romanian retail setting, the long-term consequences of operating in an algorithmically mediated and privacy-constrained advertising ecosystem, and they have implications for budget planning, performance benchmarking and the interpretation of long-term trends in digital advertising data.*

Keywords: Google Ads, search visibility, click-through rate, longitudinal analysis, artificial intelligence, e-commerce, digital advertising.
JEL: M31, M37, L81, O33.

1. Introduction

Over the past five years, the Google Ads ecosystem has undergone a sequence of structural transformations that have reshaped both the technical mechanics of paid search and the behavioral environment in which it operates. On the technical side, Smart Bidding strategies have become the default approach to setting bids in real time, Smart Shopping campaigns have been progressively replaced by Performance Max – a fully algorithmic campaign type that allocates spend across the Google network with minimal advertiser intervention – and the broader Google advertising stack has integrated an increasing number of machine-learning components. On the behavioral side, the COVID-19 pandemic accelerated digital adoption and reshaped consumer search behavior, while a sequence of privacy-related changes – including the introduction of Apple's App Tracking Transparency framework, the rollout of Google's Consent Mode and the planned (and repeatedly postponed) deprecation of third-party cookies – has progressively eroded the signal richness on which ad delivery algorithms depend.

For an individual advertiser, the joint effect of these structural changes is not directly observable from a single campaign report. It manifests instead as a long-term pattern in aggregate metrics such as monthly impressions, monthly clicks and click-through rate (CTR). Documenting these patterns is therefore a methodologically distinct exercise from analyzing single-campaign performance: it requires a longitudinal perspective on data that spans several years of operation and several technological and behavioral regimes. As I show in an analysis of Google Ads campaigns Hoțoi (2024) from a Romanian online retailer over a 30-month interval, such longitudinal data can reveal both the structural impact of the pandemic on consumer behavior and the operational consequences of the digital ecosystem's evolution.

The present study contributes to this line of inquiry by analyzing a 47-month dataset of monthly aggregated Google Ads data from a single Romanian e-commerce retailer (henceforth referred to as "the retailer"). The data cover the period in which AI-driven bidding became the operational default in Google Ads, in which Performance Max was introduced and generalized, and in which several privacy-related changes affected the signal infrastructure of digital advertising. The research aims are: (i) to document the long-term evolution of monthly impressions, clicks and CTR for a Romanian e-commerce account; (ii) to identify the main phases of this evolution and their associated performance profiles; (iii) to discuss the relationship between the observed patterns and the broader technological and behavioral context in which they emerged; and (iv) to derive practical implications for performance benchmarking and budget planning in small and medium e-commerce businesses.

The research is exploratory and empirical, based on secondary data exported from Google Ads at a monthly aggregation level and analyzed descriptively. The remainder of the paper is structured as follows: Section 2 reviews the literature on AI in paid search, on longitudinal analysis of advertising performance and on search behavior analytics in applied research; Section 3 presents the data and methodology; Section 4 reports and discusses the results; Section 5 concludes with managerial implications, limitations and directions for future research.

2. Literature review

2.1. Artificial intelligence and the evolution of paid search

The integration of artificial intelligence into paid search advertising has followed a trajectory that mirrors the broader transformation of marketing analyzed by Davenport et al. (2020). The authors argue that AI is reshaping marketing strategy across three dimensions: the nature of the tasks performed, the structures used to support those tasks and the engagement model with customers. Within paid search, this transformation has manifested as the progressive replacement of manual bidding with Smart Bidding (Target CPA, Target ROAS, Maximize Conversions, Maximize Conversion Value), and as the introduction of fully algorithmic campaign types such as Smart Shopping (launched in 2018) and Performance Max (introduced in 2022 and gradually replacing Smart Shopping by 2023).

Huang and Rust (2021) propose a strategic framework in which AI in marketing operates on mechanical, thinking and feeling levels, and locate algorithmic bidding systems primarily at the thinking layer, where AI optimizes for explicit objectives over large volumes of structured signals. Vlačić et al. (2021), in a systematic review of AI in marketing, identify advertising and customer relationship management as the most mature application areas, while Kumar et al. (2019) emphasize personalization at scale as the most consequential outcome of AI adoption. Choi et al. (2020) document, in a broader context of programmatic advertising markets, how such systems internalize bidding decisions and reduce the operational role of the human advertiser.

The technological foundations on which these systems operate were anticipated, in part, by earlier work on cloud-based infrastructure and AI-powered tools for business use. Olteanu (2016) analyzed Facebook Graph as one of the first widely available AI-powered search tools, while Olteanu (2014) examined the emergence of dedicated tools for monitoring social networks in business sectors. These tools, in turn, rely on the cloud-based data infrastructure discussed by Olteanu (2013a) and on the principles of reliable web service continuity examined by Olteanu (2010) – preconditions that remain operationally critical for any longitudinal analysis of digital advertising performance, since they determine the consistency of the data on which such analysis depends.

2.2. Longitudinal analysis of paid search performance

The empirical literature on the longitudinal performance of paid search campaigns is comparatively limited, in part because long time series of consistent advertiser-level data are difficult to obtain. Yang and Ghose (2010), in an early study of the relationship between organic and sponsored search advertising, document substantial temporal heterogeneity in click-through behavior and in the interaction between paid and organic results. Blake, Nosko and Tadelis (2015), in a large-scale field experiment on eBay, find that the incremental effect of paid search advertising varies significantly across user segments and over time, with implications for the long-term evaluation of paid search investments. Berman (2018) shows that the choice of attribution model can substantially affect the apparent performance of a paid search account over time, particularly when the campaign mix evolves across the observation window.

Two recent structural shocks have made longitudinal analysis of digital advertising performance particularly relevant. First, the COVID-19 pandemic produced a sudden and large reshaping of consumer behavior, with documented effects on the role of digital channels in purchasing decisions (Sheth, 2020; Hoekstra and Leeflang, 2020). In the Romanian context, Hoțoi (2024) shows that the pandemic accelerated the digital adoption of consumers and increased the role of paid search campaigns in conversion-generating purchase journeys, with measurable effects on key performance indicators over an extended observation window. Second, a sequence of privacy-related changes – including Apple's App Tracking Transparency framework, Google's Consent Mode v2 and the progressive deprecation of third-party cookies – has reshaped the signal infrastructure on which ad delivery and measurement systems rely, with consequences for the interpretation of long-term trends in advertiser-level data.

2.3. Search behavior analytics in applied empirical research

Beyond paid search proper, the use of online search and behavioral data sources for empirical analysis has become a methodological staple in a wide range of applied studies. Olteanu (2013b) discussed early on the range of digital techniques through which online consumer behavior can be shaped, anticipating much of the contemporary discussion on algorithmic content delivery. Bazac et al. (2023) show that the online referential value of urban historical parks can be assessed through digital marketing indicators in order to support sustainable management decisions, while Marin et al. (2025) propose a software-based assessment framework that analyzes online search behavior to support the integration of scientific heritage sites into their urban environment. In adjacent applied domains, Grecu et al. (2020) document the role of mega-events in the development of structural tourism capabilities, drawing on audience-related data, while Drăghici et al. (2022) illustrate the broader methodological importance of longitudinal demographic and behavioral data in understanding the dynamics of specific populations. Chaffey and Ellis-Chadwick (2022), in a foundational textbook on digital marketing, position the longitudinal analysis of search visibility and CTR among the core analytical practices for managerial decision-making in digital advertising.

3. Research methodology

The research is quantitative, exploratory and descriptive, based on secondary data exported from the Google Ads account of a Romanian online retailer operating in the discount and promotional e-commerce segment. To preserve the anonymity of the retailer, the exact identity of the account, the specific calendar dates of the observation window and the absolute level of advertising spend are not disclosed. The observation window is reported as a 47-month period covering both the post-pandemic recovery and the progressive integration of AI-driven bidding and delivery systems into Google Ads.

The data source is a monthly aggregated report from Google Ads, containing for each calendar month two performance indicators: the number of impressions delivered and the number of clicks received. From these two indicators, the monthly click-through rate (CTR) was computed as the ratio of clicks to impressions, expressed as a percentage. The dataset thus contains three

time series – monthly impressions, monthly clicks and monthly CTR – over 47 calendar months, of which 44 record non-zero activity. The three months with zero activity, which occur consecutively at the start of the observation window, are interpreted as a period during which the account was either inactive or running campaigns with no impression delivery; they are excluded from the calculation of averages but retained when characterizing the overall structure of the time series.

The analysis is performed at three levels of aggregation: the entire observation window, individual annual periods (covering 12 consecutive months, except for the first and last annual periods, which are partial) and individual months. The objective of this multi-level analysis is to separate three components of the observed time series: a long-term trend across the four-year window, a recurring seasonal pattern centered on the fourth quarter, and month-to-month variation that may reflect specific operational or contextual events. The methodological approach is descriptive and comparative, in line with the longitudinal secondary-data design used by Hoțoi (2024) and consistent with the framework of online behavior analytics articulated by Marin et al. (2025). No attempt is made to estimate causal effects, since the data do not contain the controls or counterfactual structure required for such estimation; the analysis is limited to documenting and interpreting the observed patterns.

4. Results and discussion

4.1. Overall structure of the time series

Over the 47-month observation window, the account recorded a cumulative total of 1,246,015 clicks and 61,195,794 impressions, corresponding to an overall click-through rate of 2.04%. The activity covers 44 months, with three consecutive months of zero delivery at the start of the window. The monthly distribution of impressions is highly heterogeneous: at the upper end, the most active months recorded volumes above two million impressions, while at the lower end, the least active months recorded fewer than 300,000 impressions – a ratio of approximately ten to one between the highest and the lowest monthly levels of search visibility. The monthly CTR is comparatively more stable, ranging between 1.56% and 2.89% across the entire window, with the great majority of months falling between 1.7% and 2.2%.

4.2. Long-term trend: three phases of search visibility

The annual aggregation of the data reveals a clearly non-monotonic long-term trajectory, with three distinguishable phases. The first phase corresponds to the early portion of the observation window, when the account averaged approximately 2.1 million impressions per month over the seven active months recorded in that period, with an annual CTR of approximately 2.23%. This phase is characterized by relatively high search visibility, an above-average CTR, and click volumes consistent with active growth in the account.

The second phase spans the following two full annual periods, in which the account recorded its peak aggregate volumes: more than 18 million impressions in the first full year and more

than 21 million impressions in the second full year, corresponding to monthly averages of approximately 1.5 and 1.8 million impressions respectively. The annual CTR in this phase declined modestly to between 1.95% and 2.15%, but the absolute click volumes reached their highest levels in the dataset – consistent with a mature account operating at scale within the algorithmically mediated Google Ads ecosystem. This phase corresponds, in the broader market context, to the progressive generalization of Smart Bidding strategies and to the introduction of Performance Max, as well as to the post-pandemic normalization of consumer search behavior discussed by Sheth (2020) and Hoekstra and Leeflang (2020).

The third phase, covering the most recent full annual period and the partial period at the end of the window, displays a sustained and substantial decline. Monthly impressions fell to an average of approximately 960,000 in the third year – less than half of their previous peak – and to an average of approximately 430,000 in the partial fourth year, while the annual CTR remained broadly stable between 1.81% and 1.90%. The stability of the CTR alongside the sharp decline in volume indicates that the contraction operates primarily on the supply side of impressions, rather than on the click responsiveness of the audience: the algorithm continues to deliver impressions at approximately the same rate of click conversion, but to a substantially smaller volume of users. This pattern is consistent with the cumulative effect of the privacy-related changes discussed in the literature (Yang and Ghose, 2010; Berman, 2018) and with a hypothesis of intensified competition for high-value impressions within a contracting addressable audience.

4.3. Seasonal pattern: Q4 concentration

Superimposed on the long-term trend, a recurring seasonal pattern is visible throughout the observation window. The fourth quarter, and in particular the months of November and December, systematically records higher click and impression volumes than the rest of the year, consistent with the well-documented importance of Black Friday and end-of-year promotional periods in Romanian e-commerce. In the highest-volume year, November alone recorded approximately 70,000 clicks and more than 3.2 million impressions, with a CTR of 2.17% – substantially above the surrounding monthly levels. In the preceding year, November recorded its own local peak at approximately 52,000 clicks and a CTR of 2.89%, the highest single-month value in the dataset.

The persistence of this seasonal pattern across all phases of the long-term trend has practical implications. First, performance comparisons that do not account for seasonality are highly sensitive to the choice of reference period, with potentially misleading conclusions about year-over-year evolution. Second, the maintenance of clear seasonal peaks even in the contraction phase suggests that the structural factors responsible for the long-term decline – algorithmic, competitive or privacy-related – do not eliminate the underlying seasonality of consumer demand. As Hoțoi (2024) notes in a comparable Romanian setting, the seasonality of digital marketing campaigns has remained robust even through the structural shocks of the pandemic and post-pandemic period.

4.4. CTR stability and the algorithmic interpretation

The relative stability of the monthly CTR across the observation window – moving between approximately 1.7% and 2.2% for the great majority of months, with isolated peaks above 2.8% in seasonal high-points – is, in itself, a finding worth highlighting. Within an algorithmically mediated bidding and delivery ecosystem, the CTR can be interpreted as a joint product of three factors: the quality of the match between the ad and the user (largely controlled by the algorithm), the relevance and competitiveness of the ad creative (controlled by the advertiser) and the propensity of the user to click (a function of the user's intent and the broader behavioral context). The fact that this composite indicator remains broadly stable while the absolute volume of impressions varies by an order of magnitude suggests that the contraction of search visibility operates primarily through changes in the volume of addressable users, rather than through a degradation in match quality.

This pattern is consistent with the broader frameworks proposed by Davenport et al. (2020), Huang and Rust (2021) and Vlačić et al. (2021), in which AI-driven advertising systems are designed to optimize the marginal value of impressions and tend to defend per-impression performance metrics even as macro-level conditions deteriorate. It also echoes the observation by Olteanu (2013b) that digital influencing techniques operate through targeted matching rather than through volume alone – an observation made more than a decade before AI-driven bidding became the operational default. For a contemporary advertiser, the implication is that long-term performance benchmarks should be constructed at the level of volume metrics (impressions, clicks) as well as at the level of rate metrics (CTR), since the two can evolve in substantially different ways within the same account.

5. Conclusions

This paper has analyzed the long-term evolution of search visibility and click-through performance in a Romanian e-commerce account over a 47-month observation window, using monthly aggregated Google Ads data on impressions and clicks. Four findings emerge from the analysis.

First, the long-term trajectory of search visibility is markedly non-monotonic and can be characterized as three phases: an early high-visibility phase, a peak-volume phase corresponding to the maturation of AI-driven bidding and the introduction of Performance Max, and a sustained decline phase in which monthly impressions fall to less than half of their previous peak. Second, the monthly CTR remains broadly stable across the entire observation window, indicating that the contraction in search visibility operates primarily on the supply side of impressions rather than on the click responsiveness of the audience. Third, the seasonal concentration of activity in the fourth quarter – consistent with the importance of Black Friday and end-of-year promotional periods – persists robustly across all phases of the long-term trend. Fourth, the joint pattern of declining volumes and stable CTR is consistent with the cumulative effects of privacy-related signal loss and intensified competition for a contracting addressable audience, within a broadly stable algorithmic matching environment.

These findings have implications for both research and practice. For practice, they argue against the use of volume metrics alone as benchmarks of long-term performance, since substantial declines in impressions and clicks can occur in the absence of any degradation in per-impression efficiency. They also support the construction of performance dashboards that combine rate and volume indicators, with explicit attention to seasonality, in order to provide a sound basis for budget planning and target setting. For research, the findings extend to a Romanian e-commerce setting the broader patterns documented in the literature on AI-driven advertising (Davenport et al., 2020; Huang and Rust, 2021; Vlačić et al., 2021), on longitudinal advertising performance (Yang and Ghose, 2010; Blake et al., 2015; Berman, 2018) and on the post-pandemic evolution of consumer behavior (Sheth, 2020; Hoekstra and Leeflang, 2020), and they complement the Romanian longitudinal evidence developed by Hoțoi (2024).

The study has several limitations. First, it is based on a single account in the discount e-commerce segment, which limits the generalizability of the quantitative findings; future work should compare long-term patterns across multiple accounts and verticals. Second, the available data are limited to impressions and clicks, with no information on cost, on conversion outcomes or on the campaign-type composition of the account; consequently, the analysis cannot decompose the observed trends into their algorithmic, competitive and behavioral components. Third, the analysis is descriptive rather than causal: it documents patterns and discusses plausible interpretations, but does not estimate the marginal effect of specific changes in the Google Ads ecosystem (such as the transition from Smart Shopping to Performance Max or the rollout of Consent Mode v2). Future research could address these limitations by combining monthly Google Ads data with cost and conversion data, by using quasi-experimental designs around well-defined platform changes, and by comparing the long-term patterns across accounts operating with different campaign-type mixes.

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Two Decades of Digital Marketing Research: From Web-Based Consumer Influence to AI-Mediated Marketing Decisions

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Abstract: *The past two decades have witnessed a profound transformation of digital marketing, both as a managerial practice and as a field of academic inquiry. This paper offers a narrative review of this transformation, organized around four overlapping eras: the web infrastructure era of the early 2010s, in which the operational foundations of digital marketing capabilities were established; the social analytics era of the mid-2010s, in which monitoring tools, search-based AI applications and the systematic study of online consumer influence emerged; the maturation era of the late 2010s and the pandemic shock of 2020-2022, in which algorithmic ad delivery became the operational default and consumer behavior was substantially reshaped; and the AI-mediated era of 2023-2026, in which generative AI, fully algorithmic campaign types and privacy-related signal loss have redefined the conditions of digital advertising. For each era, the paper identifies the dominant technological capabilities, the corresponding consumer-behavior questions and the main research approaches developed in response. Three short illustrative cases drawn from Romanian small and medium e-commerce settings are used to ground the conceptual discussion in contemporary empirical practice. The review concludes with a synthesis of cross-era continuities and discontinuities, with implications for the design of empirical research in digital marketing and with directions for future inquiry in the increasingly algorithmic and generative-AI-mediated marketing environment.*

Keywords: digital marketing, artificial intelligence, consumer behavior, social media, narrative review, algorithmic delivery, e-commerce.

JEL: M31, M37, O33, L86.

1. Introduction

Digital marketing as a domain of both practice and inquiry has changed almost beyond recognition over the past two decades. In the early 2010s, marketing managers were primarily concerned with the operational stability of their digital infrastructure – ensuring website availability, securing data, integrating with the first widely adopted social platforms – and the academic literature was focused on conceptualizing the new digital channels (Kaplan and Haenlein, 2010; Constantinides, 2014). By the mid-2010s, attention had shifted toward the systematic monitoring of social networks, the analysis of online consumer behavior and the first commercially available AI-powered search tools (Olteanu, 2014, 2016; Stephen, 2016). By the early 2020s, AI-driven bidding and delivery had become the operational default within the major advertising platforms (Davenport et al., 2020; Huang and Rust, 2021), and the COVID-19 pandemic had introduced a structural shock to consumer behavior whose effects continue to be analyzed today (Sheth, 2020; Hoekstra and Leeflang, 2020; Hoțoi, 2024). By the mid-2020s, generative AI and fully algorithmic campaign types have begun to redefine the boundary between what is decided by the advertiser and what is decided by the platform.

These developments did not occur as a sequence of clean, mutually exclusive stages. Each era built on the operational and intellectual achievements of the previous ones, and several of the questions raised in the early 2010s – about how digital techniques shape consumer decisions, about how marketing data can be used to support managerial choices, about how to maintain reliable digital services in the face of growing complexity – remain central to the contemporary research agenda, even as the technological context has changed dramatically. The aim of this paper is to provide a narrative review of this two-decade trajectory, identify continuities and discontinuities across eras and discuss the implications for the design of empirical research in the current AI-mediated marketing environment.

The review is organized around four overlapping eras. Section 2 examines the web infrastructure era of the early 2010s, focusing on the operational foundations of digital marketing capabilities. Section 3 turns to the social analytics era of the mid-2010s, in which monitoring tools, AI-powered search and consumer-behavior research converged. Section 4 covers the maturation era of the late 2010s and the pandemic shock of 2020-2022. Section 5 discusses the AI-mediated era of 2023-2026, with three short illustrative cases drawn from contemporary Romanian e-commerce practice. Section 6 synthesizes the continuities and discontinuities across eras, and Section 7 concludes with implications for research and practice.

2. The web infrastructure era (2010-2013): foundations of digital marketing capabilities

The early 2010s were dominated, on the practitioner side, by concerns about the operational reliability of the digital channels through which marketing activities were beginning to flow. Olteanu (2010), writing on the prevention, backup and restoration procedures necessary for the continuity of web server operation, articulated a set of preoccupations that may appear technical but were – and still are – preconditions for any sustained digital marketing program. A digital campaign cannot deliver value if the underlying web infrastructure is unreliable; the analytics

that inform marketing decisions cannot be trusted if the data they rely on is intermittently lost or corrupted. By the middle of the period, attention was shifting toward cloud computing as a way to handle the growing volume and variety of marketing-relevant data; Olteanu (2013a) discussed the migration of applications to cloud environments and the corresponding questions of data reliability and portability.

On the conceptual side, the early 2010s saw the consolidation of foundational frameworks for understanding the new digital marketing landscape. Kaplan and Haenlein (2010), in a paper that has since become one of the most-cited references in the field, proposed a typology of social media that organized a then-confusing proliferation of platforms into a coherent framework, and articulated the strategic challenges and opportunities they presented for businesses. Constantinides (2014), building on this and related earlier work, synthesized the foundations of social media marketing into a structured set of strategic and operational guidelines for managers.

Two characteristics of this era are worth highlighting in retrospect. First, the technological and conceptual layers were tightly coupled: managerial practice could not move faster than the underlying infrastructure allowed, and academic research was occupied with conceptualizing the practices that were just becoming feasible. Second, the agency of the marketing manager remained largely intact: the principal automation decisions concerned the infrastructure, while content, targeting and budgeting decisions were still primarily made by humans.

3. The social analytics era (2013-2016): from online influence to AI-powered search tools

The middle of the 2010s saw a marked acceleration of attention toward the systematic study and operational exploitation of online consumer behavior. Olteanu (2013b), writing on the influencing of the average internet consumer's online behavior, identified the range of digital techniques through which choices, attitudes and preferences could be shaped in online environments. The argument anticipated, in a foundational way, the contemporary discussion on personalization, retargeting and algorithmic content delivery, by treating the influencing of online behavior as an explicit object of managerial design rather than as an incidental byproduct of digital advertising. Stephen (2016), in an influential review of the role of digital and social media marketing in consumer behavior, formalized many of the same intuitions within the consumer-research tradition.

Parallel to the development of consumer-behavior research, the period saw the emergence of dedicated tools for the operational monitoring of social networks by business actors. Olteanu (2014) discussed the new generation of monitoring tools available to firms, while Tuten and Solomon (2017) provided a comprehensive textbook synthesis of the resulting practices. The convergence of consumer-behavior research and monitoring infrastructure produced, by the second half of the period, the first commercially available AI-powered search and audience tools. Olteanu (2016) analyzed Facebook Graph as one of the earliest such tools, intended for data-informed customer acquisition and business management, and prefigured many of the algorithmic mechanisms that would, a decade later, become embedded in mainstream advertising platforms.

This era also produced the conceptual foundations for the contemporary discussion of attribution and customer journeys. Yang and Ghose (2010), in a study of the interaction between organic and sponsored search advertising, documented systematic interdependencies between

channels and warned against simplistic single-channel evaluation, while Kannan, Reinartz and Verhoef (2016) and Anderl et al. (2016) developed multichannel attribution frameworks that remain the methodological backbone of contemporary research.

4. The maturation era (2018-2022): algorithmic mediation and the pandemic shock

By the late 2010s, the operational locus of decision-making within major advertising platforms had shifted decisively from the human advertiser to the platform's machine-learning systems. Davenport et al. (2020) argue that AI is reshaping marketing strategy across three dimensions – tasks, supporting structures and customer engagement – and locate algorithmic ad delivery among the most advanced manifestations of this shift. Huang and Rust (2021) propose a strategic framework in which AI operates on mechanical, thinking and feeling levels, while Vlačić et al. (2021), in a systematic review of AI in marketing, identify advertising and customer relationship management as the most mature application areas. Kumar et al. (2019) emphasize personalization at scale as the most consequential outcome of AI adoption, and Choi et al. (2020) document how programmatic systems internalize bidding decisions in online display markets.

Within this maturation phase, the gap between advertiser intent and algorithmic delivery emerged as a research concern in its own right. Ali et al. (2019), in an empirical analysis of Facebook ad delivery, document significant demographic skews produced by the platform's optimization systems even for nominally inclusive audiences. Lambrecht and Tucker (2019), in a study of STEM career advertising, document complementary patterns and discuss the implications for advertiser accountability. Berman (2018) shows that the choice of attribution model can substantially affect the apparent performance of an advertising account, particularly when the campaign mix evolves over time. Voorveld et al. (2018) and Lee, Hosanagar and Nair (2018) document, in different empirical settings, how engagement with social media advertising varies systematically across content types and audience segments.

Superimposed on this gradual technological maturation, the COVID-19 pandemic produced a sudden and large structural shock. Sheth (2020) argues that the pandemic disrupted established consumer habits across categories and that some of these disruptions are likely to persist. Hoekstra and Leeflang (2020) and Kirk and Rifkin (2020) document the corresponding implications for marketing strategy, while Dwivedi et al. (2021), in a multi-author research agenda, position the post-pandemic period as a natural inflection point for digital and social media marketing research. In the Romanian context, Hoțoi (2024), analyzing Google Ads data from an online retailer over an extended observation window, shows that the pandemic accelerated digital adoption and increased the role of paid digital channels in conversion-generating purchase journeys – effects that remained measurable well after the immediate crisis.

The applied empirical literature from this period also illustrates the broader methodological orientation that became dominant by the early 2020s: the use of digital data sources for empirical analysis across an increasingly diverse range of domains. Bazac et al. (2023) analyze the online referential value of urban historical parks for sustainable management decisions; Grecu et al. (2020) study the role of mega-events in the development of structural tourism capabilities;

Drăghici et al. (2022) examine the demographic dynamics of populations in the Danube Delta, drawing on disaggregated data sources. Each of these studies operates outside the marketing literature in a narrow sense, but each contributes methodologically to the broader practice of using digital and behavioral data for empirical inquiry. Chaffey and Ellis-Chadwick (2022), in a foundational textbook, summarize the resulting analytical practices for managerial use.

5. The AI-mediated era (2023-2026): generative AI, algorithmic delivery and empirical research

The most recent era – spanning the time from the public release of large generative-AI models in late 2022 through the present – combines three structural transformations that have begun to redefine the field. First, generative AI has moved from research demonstration to operational tool: Eloundou et al. (2023) document, in a large-scale labor-market study, that generative-AI capabilities now overlap with a substantial share of professional tasks, including many tasks in marketing; Brynjolfsson, Li and Raymond (2023) provide complementary evidence on the productivity effects of generative-AI tools in workplace settings. Second, fully algorithmic campaign types – such as Google's Performance Max and Meta's Advantage+ – have become the default option in major advertising platforms, internalizing not only bidding decisions but also placement, audience and creative decisions. Third, a sequence of privacy-related changes has progressively eroded the signal richness on which algorithmic delivery and measurement systems rely.

The empirical literature from this era is still emerging. Hoțoi (2024) provides a Romanian longitudinal analysis of Google Ads campaigns over the April 2022 – September 2024 interval, documenting the structural reshaping of consumer behavior and the evolution of paid digital channels in the post-pandemic period. Marin et al. (2025) propose a software-based assessment framework for the analysis of online search behavior, applied in a heritage management context but methodologically transferable to commercial marketing settings. Three short cases from contemporary Romanian small and medium e-commerce practice illustrate the kinds of empirical questions that have become central in this era.

A first illustrative case concerns the comparison between AI-driven Smart Shopping campaigns and manually managed Search campaigns in a Romanian online wine retailer. The case documents how Smart Shopping campaigns generate the largest share of clicks but record lower last-click conversion rates, while manual Search campaigns achieve higher conversion efficiency on direct-response intent. An assisted-conversion analysis, performed over a 30-day lookback window, shows that approximately 47.6% of conversions attributable to Google Ads are assisted rather than last-click, suggesting that last-click attribution systematically underestimates the contribution of AI-driven prospecting campaigns. The case operationalizes, in a small-business setting, the attribution concerns raised by Berman (2018) and Kannan et al. (2016).

A second illustrative case concerns the demographic distribution of impressions delivered by Meta Ads in a remarketing campaign run by a Romanian private aesthetic medicine clinic. The case shows that, within a nominally inclusive remarketing audience, the platform's delivery algorithm produces a very strong demographic concentration: women aged 35 to 54 absorb close

to 60% of total spend, and women aged 35 to 64 absorb more than three quarters of it. The case provides, in a Romanian healthcare-service setting, empirical evidence of the dynamics documented at a broader level by Ali et al. (2019) and Lambrecht and Tucker (2019), and illustrates the importance of monitoring the realized – rather than only the configured – distribution of algorithmic ad delivery.

A third illustrative case concerns the long-term evolution of search visibility in a Romanian discount e-commerce account, analyzed over a 47-month window. The case documents a non-monotonic trajectory: an early high-visibility phase, a peak-volume phase corresponding to the maturation of AI-driven bidding, and a sustained decline phase in which monthly impressions fall to less than half of their previous peak while click-through rates remain broadly stable. The pattern is consistent with the cumulative effects of privacy-related signal loss and intensified competition for a contracting addressable audience, within a stable algorithmic matching environment. The case extends, in a Romanian setting, the longitudinal patterns discussed by Yang and Ghose (2010), Blake, Nosko and Tadelis (2015) and Hoțoi (2024).

6. Synthesis: continuities and discontinuities across eras

Three continuities are visible across the four eras reviewed above. First, the operational reliability of the underlying digital infrastructure remains a precondition for everything else: the concerns articulated by Olteanu (2010) about web server continuity and by Olteanu (2013a) about cloud-based data reliability are still relevant to the contemporary advertiser, even if they are now embedded in platform services rather than managed directly. Second, the question of how digital techniques shape consumer behavior – introduced by Olteanu (2013b) and developed by Stephen (2016) and many subsequent authors – continues to organize a substantial share of the contemporary research agenda, even as the specific techniques have evolved. Third, the methodological orientation toward the use of digital and behavioral data for empirical inquiry, visible in the applied work of Grecu et al. (2020), Drăghici et al. (2022), Bazac et al. (2023) and Marin et al. (2025), has become a default approach for any empirical study in marketing and adjacent domains.

Three discontinuities are equally visible. First, the locus of decision-making has shifted decisively from the human advertiser to the platform's algorithm, a transformation that has been documented progressively from Olteanu (2016) through Davenport et al. (2020), Huang and Rust (2021) and Vlačić et al. (2021), and that has reached a new threshold with the generalization of fully algorithmic campaign types in 2023-2026. Second, the relationship between advertiser intent and algorithmic delivery has emerged as an autonomous object of research, with Ali et al. (2019) and Lambrecht and Tucker (2019) providing landmark empirical evidence. Third, the contemporary research environment is shaped by structural shocks – the COVID-19 pandemic, privacy-related signal loss, the emergence of generative AI – at a frequency and magnitude that earlier eras did not display.

7. Conclusions

This paper has offered a narrative review of two decades of digital marketing research, organized around four overlapping eras: a web infrastructure era in the early 2010s, a social analytics era in the mid-2010s, a maturation era in the late 2010s combined with the pandemic shock of 2020-2022, and an AI-mediated era from 2023 onward. The review has identified, across these eras, three durable continuities – the importance of operational infrastructure, the centrality of consumer-behavior questions and the methodological orientation toward digital-data analysis – and three structural discontinuities – the shift of decision-making toward platform algorithms, the emergence of advertiser-versus-algorithm dynamics as an autonomous research object, and the increasing frequency of structural shocks in the broader research environment.

The review has several implications for empirical research in digital marketing. First, contemporary empirical work benefits from being explicitly situated within this two-decade trajectory: studies that engage with both the foundational concerns articulated in the early 2010s and the contemporary algorithmic environment are likely to produce more durable contributions than studies that engage only with the current technical configuration. Second, the methodological repertoire developed in adjacent applied domains – the search-behavior frameworks of Bazac et al. (2023) and Marin et al. (2025), the longitudinal demographic analyses exemplified by Drăghici et al. (2022) – offers transferable tools for marketing research that go beyond the standard set of platform-supplied metrics. Third, in the AI-mediated environment, the documentation of the realized – as opposed to the configured – behavior of algorithmic delivery systems becomes a research priority in its own right, complementing the more traditional focus on advertiser strategy.

The review has several limitations. As a narrative rather than systematic review, it cannot claim exhaustive coverage of the relevant literature, and the selection of cited works reflects, inevitably, the perspective and the empirical horizon of the author. The illustrative cases drawn from Romanian small and medium e-commerce practice are intended as supports for the conceptual argument rather than as standalone empirical contributions, and a more developed study would integrate them within a rigorous comparative design. Finally, the AI-mediated era is, by definition, still unfolding: the conceptual framework proposed here will need to be revisited as the operational and behavioral consequences of generative AI, fully algorithmic campaign types and post-cookie measurement environments become better documented. Future research could extend the review along several axes, including the systematic comparison of long-term performance trajectories across multiple sectors and markets, the empirical documentation of the integration of generative AI into marketing workflows and the development of methodological standards for the audit of algorithmic ad delivery in regulated service sectors.

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Entrepreneurial Intention Under Digital and Environmental Uncertainty: Evidence from Young Adults in an Emerging Economy

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Abstract: *This paper explores the influence of digital competencies and entrepreneurial competencies on entrepreneurial intention in the context of digital and environmental uncertainty among young adults from an emerging economy. The study investigates how technological adaptability, continuous learning, and entrepreneurial skills contribute to professional development and entrepreneurial orientation in a constantly changing economic environment. In the contemporary digital economy, technological transformation, artificial intelligence, and labour market instability increasingly influence individuals' professional perspectives and career development. Using a mixed-methods approach, the study combines quantitative analysis conducted in SPSS with qualitative analysis performed in NVivo in order to identify the main relationships, themes, and perceptions associated with professional and entrepreneurial success. The findings highlight positive relationships between digital competencies, entrepreneurial competencies, adaptability, and entrepreneurial intention. The results also emphasize the importance of continuous learning, technological skills, flexibility, initiative, and opportunity recognition in responding to the challenges generated by digital transformation and environmental uncertainty. The study contributes to the understanding of entrepreneurial intention in emerging economies and underlines the importance of developing digital and entrepreneurial competencies in contemporary education and professional development programmes.*

Key words: entrepreneurial intention, digital competencies, entrepreneurial competencies, digital uncertainty, environmental uncertainty, human capital.

JEL: L26, M13, O33, J24.

1. Introduction

In recent years, accelerated digital transformation and economic instability have redefined the way young people shape their professional paths. Emerging technologies, artificial intelligence, and the rapid pace of innovation have created a context in which entrepreneurial opportunities are more accessible than ever before, yet at the same time more difficult to predict. In emerging economies, where technological development coexists with economic and social uncertainty, young adults are required to navigate a professional environment characterized by continuous change and volatility (World Economic Forum, 2020; OECD, 2019).

In this context, entrepreneurial intention becomes an essential mechanism through which individuals express their willingness to start a business, being influenced both by the perception of opportunities and by the ability to manage risk and uncertainty. According to the Theory of Planned Behavior, intention represents the strongest predictor of entrepreneurial behavior and is shaped by attitudes, social norms, and perceived behavioral control (Icek, 1991). Similarly, the literature on self-efficacy emphasizes that confidence in one's own competencies directly influences the willingness to act in uncertain contexts (Bandura, 1997).

Digitalization adds a new dimension to this process. Digital competencies such as technological confidence, the ability to quickly learn new applications, and the perceived efficiency of technology have become essential components of human capital within the contemporary business environment (OECD, 2019). At the same time, digital uncertainty, generated by the rapid pace of technological change, may influence both risk perception and the motivation to initiate entrepreneurial projects (World Economic Forum, 2020).

For young people in emerging economies, entrepreneurship is no longer merely a professional option, but also a strategy for adapting to a constantly evolving environment. Studies show that young adults demonstrate high levels of flexibility, opportunity orientation, and openness toward continuous learning elements that may stimulate entrepreneurial intention even under conditions of uncertainty (Heckman & Kautz, 2012; Jackson, 2016). Nevertheless, unequal access to digital resources, economic instability, and the pressure generated by technological transformation may differently influence the way young individuals perceive the possibility of becoming entrepreneurs.

The paper is structured around the theoretical foundations of entrepreneurial intention, the methodological design of the empirical research, the interpretation of quantitative and qualitative findings, and the main conclusions regarding the role of competencies in entrepreneurial development.

2. Literature review

2.1 Entrepreneurial intention and human capital

Entrepreneurial intention represents one of the most important concepts analyzed in the literature on entrepreneurial behavior, being considered a key predictor of business creation and entrepreneurial activity. It reflects an individual's willingness and desire to develop an

entrepreneurial venture in the future, as well as their orientation toward assuming an active role within the economic environment.

In the economic and managerial literature, entrepreneurial intention is defined as the conscious intention of an individual to create a new business or to engage in independent activities oriented toward economic opportunities. According to (Icek, 1991), intention represents the closest determinant of actual behavior and is influenced by individual attitudes, perceived social norms, and perceived behavioral control. At the same time, (Bird, 1988) argues that entrepreneurial intention is the result of a combination of cognitive, motivational, and contextual factors.

In the current context of the digital economy, entrepreneurial intention is influenced by a variety of economic, social, and technological factors. Rapid technological development, digital transformation, and increasing economic uncertainty require individuals to continuously adapt their competencies and professional strategies. Consequently, digital competencies, adaptability, and the ability to identify new opportunities become essential elements in the development of entrepreneurial orientation (OECD, 2019) (World Economic Forum, 2020).

In the case of young adults, entrepreneurial intention is strongly influenced by the perception of existing opportunities within the economic environment and by confidence in their own competencies. According to Krueger, Reilly, and Carsrud (Krueger, Reilly, & Carsrud, 2000), individuals who perceive that they possess the necessary resources and abilities tend to exhibit higher levels of entrepreneurial intention. At the same time, constant exposure to technology and digitalization contributes to the development of a mindset oriented toward innovation and professional flexibility.

The literature also highlights the important role of entrepreneurial self-efficacy in the development of entrepreneurial intention. According to Zhao, Seibert, and Hills (Zhao, Seibert, Scott E., & Hills, Gerald E., 2005) individuals who demonstrate higher levels of confidence in their own abilities and competencies are more likely to express entrepreneurial intentions and engage in entrepreneurial activities. Therefore, the development of professional, digital, and entrepreneurial competencies contributes to strengthening self-confidence and increasing the likelihood of entrepreneurial action.

Human Capital Theory represents one of the most important theoretical perspectives used to explain the relationship between education, competencies, and economic performance. According to this theory, individuals invest in education, training, and personal development in order to increase their productivity, skill levels, and ability to integrate into the labour market. Human capital includes the totality of knowledge, abilities, and experiences acquired throughout individuals' educational and professional development, all of which influence economic performance and professional opportunities. Within the contemporary economy, human capital is considered an essential factor of competitiveness and economic development, as it contributes to increasing the ability of individuals and organizations to respond to changes and challenges within the economic environment.

(Becker, 1964) and (Schultz, 1961) argue that education and competency development constitute essential forms of capital because they contribute to improving professional performance and increasing economic opportunities. From this perspective, investments in education and

professional development generate benefits both for individuals and for the economy through increased productivity and innovation. In the entrepreneurial context, human capital includes not only technical and digital competencies, but also behavioural competencies such as initiative, leadership, critical thinking, creativity, and responsibility. These competencies contribute to the development of individuals' ability to identify economic opportunities, make effective decisions, and respond to the challenges generated by the contemporary economic environment.

The contemporary economy is characterized by accelerated digitalization, global competition, and continuous technological transformation. In this context, entrepreneurial success no longer depends exclusively on financial resources or access to economic capital, but also on individuals' capacity to engage in continuous learning, use technology efficiently, and rapidly adapt to changes within the economic and professional environment (OECD, 2019). The development of digital platforms, artificial intelligence, and emerging technologies continuously reshapes labour market structures and professional requirements, increasing the importance of digital competencies and adaptability. At the same time, the contemporary economic environment is characterized by high levels of uncertainty and competitiveness, which create the need for competencies such as flexibility, rapid learning capacity, and an orientation toward innovation.

2.2 Digital and entrepreneurial competencies

Digital competencies are considered a central component of human capital because technology influences most economic and professional activities. According to the (World Economic Forum, 2020), digital competencies and the ability to adapt to technological changes represent some of the most important skills required in the contemporary labour market. The efficient use of technology contributes to improved professional performance, increased flexibility, and enhanced decision-making processes. Digital competencies also facilitate access to information, resources, and economic opportunities, contributing to the development of innovative business models and increasing professional and entrepreneurial competitiveness. Moreover, individuals who demonstrate high levels of digital competencies also tend to exhibit higher levels of adaptability and confidence in their professional abilities.

In addition, the development of human capital contributes to increasing individuals' ability to identify economic opportunities and effectively respond to business environment challenges. In the current context, entrepreneurship requires not only technical competencies, but also flexibility, strategic thinking, creativity, and the ability to manage change and uncertainty. Entrepreneurs must be capable of using technology, adapting rapidly to market transformations, and identifying opportunities within an economic environment characterized by competition and continuous innovation. Therefore, human capital and the development of digital and entrepreneurial competencies represent essential factors for professional success and for the development of entrepreneurial intention in the contemporary economy.

The importance of human capital for entrepreneurial success is further supported by the findings of (Unger, Rauch, Frese, & Rosenbusch, 2011) who demonstrate a positive relationship between competencies, accumulated experience, and entrepreneurial performance. Their study

suggests that individuals who continuously invest in the development of their skills are better equipped to identify and exploit business opportunities and are more likely to achieve entrepreneurial success.

Digital competencies have become increasingly important in contemporary labour markets, influencing individuals' adaptability, technological confidence, and capacity to respond to rapid technological change. Previous studies suggest that individuals with stronger digital competencies are more likely to identify opportunities, embrace innovation, and engage in entrepreneurial activities (OECD, 2019; World Economic Forum, 2020; Nambisan, 2017).

Entrepreneurial competencies, including initiative, responsibility, opportunity recognition, and goal orientation, are widely recognized as key determinants of entrepreneurial behavior and business creation. Individuals who possess higher levels of entrepreneurial competencies are generally more inclined to pursue entrepreneurial opportunities and develop entrepreneurial intentions (McClelland, 1961; Bandura, 1997; Man et al., 2002).

Furthermore, recent literature suggests that digital competencies and entrepreneurial competencies are closely interconnected. The ability to adapt to technological change, learn continuously, and effectively use digital tools may contribute to the development of entrepreneurial skills and opportunity recognition capabilities (Van Laar et al., 2017; Kraus et al., 2019; Vial, 2019).

2.3 Uncertainty and entrepreneurial behaviour

Uncertainty represents a central element of the contemporary economic environment and directly influences the decision-making processes of individuals and organizations. (Milliken, 1987)defines uncertainty as individuals' difficulty in anticipating future changes and evaluating their impact on economic and organizational activities. At the same time, (Knight, 1921) considers uncertainty to be the inability to accurately predict the outcomes of economic actions, an aspect that influences decision-making and risk-taking processes.

Within the contemporary economy, uncertainty is intensified by globalization processes, accelerated technological development, and continuous labour market transformations. Consequently, individuals and organizations are required to constantly adapt their strategies and competencies in order to respond to economic and technological changes.

The concept of digital uncertainty refers to the accelerated pace of technological change and the difficulty of anticipating the evolution of digital technologies and their impact on the professional and entrepreneurial environment. The continuous development of digital platforms, artificial intelligence, and automation creates new professional competency requirements and increases the need for continuous adaptation to emerging technologies.

According to the (World Economic Forum, 2020), digital transformation significantly reshapes labour market structures and influences both the way individuals carry out their professional activities and the competencies required for integration into a technology- and innovation-based economy. In this context, digital competencies and continuous learning capacity become essential elements for professional and entrepreneurial success.

Digital uncertainty is also associated with individuals' difficulty in anticipating the impact of emerging technologies on career development and professional growth. The emergence of

artificial intelligence, process automation, and digital platforms generates both opportunities and risks regarding professional stability and adaptation to new labour market requirements.

On the other hand, the concept of environmental uncertainty includes economic instability, social changes, legislative modifications, and continuous transformations within the business environment. (Duncan, 1972) argues that environmental uncertainty is determined by the difficulty individuals and organizations experience in obtaining sufficient information to anticipate external changes and make effective decisions.

In the entrepreneurial context, environmental uncertainty may influence business development, investment processes, and individuals' ability to identify economic opportunities. Frequent changes in market demands, economic instability, and global competition create the need for competencies such as flexibility, resilience, and adaptability.

(McMullen & Shepherd, 2006) emphasize that uncertainty may have both negative and positive effects on entrepreneurial behavior. Although instability may create difficulties in decision-making and business planning processes, it may also stimulate the identification of new opportunities for individuals who demonstrate initiative and adaptability.

In the entrepreneurial context, uncertainty may represent both a challenge and an opportunity. Economic and technological changes influence the way individuals perceive the risks and opportunities associated with developing entrepreneurial activities. High levels of uncertainty may generate difficulties in decision-making processes and may influence individuals' perceptions regarding professional and economic stability.

(McMullen & Shepherd, 2006) argue that individuals who manage uncertainty effectively tend to demonstrate higher levels of initiative and orientation toward entrepreneurial opportunities. The ability to adapt to economic and technological changes influences the development of entrepreneurial behavior and individuals' capacity to identify and capitalize on economic opportunities within a context characterized by continuous change.

Furthermore, individuals who exhibit high levels of self-efficacy and digital competencies tend to demonstrate a greater capacity for risk management and adaptation to market changes. Thus, digital competencies and professional flexibility contribute to reducing risk perception and increasing confidence in the ability to develop entrepreneurial activities.

Uncertainty may also stimulate creativity and orientation toward innovation, as individuals are required to identify rapid and efficient solutions in order to respond to the challenges generated by the contemporary economic environment. In this context, entrepreneurial success increasingly depends on individuals' capacity for continuous learning, efficient technology use, and rapid adaptation to the changes generated by digital transformation and the evolution of the economic environment.

In the entrepreneurial context, uncertainty may represent both a challenge and an opportunity for individuals who are developing their professional and entrepreneurial orientation. (McMullen & Shepherd, 2006) argue that individuals who are able to manage uncertainty effectively tend to identify entrepreneurial opportunities more easily and demonstrate higher levels of initiative, innovation, and responsibility-taking.

The ability to adapt to economic and technological changes directly influences the development of entrepreneurial behavior and the level of individuals' involvement in activities oriented

toward innovation and professional development. In addition, individuals who demonstrate flexibility and confidence in their own competencies tend to perceive change not only as a risk, but also as an opportunity for professional development and differentiation within a competitive and dynamic economic environment.

Adaptability, continuous learning, and the efficient use of technology therefore become essential elements of entrepreneurial success in the current context. Furthermore, high levels of uncertainty encourage individuals to develop proactive behaviors and strategies oriented toward flexibility and innovation in order to respond rapidly to the changes generated by digital transformation and labour market evolution.

At the same time, digital and entrepreneurial competencies contribute to increasing individuals' ability to identify economic opportunities, make effective decisions, and capitalize on the advantages offered by technology and digitalization. In this context, professional and entrepreneurial success increasingly depends on individuals' capacity for continuous learning, efficient technology use, and rapid adaptation to the challenges generated by the contemporary economic environment.

Therefore, the literature suggests that digital competencies, entrepreneurial competencies, adaptability, and continuous learning should be analyzed together when explaining entrepreneurial intention among young adults exposed to digital and environmental uncertainty.

Based on these theoretical considerations, the following hypotheses were formulated:

H1: Digital competencies are positively associated with entrepreneurial intention among young adults.

H2: Entrepreneurial competencies are positively associated with entrepreneurial intention among young adults.

H3: Digital competencies are positively associated with entrepreneurial competencies among young adults.

The conceptual model of the study assumes that both digital competencies and entrepreneurial competencies contribute to the development of entrepreneurial intention in a context characterized by technological transformation and environmental uncertainty.

3. Research methodology

3.1 Research Design

The present research is based on a mixed-methods approach, combining both quantitative and qualitative perspectives, with the aim of analyzing the relationship between digital competencies, digital and environmental uncertainty, and entrepreneurial intention among young adults from an emerging economy.

The quantitative research has a descriptive-correlational character and employs a cross-sectional design, with data being collected at a single point in time through an online questionnaire. This type of research allows the identification of relationships between variables and the analysis of the influence of digital and entrepreneurial competencies on entrepreneurial intention.

The qualitative component complements the statistical analysis through the interpretation of open-ended responses and the identification of the main themes associated with competencies

considered relevant for professional and entrepreneurial success. The qualitative analysis was conducted using NVivo software, which enabled the organization and thematic interpretation of textual data.

According to Creswell (2014), mixed-methods approaches provide a more comprehensive perspective on social phenomena and allow the integration of quantitative and qualitative data within a unified analytical framework.

3.2 Research Population and Sample

The research population consists of young adults situated at different stages of academic and professional development. The selection of this target group is justified by young people's high exposure to digitalization processes and by their relevance for the future development of the entrepreneurial environment.

The research sample consisted of 246 respondents selected through the non-probability convenience sampling method. Participants voluntarily completed the online questionnaire distributed through digital platforms and social media networks.

Respondents came from different educational backgrounds, including undergraduate students, master's students, and university graduates. Furthermore, the study included both male and female participants in order to allow comparative analyses.

According to Saunders, Lewis, and Thornhill (2019), the use of convenience sampling is frequently encountered in exploratory and descriptive research conducted within the academic environment.

3.3 Data Collection Instrument and Questionnaire Structure

The main instrument used for data collection was an online questionnaire developed in accordance with the research objectives and the specialized literature regarding entrepreneurial intention and digital competencies.

The questionnaire was structured into two main sections:

- socio-demographic questions;
- items related to digital competencies, entrepreneurial competencies, and perceptions regarding the influence of technology.

The socio-demographic data included information regarding respondents' gender and current level of education.

The items used to assess digital and entrepreneurial competencies were formulated as statements evaluated on a 5-point Likert scale, where: 1 = strongly disagree; 2 = disagree; 3 = neutral; 4 = agree; 5 = strongly agree.

The use of the Likert scale allows the measurement of individual attitudes and perceptions and is frequently used in social science and economic research (Likert, 1932).

Among the dimensions evaluated within the questionnaire are:

- comfort in using technology;
- digital learning capacity;

- efficiency in technology use;
- personal initiative;
- goal orientation;
- responsibility-taking;
- opportunity identification.

In addition, the questionnaire included an open-ended question regarding the competencies considered important for future professional success, which was subsequently used in the qualitative analysis conducted in NVivo.

3.4 Operationalization of Variables and Theoretical Constructs

Several categories of variables were analyzed within the research, structured according to the objectives and hypotheses of the study.

The variables related to digital competencies include:

- comfort in using technology;
- ability to learn digital platforms;
- perception of the professional advantages generated by technology;
- efficiency in ICT use.

The variables related to entrepreneurial competencies include:

- initiative;
- responsibility-taking;
- opportunity identification;
- goal orientation;
- professional motivation.

The dependent variable is represented by entrepreneurial intention, analyzed in relation to professional orientation and respondents' perceptions regarding entrepreneurial success within the current digital and economic context.

Table 1: Operationalization of the Main Variables

	Variable	**Analyzed Dimensions**
a.	Digital competencies	Technology use, digital learning, technological efficiency
b.	Entrepreneurial competencies	Initiative, responsibility, opportunities, motivation
c.	Entrepreneurial intention	Professional and entrepreneurial orientation

Source: Authors' own research results.

The operationalization of variables was carried out based on the specialized literature regarding digital competencies, entrepreneurship, and Human Capital Theory (Ajzen, 1991; Becker, 1964; OECD, 2019).

3.5 Data Collection and Processing Procedure

Data collection was conducted online through the distribution of the questionnaire to respondents via digital platforms and social media networks. Participation in the research was voluntary, and respondents were informed about the academic purpose of the study and the confidential nature of their responses.

The quantitative data were processed and analyzed using IBM SPSS Statistics software. The statistical analysis included:

- descriptive statistics;
- reliability analysis of the scales;
- Spearman correlations;
- Mann–Whitney and Kruskal–Wallis comparative tests.

For the qualitative component, the open-ended responses were analyzed using NVivo software. The qualitative analysis enabled the identification of the main themes and codes associated with the competencies considered important for professional and entrepreneurial success.

According to Bazeley and Jackson (2013), the use of NVivo facilitates the organization and systematic interpretation of qualitative data and contributes to increasing research rigor.

3.6 Reliability of the Instrument and Statistical Analysis Methods

The reliability of the research instrument was assessed using Cronbach's Alpha coefficient, employed to verify the internal consistency of the items included in the questionnaire.

According to Tavakol and Dennick (2011), Cronbach's Alpha values higher than 0.70 indicate an acceptable level of internal consistency, suggesting that the items consistently measure the same theoretical construct.

Within the research, non-parametric statistical methods were used, considering the ordinal nature of the data collected through the Likert scale.

Spearman correlation was used to analyze the relationships between the research variables and to test the formulated hypotheses.

The Mann–Whitney test was used to identify differences between two independent groups according to gender.

The Kruskal–Wallis test was used to analyze differences between multiple independent groups according to respondents' educational level.

The obtained results were interpreted in relation to the research objectives and the specialized literature analyzed in the previous chapters.

4. Results and discussions

The first stage of the empirical investigation focused on assessing the internal consistency of the measurement scales used in the study. Reliability was examined through Cronbach's alpha coefficients, which indicate the degree to which the items included in each scale measure the same underlying construct. This step is essential for ensuring that the composite indices digital

competencies, entrepreneurial competencies, and entrepreneurial intention are statistically robust and conceptually coherent.

The results of the reliability analysis are presented in Table 2. The digital competencies scale recorded a Cronbach's alpha of 0.598, a value that is considered acceptable for exploratory research. Although slightly below the conventional threshold of 0.70, this coefficient reflects the multidimensional nature of digital competencies, which encompass aspects such as technological comfort, perceived efficiency, rapid learning, and the perceived impact of technology. In contrast, the entrepreneurial competencies scale and the entrepreneurial intention scale both achieved Cronbach's alpha values of 0.776, indicating good internal consistency and confirming that the items within these scales reliably capture the constructs they were designed to measure.

Table 2: Reliability Statistics

Scale	Cronbach's Alpha	N of Items
DIG_Score	0.598	5
EC_Score	0.776	3
INT_Score	0.776	3

Source: Authors' own research results in SPSS.

Overall, the reliability results support the use of the three indices in subsequent analyses. The digital competencies scale should be interpreted with caution due to its moderate internal consistency, while the entrepreneurial competencies and entrepreneurial intention scales demonstrate strong psychometric properties.

To gain an initial understanding of the respondents' profiles in terms of digital competencies, entrepreneurial competencies, and entrepreneurial intention, descriptive statistics were computed for the three composite indices. These indicators provide insight into the central tendencies and variability of the data, offering a preliminary overview of how young adults position themselves in relation to the constructs examined.

As shown in Table 3, the median score for digital competencies is 4.40, indicating that respondents generally perceive themselves as highly competent in using technology, adapting to digital tools, and learning new applications. Entrepreneurial competencies register a median of 3.67, suggesting moderately high levels of opportunity recognition, initiative, and responsibility. Entrepreneurial intention presents a median of 4.00, reflecting a strong inclination among young adults to pursue entrepreneurial activities or consider entrepreneurship as a viable career path.

Table 3: Descriptive Statistics for DIG_Score, EC_Score, INT_Score

Variable	N	Minimum	Maximum	Median	25th Percentile	75th Percentile
DIG_Score	246	1.40	5.00	4.40	3.60	4.60
EC_Score	246	1.33	5.00	3.67	3.33	4.54
INT_Score	246	1.00	5.00	4.00	3.33	4.33

Source: Authors' own research results in SPSS.

The distribution of scores indicates that the sample is characterized by high levels of digital readiness and entrepreneurial orientation. The relatively narrow interquartile ranges suggest a consistent pattern across respondents, reinforcing the idea that young adults in emerging economies tend to develop strong digital and entrepreneurial profiles as adaptive strategies in uncertain environments.

The core objective of the study was to examine the relationships between digital competencies, entrepreneurial competencies, and entrepreneurial intention. To examine these relationships, Spearman's rank-order correlation coefficient was employed. This non-parametric statistical technique was selected due to the ordinal nature of the variables and the use of Likert-scale measurements.

The results indicate a moderate positive correlation between digital competencies and entrepreneurial intention. This finding confirms H1 and suggests that individuals who perceive themselves as more digitally competent are more likely to express entrepreneurial intentions. From a theoretical perspective, this relationship can be explained by the increasing role of digital technologies in shaping entrepreneurial opportunities.

The correlation between entrepreneurial competencies and entrepreneurial intention indicates a strong positive relationship, confirming H2. This suggests that individuals who perceive themselves as capable of identifying opportunities, taking initiative, and assuming responsibility are significantly more inclined to engage in entrepreneurial activities.

The results show a moderate positive correlation between digital competencies and entrepreneurial competencies, supporting H3. This relationship highlights the interconnected nature of digital and entrepreneurial skill sets in contemporary economic environments. Digital competencies appear to enhance entrepreneurial competencies by facilitating access to digital tools, enabling opportunity recognition, and supporting innovative thinking.

Table 4: Spearman correlations between the main variables

Relationship	**Spearman correlation**	**Significance**	**Hypothesis**
Digital competencies – Entrepreneurial intention	0.457	$p < 0.001$	H1 supported
Entrepreneurial competencies – Entrepreneurial intention	0.627	$p < 0.001$	H2 supported
Digital competencies – Entrepreneurial competencies	0.523	$p < 0.001$	H3 supported

Source: Authors' own research results in SPSS.

The results of the Mann–Whitney test indicate that no statistically significant differences were identified between male and female respondents regarding digital competencies, entrepreneurial competencies, or entrepreneurial intention. Although slight variations in median scores were observed between the groups, these differences were not sufficiently large to reach statistical significance. Therefore, gender does not appear to represent a determining factor in explaining

variations in the three constructs analyzed within the present study.

The results of the Kruskal–Wallis test reveal that no statistically significant differences were found according to educational level. Although respondents belonging to different educational categories displayed minor variations in their scores, these differences were not statistically significant. Consequently, educational level does not appear to significantly influence entrepreneurial intention within the analyzed sample.

The qualitative analysis was conducted using NVivo software, which was employed for the organization, coding, and interpretation of the open-ended responses provided by participants within the questionnaire. The purpose of the qualitative analysis was to identify the main competencies and characteristics considered relevant by respondents for professional and entrepreneurial success in a context characterized by digital transformation and economic uncertainty.

Following the coding process, several thematic categories associated with professional development and entrepreneurial orientation were identified, including adaptability and continuous learning, critical thinking and problem-solving, communication and leadership, professionalism and responsibility, and digital and technological competencies.

The obtained results highlight that respondents attach high importance to both digital competencies and behavioral and social competencies, which are considered essential for integration into a modern and competitive professional environment.

The qualitative analysis complements and supports the results obtained within the quantitative research by highlighting the main competencies and perceptions associated with professional and entrepreneurial success in the context of digital transformation and environmental uncertainty. The themes identified in participants' responses confirm the importance of digital competencies, adaptability, continuous learning, and entrepreneurial competencies in the development of the professional and entrepreneurial orientation of young adults.

Taken together, the quantitative and qualitative results suggest that entrepreneurial intention is shaped by a combination of digital readiness, perceived entrepreneurial capability, adaptability, and confidence in continuous learning.

5. Conclusions

The results of this research provide a comprehensive understanding of the way digital competencies and entrepreneurial competencies contribute to the development of entrepreneurial intention among young adults in an emerging economy. The quantitative analysis conducted in SPSS confirms all three hypotheses formulated in the conceptual model, demonstrating that both digital competencies and entrepreneurial competencies represent essential components of human capital that shape individuals' professional orientation and entrepreneurial motivation.

The strongest relationship was observed between entrepreneurial competencies and entrepreneurial intention, suggesting that individuals who perceive themselves as capable of identifying opportunities, taking initiative, and assuming responsibility are significantly more inclined to pursue entrepreneurial activities. This finding aligns with the theoretical assumptions of the Theory of Planned Behavior, which emphasizes the role of perceived behavioral control and self-efficacy in shaping entrepreneurial intention.

The positive association between digital competencies and entrepreneurial intention highlights the increasingly strategic role of digital literacy in contemporary professional environments. Respondents who reported higher levels of digital proficiency also expressed stronger entrepreneurial intentions, suggesting that the ability to use technology effectively enhances confidence in navigating uncertain environments, identifying opportunities, and engaging in innovative activities.

The study underscores the importance of integrating digital literacy and entrepreneurial training into educational programs and professional development initiatives. Strengthening these competencies may enhance young adults' capacity to adapt to technological changes, to innovate, and to pursue entrepreneurial activities. The results also highlight the need for educational institutions and organizations to promote continuous learning, creativity, and initiative, as these competencies play a crucial role in shaping individuals' professional trajectories in a rapidly evolving economic context.

The study presents several limitations. First, the use of a convenience sample limits the generalizability of the findings. Second, the reliance on self-reported data may introduce subjectivity in participants' evaluations of their competencies. Third, the cross-sectional design does not allow for the analysis of changes in competencies or entrepreneurial intention over time.

Future research could extend the sample, include longitudinal data, and explore how emerging technologies such as artificial intelligence reshape entrepreneurial behavior and competency development in different cultural and economic contexts.

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