STRATEGII MANAGERIALE

MANAGEMENT STRATEGIES

Revistă editată de
Universitatea „Constantin Brâncoveanu”
Piteşti

Anul XVIII, nr. IV (70) / 2025

Editura
Independența Economică

© Editura „Independenţa Economică"
Piteşti, Calea Bascovului nr. 2A
Tel./Fax: 0248/21.64.27

Editură acreditată de către C.N.C.S.I.S.

ISSN 2392 – 8123
ISSN–L 1844 – 668X

CUPRINS

RESILIENCE THROUGH PEOPLE: PERFORMANCE EVALUATION AND MOTIVATION AS STRATEGIC TOOLS IN EUROPEAN CIVIL PROTECTION SYSTEMS. A CASE STUDY OF THE ROMANIAN GENERAL INSPECTORATE FOR EMERGENCY SITUATIONS

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Abstract:*In an era marked by increasingly complex and interconnected global crises — from climate change and pandemics to threats targeting the security of European states — Europe's resilience depends not only on strategic policies, but also on the strength, preparedness, and adaptability of its human resources. This paper examines how performance evaluation systems and employee motivation function as strategic management tools in strengthening institutional resilience within European civil protection structures. The article analyzes the mechanisms through which performance appraisal, feedback, and incentive systems influence employee motivation, organizational effectiveness, and alignment with European standards for crisis management, using the Romanian General Inspectorate for Emergency Situations (IGSU) as a case study. Drawing on a managerial perspective, the paper discusses how a well-designed performance evaluation framework can reinforce professional commitment, foster innovation, and enhance inter-institutional collaboration, thus supporting the broader objectives of the European Civil Protection Mechanism.The findings suggest that developing a culture grounded in performance and motivation is essential for transforming national emergency services into strategic assets of European resilience. The article concludes with recommendations aimed at harmonizing human resource management practices within European civil protection systems, in order to strengthen adaptability, efficiency, and collective crisis response capacity.*

Keywords: *performance evaluation, motivation, resilience, civil protection, strategic management, IGSU, European cooperation*

JEL Classification: M12, H83, H56

1. Introduction

Europe is increasingly confronted with a multitude of complex and interdependent global challenges that test the ability of public institutions to respond rapidly, effectively, and collaboratively. Recent climate change dynamics have intensified the frequency and severity of natural disasters—ranging from wildfires and floods to prolonged droughts—placing unprecedented pressure on emergency response structures. At the same time, large-scale migratory flows, pandemics such as COVID-19, hybrid security threats, and geopolitical instability have amplified the need for coordinated crisis management at the European, and even international, level. In this context, the capacity of European states to ensure societal resilience depends not only on technological capabilities and regulatory frameworks, but fundamentally on the strength, preparedness, and motivation of the individuals operating within critical public institutions.

Civil protection systems, as frontline actors in safeguarding communities, rely heavily on human resources capable of adapting to evolving risks, maintaining operational continuity, and cultivating organizational learning. Consequently, Human Resource Management (HRM) emerges as a strategic pillar in building institutional resilience. Performance evaluation mechanisms, when effectively designed, clarify expectations, enhance accountability, and support continuous professional development, while motivation systems—both intrinsic and extrinsic—help sustain high levels of engagement, commitment, and psychological readiness among personnel. Together, these elements shape the ability of emergency structures to anticipate, withstand, and recover from crises.

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According to the systematic self-reflection model developed by *Crane et al. (2019)*, organizational resilience is built through a continuous process of experiential learning, grounded in the principle of „*learning through reflection on action*." From this standpoint, activities carried out within the field of civil protection clearly demonstrate the applicability and relevance of this model. The experiences gained during international missions not only enhance the operational readiness and professional skills of emergency personnel but also contribute to the overall strengthening of the national civil protection system. The robustness of this system is closely linked to the ongoing improvement and adaptation of the legislative framework, which is systematically revised in light of the lessons identified during operational missions and international exercises.

Against this background, the present paper examines how performance evaluation and motivation systems can strengthen the strategic resilience of civil protection organizations across Europe. The central research question guiding this study is: *How can human resource management instruments—particularly performance appraisal and motivation mechanisms—support the resilience, adaptability, and long-term effectiveness of emergency services?* To explore this question, the paper employs a case study of the Romanian General Inspectorate for Emergency Situations (IGSU), a key national institution that also plays an active role within the European Civil Protection Mechanism. IGSU provides a relevant empirical context given its dual positioning: as a national emergency response authority responsible for managing a wide spectrum of risks, and as a European partner regularly involved in cross-border operations, joint exercises, and the standardized development of capacities.

By examining IGSU's performance evaluation framework, motivation tools, and alignment with European strategic objectives, the paper seeks to illustrate how national HRM practices contribute to Europe's collective resilience architecture. The introduction thus lays the foundation for a broader analysis of HRM as a strategic choice for strengthening civil protection capacities in the face of global challenges.

2. Theoretical Background: Strategic Human Resource Management and Resilience

Building resilience within public institutions—particularly those responsible for crisis response—requires an integrated combination of organizational structures, resources, leadership, and human capital. Contemporary research emphasizes that human resources represent a critical determinant of institutional performance and adaptability in complex environments (Wright & McMahan, 1992; Boxall & Purcell, 2016). Among these components, Human Resource Management (HRM) plays a central role by shaping the skills, motivation, and flexibility of personnel, who ultimately determine the quality and effectiveness of emergency interventions (Becker & Huselid, 1998). Strategic Human Resource Management (SHRM) extends beyond administrative HR practices, positioning human capital as a key driver of organizational resilience and long-term sustainability (Lengnick-Hall et al., 2011). In the context of civil protection, SHRM involves aligning HR policies with organizational missions, anticipating future operational requirements, and fostering a culture of continuous learning and improvement.

A core dimension of SHRM is performance evaluation, which serves as a systematic process for measuring individual and organizational achievements. In public-sector institutions, performance evaluation frameworks contribute to clarifying job expectations, strengthening accountability, and identifying areas for professional development (Van Dooren et al., 2015; Poister et al., 2015). Well-designed performance management systems enhance transparency and communication between managers and employees, while supporting competency development in highly complex operational settings (Aguinis, 2019). Within emergency management agencies,

where decisions must often be made under conditions of uncertainty, time pressure, and risk, performance evaluation mechanisms can also reinforce procedural knowledge, promote coordination, and support high-reliability organizational practices (Bigley & Roberts, 2001; Weick & Sutcliffe, 2015).

Another essential element of institutional resilience is employee motivation. Classical motivational theories distinguish between intrinsic motivation—driven by personal satisfaction, professional identity, and commitment to public values—and extrinsic motivation, which includes financial rewards, recognition, career advancement, and organizational support (Deci & Ryan, 2000; Gagné & Deci, 2005). In the public sector, motivation is further shaped by the concept of Public Service Motivation (PSM), which highlights altruism, sense of duty, and the desire to contribute to societal well-being as key drivers of employee behavior (Perry & Wise, 1990; Vandenabeele, 2007). These motivational factors are particularly relevant in emergency response organizations, where personnel are frequently exposed to stress, risk, and demanding operational conditions. Empirical studies suggest that motivation in high-risk public organizations contributes not only to employee well-being and retention, but also to operational readiness, engagement during crises, and the willingness to assume responsibility in dynamic environments (Britt et al., 2007).

The relationship between performance evaluation, motivation, and organizational resilience has gained increasing attention in recent literature. Organizations that cultivate a culture of performance, learning, and recognition demonstrate higher levels of adaptability, faster recovery following crises, and stronger innovation capacities (Comfort et al., 2010; Lengnick-Hall et al., 2011). These attributes are particularly important for civil protection agencies operating in a European context, where interoperability, cross-border cooperation, and standardization are strategic priorities. The European Union Civil Protection Mechanism emphasizes the professionalization of human resources and the development of competencies necessary for effective national and multinational emergency response (European Commission, 2021).

Despite the acknowledged importance of HRM for institutional resilience, empirical research focusing on emergency services in Europe remains relatively limited. Existing studies tend to prioritize operational, technical, or coordination aspects of crisis management, often overlooking the human and organizational factors that underpin performance and long-term resilience (Boin et al., 2017; Waugh & Streib, 2006). This paper seeks to contribute to bridging this gap by examining how performance evaluation and motivation strategies within the Romanian General Inspectorate for Emergency Situations (IGSU) reflect broader trends in Strategic Human Resource Management and support the development of resilient civil protection structures in the European context.

3. Case Study: The Romanian General Inspectorate for Emergency Situations (I.G.S.U.)

The General Inspectorate for Emergency Situations (IGSU) represents the central public authority responsible for the coordination, management, and implementation of emergency response at the national level. Established as an integrated institutional structure that brings together fire-fighting services, civil protection components, and the national framework for emergency management, IGSU operates under the authority of the Ministry of Internal Affairs and plays a fundamental role in ensuring public safety. The institution's mandate encompasses a broad range of responsibilities, including prevention and response activities, risk assessment and analysis, disaster management planning, public warning and information, coordination of

specialized rescue units, and participation in international missions. Within the framework of the Union Civil Protection Mechanism (UCPM), IGSU contributes both operational capacities and institutional expertise, taking part in joint exercises, cross-border interventions, rescEU operations, and capacity-building initiatives at the European level.

A fundamental objective of the Union Civil Protection Mechanism (UCPM) is to strengthen collective disaster preparedness through coordinated planning, shared resource mobilization, and joint training activities (Gromek, 2023). By consolidating specialized response assets, the UCPM enables participating states to access a diverse range of capabilities, including aerial firefighting resources, medical response teams, and high-capacity water pumping units. This collaborative framework mitigates the constraints that individual countries may encounter when addressing large-scale or complex emergencies. Consequently, all participating states—irrespective of their size or national capacities—benefit from the pooled expertise, equipment, and personnel made available through the UCPM, thereby enhancing resilience and response capacity across the European Union (Widmalm et al., 2023).

The robustness of the national civil protection system is closely linked to the existence of a legislative and strategic framework that has undergone continuous refinement and adaptation, informed by lessons identified through the management of emergency situations. This iterative process has resulted in the adoption of a substantial number of strategic and normative documents, including the Strategy for Strengthening and Developing the Role of the Department for Emergency Situations within the National Emergency Management System 2024–2030 (Ministry of Internal Affairs, 2024), the National Disaster Risk Reduction Strategy 2023–2035 (General Inspectorate for Emergency Situations, 2023), and the National Strategy on Climate Change Adaptation for the period 2024–2030 (Ministry of Environment, Waters and Forests, 2024). These are complemented by the Strategy for the Consolidation and Development of the General Inspectorate for Emergency Situations 2016–2025 (https://igsu.ro), the National Disaster Risk Management Plan, the National Platform for Disaster Risk Reduction (https://igsu.ro), as well as national response frameworks addressing major risk categories, including epidemics, earthquakes, floods, forest fires, and nuclear or radiological accidents (https://igsu.ro).

In this context, the convergence of a consolidated legal and strategic framework, increased financial resource allocation—primarily through European Union structural funds—and the exercise of coherent strategic leadership has created the necessary conditions for strengthening institutional capacity to effectively address emerging risks. This continuous cycle of adaptation, learning, and innovation positions civil protection as a strategic domain of major importance for both national and European security.

3.1. Overview of the Performance Evaluation System in IGSU

Performance evaluation within the General Inspectorate for Emergency Situations (IGSU) is governed by a well-defined legal and regulatory framework that reflects both the specificities of military-status personnel and the operational requirements of emergency management. The evaluation system is designed to ensure that personnel meet established professional standards, fulfill operational responsibilities, and contribute effectively to the achievement of institutional objectives. As a core human resource management instrument, performance appraisal supports accountability, professional development, and organizational coherence in a high-risk, high-reliability environment.

From a legislative perspective, the performance evaluation of IGSU personnel is primarily regulated by Law No. 80/1995 on the Statute of Military Personnel, which establishes the general

principles governing career management, professional conduct, rights, and obligations of military staff. According to this legal framework, performance evaluation constitutes a mandatory component of career progression, influencing promotion, assignment to leadership positions, access to specialized training, and participation in international missions. The statute emphasizes merit-based assessment, professional competence, and compliance with military discipline and ethical standards as fundamental evaluation criteria.

In addition, the operationalization of performance evaluation is further detailed through Order of the Minister of Internal Affairs No. 177/2016 - regarding the human resources management activity in the military units of the Ministry of Internal Affairs, which regulates the annual assessment of military personnel within the Ministry of Internal Affairs, including IGSU staff. This order provides a standardized methodological framework for performance appraisal, defining evaluation stages, responsible actors, scoring systems, and documentation requirements. Under order No. 177/2016, performance evaluation is conducted on an annual basis and is structured around clearly articulated job descriptions, individual objectives, performance indicators, and competency criteria aligned with the position held.

The evaluation process typically comprises several interconnected components: self-assessment, assessment by the direct superior, hierarchical validation, and formal feedback discussions. This multi-layered approach is intended to enhance objectivity, ensure consistency across organizational levels, and promote constructive dialogue between evaluators and evaluated personnel. The final appraisal outcome is formally documented and integrated into the individual's professional record, serving as a reference for career planning and development decisions.

Substantively, the evaluation system emphasizes a set of core performance dimensions that are directly linked to the operational mission of IGSU. These include operational readiness, compliance with established procedures and operational doctrines, teamwork and inter-unit cooperation, communication skills, leadership potential (where applicable), and the capacity to make effective decisions under conditions of uncertainty, time pressure, and elevated risk. Particular attention is also given to participation in training programs, simulations, field exercises, and preparedness activities, which are essential for maintaining a high level of institutional readiness.

Beyond formal annual appraisals, performance assessment within IGSU incorporates elements of continuous and situational evaluation, especially during exercises, large-scale simulations, and real emergency interventions. These contextual assessments allow commanders and managers to observe behavior, coordination, and decision-making in real time, facilitating the identification of strengths, skill gaps, and learning needs. Such feedback is instrumental in refining operational procedures, enhancing interoperability, and strengthening team cohesion.

Performance evaluation outcomes play a critical role in supporting career advancement, eligibility for specialized or advanced training, and selection for international deployments, including those conducted under the Union Civil Protection Mechanism (UCPM). Personnel demonstrating high levels of competence, adaptability, and motivation are more likely to be nominated for international missions, training exchanges, and multinational exercises, thereby contributing to both individual professional development and institutional learning.

Despite the robustness of the existing legal and procedural framework, several challenges persist in the practical implementation of performance evaluation within IGSU. These include the administrative burden associated with appraisal documentation, variations in evaluator experience and interpretative practices, and the limited use of fully integrated digital performance management tools. Addressing these challenges through further standardization, evaluator

training, and digitalization could enhance the effectiveness, transparency, and strategic value of performance evaluation as a component of Strategic Human Resource Management within IGSU.

3.2. Motivation Instruments and Human Resource Development

Motivation within the General Inspectorate for Emergency Situations (IGSU) is shaped by a dynamic interaction between intrinsic and extrinsic factors, reflecting both the specific professional ethos of emergency responders and the regulatory framework governing military personnel within the Ministry of Internal Affairs. Intrinsic motivation is strongly rooted in public service values, a well-defined professional identity, commitment to collective mission objectives, and a culture of teamwork that is reinforced through shared operational experiences. The high societal relevance of emergency response activities and the direct contribution to the protection of life, property, and the environment further enhance personnel's sense of purpose and professional fulfillment.

Extrinsic motivation mechanisms within IGSU are formally regulated through Order of the Minister of Internal Affairs No. 135/2019, which establishes the conditions for granting moral, financial, and material rewards to military personnel within the Ministry of Internal Affairs. This normative act provides a structured and transparent framework for recognizing professional merit, exceptional performance, and outstanding conduct during missions, exercises, or routine activities. Recompenses may take the form of moral recognition (commendations, diplomas, honorary distinctions), financial rewards (bonuses and allowances), or material benefits, all of which serve to reinforce desired behaviors, operational excellence, and adherence to institutional values.

Order No. 135/2019 also introduces Councils of Honor, constituted at various organizational levels, which play a dual role in reinforcing motivation and professional ethics. These councils contribute to maintaining discipline, fairness, and moral standards within the institution, while simultaneously strengthening trust in leadership and organizational justice—factors that are widely recognized in the literature as critical determinants of sustained motivation in high-risk public organizations.

Career development represents another central pillar of motivation within IGSU and is comprehensively addressed in the Career Guide for Active Military Personnel within the General Inspectorate for Emergency Situations and Subordinate Units (2025). The guide operationalizes the principles established in the Statute of Military Personnel by outlining clear career pathways, promotion criteria, competency requirements, and professional milestones. By providing predictability, transparency, and alignment between individual aspirations and organizational needs, the career management framework enhances long-term commitment and retention.

Continuing Professional Development constitutes a key motivational driver, as access to specialized training and professionalization opportunities is directly linked to career advancement, performance evaluation outcomes, and eligibility for leadership roles. Training programs in advanced rescue techniques, CBRN response, disaster risk management, crisis leadership, and inter-agency coordination contribute not only to enhanced operational competence but also to increased professional confidence and job satisfaction. Participation in national and international exercises further reinforces experiential learning and institutional cohesion.

At the European level, engagement in Union Civil Protection Mechanism (UCPM) training activities, including courses supported by DG ECHO, represents a significant motivational instrument for IGSU personnel. These programs provide exposure to European standards, interoperability procedures, and multinational operational environments, while offering recognition, professional visibility, and opportunities for international deployment. Selection for

UCPM training and missions is commonly perceived as both a professional achievement and a career-enhancing experience, thereby reinforcing motivation, engagement, and organizational loyalty.

Despite the robustness of this motivational architecture, several structural and contextual challenges persist. Limited financial resources, high operational tempo, exposure to occupational hazards, staffing shortages, and prolonged periods of stress can negatively affect morale and intrinsic motivation. In response, IGSU has increasingly prioritized psychological support services, resilience-building programs, and leadership development initiatives aimed at enhancing emotional well-being, stress management, and adaptive capacity. These measures align with contemporary approaches to human resource management in emergency services, which emphasize holistic support for personnel as a prerequisite for sustained performance and institutional resilience.

3.3. Alignment with European Strategic Objectives

Human Resource Management (HRM) practices within the General Inspectorate for Emergency Situations (IGSU) increasingly reflect European strategic priorities related to interoperability, professionalization, and standardized crisis response. Through sustained participation in the Union Civil Protection Mechanism (UCPM), IGSU has progressively aligned its training systems, performance evaluation criteria, and operational procedures with EU-wide frameworks and standards. This alignment supports the development of a professional, adaptable, and interoperable workforce capable of responding effectively to both national emergencies and cross-border crises.

At the strategic level, HRM serves as a key enabler for achieving the EU Civil Protection Mechanism Resilience Goals, adopted by the European Commission in 2023. These goals—Anticipate, Prepare, Alert, Respond, and Secure—define a comprehensive framework for strengthening Europe's collective capacity to manage increasingly complex and interdependent risks, including climate-related disasters, public health emergencies, and security-related crises. The contribution of IGSU to these objectives is mediated largely through human capital development, leadership, and organizational learning.

The Anticipate objective, which emphasizes improved risk assessment and foresight, is supported through HRM policies that prioritize specialized training, analytical competencies, and continuous professional development. IGSU personnel are trained in risk analysis, scenario planning, and disaster forecasting, enabling the institution to contribute to evidence-based preparedness and early decision-making processes at both national and European levels. Performance evaluation systems further reinforce these competencies by assessing analytical skills, situational awareness, and the capacity to operate under uncertainty.

The Prepare goal, focused on strengthening preparedness and public awareness, is closely linked to HRM practices that promote training, exercises, and simulations. IGSU's participation in joint EU exercises, UCPM training programs, and multinational modules enhances not only technical preparedness but also behavioral competencies such as teamwork, leadership, and communication. These activities foster a shared professional culture and common operational language, which are essential for coordinated action during multinational interventions.

The Alert objective, aimed at enhancing early warning and communication systems, relies heavily on skilled and motivated personnel capable of managing complex information flows and engaging with both institutional partners and the public. HRM contributes to this goal by developing communication skills, decision-making capabilities, and ethical responsibility through

targeted training and performance feedback mechanisms. Motivation, reinforced through recognition and career incentives, plays a critical role in ensuring vigilance, responsiveness, and accountability in time-sensitive situations.

The Respond objective, which seeks to strengthen EU response capacity, is directly supported by HRM strategies that emphasize operational readiness, performance excellence, and personnel deployment. The integration of IGSU teams into European civil protection modules—such as urban search and rescue, emergency medical response, and wildfire suppression units—illustrates the strategic importance of performance evaluation and motivation as pillars of institutional resilience. Selection for these modules is contingent upon demonstrated competence, adaptability, and commitment, thereby linking individual performance management to collective European response capabilities.

Finally, the Secure objective, which focuses on building robust and sustainable civil protection systems, underscores the long-term role of HRM in institutional resilience. Career management frameworks, leadership development programs, psychological resilience initiatives, and retention strategies contribute to workforce stability and organizational continuity. By investing in human capital and aligning individual career trajectories with institutional and European priorities, IGSU enhances its capacity to sustain performance over time and adapt to evolving risk landscapes.

In sum, the convergence between IGSU's HRM practices and the EU Civil Protection Mechanism Resilience Goals demonstrates that resilience is not solely a function of technical assets or infrastructure, but is fundamentally grounded in people, competencies, and organizational culture. Performance management and motivation emerge as strategic instruments through which national civil protection institutions contribute to a more resilient, coordinated, and responsive European disaster management system.

4. Linking Performance, Motivation to Strategic Resilience

Contemporary research on civil protection and emergency management increasingly underscores the strategic importance of human resource management in strengthening organizational resilience. Within civil protection institutions, performance evaluation and motivation systems should not be understood solely as administrative or compliance-oriented instruments, but rather as strategic mechanisms that shape organizational culture, operational behavior, and long-term adaptive capacity. As demonstrated in the preceding sections, the integration of these HRM components is particularly relevant in high-reliability organizations operating under conditions of uncertainty, time pressure, and elevated risk.

Performance evaluation contributes to strategic resilience by clarifying operational expectations, reinforcing accountability, and supporting the systematic development of competencies essential for crisis response. The structured assessment of professional performance—encompassing decision-making under pressure, teamwork, communication, leadership, and adherence to procedures—ensures that personnel remain prepared to address evolving and complex risk scenarios. Moreover, the incorporation of feedback mechanisms and continuous assessment during training activities, simulations, and operational deployments fosters organizational learning, which is widely recognized as a core determinant of resilience in emergency management systems. Such learning processes are critical in a context characterized by emerging threats linked to climate change, technological advancement, and geopolitical instability.

Motivation represents a complementary pillar of resilience, particularly in organizations exposed to sustained operational stress and high emotional demands. As discussed earlier, intrinsic motivation grounded in public service values, professional identity, and commitment to societal protection constitutes a defining feature of emergency services. However, intrinsic drivers must be supported by coherent extrinsic mechanisms—such as recognition, career advancement, access to specialized training, and participation in national and international missions—in order to sustain engagement over time. These motivational instruments contribute not only to performance continuity but also to psychological resilience, retention, and the willingness of personnel to assume responsibility in dynamic and unpredictable environments.

When examined in conjunction, performance evaluation and motivation systems support the development of key organizational resilience capabilities identified in the literature, namely anticipation, absorption, adaptation, and transformation. Performance management frameworks enhance anticipation by enabling institutions to identify competency gaps, forecast workforce needs, and align training priorities with emerging risks. Motivation mechanisms support absorption by strengthening morale, cohesion, and coping capacity during periods of intense operational pressure. Continuous professional development and structured feedback processes facilitate adaptation by enabling organizations to revise procedures, doctrines, and coordination mechanisms in response to lessons learned. Finally, Strategic Human Resource Management (SHRM) contributes to transformation by aligning human capital development with long-term institutional objectives and broader European resilience priorities.

This integrated perspective on performance and motivation aligns closely with the objectives of the Union Civil Protection Mechanism and its Resilience Goals, which emphasize preparedness, interoperability, and the sustainability of civil protection systems across Europe. The standardization of competencies, promotion of professionalization, and emphasis on continuous training reflect a shared European understanding that resilience is fundamentally rooted in people, skills, and organizational culture. In this context, human resource development emerges as a collective priority rather than a purely national concern.

Overall, the discussion highlights that HRM in civil protection should be approached as a strategic governance function rather than a support activity. By embedding performance evaluation and motivation within a coherent SHRM framework, civil protection organizations can enhance their capacity to anticipate, withstand, and adapt to crises, while simultaneously contributing to a more resilient and interoperable European disaster response architecture.

5. Conclusions and Recommendations

This paper has examined the strategic role of performance evaluation and motivation systems in strengthening the resilience of civil protection organizations operating in complex and high-risk environments. The analysis highlights that human capital constitutes a critical strategic asset for contemporary crisis management in Europe and that Human Resource Management (HRM) mechanisms, when coherently designed and aligned with organizational and European-level objectives, can significantly enhance preparedness, adaptability, and long-term institutional sustainability.

The findings underscore several key conclusions. First, performance evaluation emerges as a central mechanism for reinforcing institutional resilience by ensuring compliance with professional standards, supporting continuous learning processes, and guiding systematic capacity development. Through structured assessment of competencies and operational behavior, performance management frameworks contribute to anticipatory capacity and organizational

accountability. Second, motivation systems—encompassing both intrinsic drivers rooted in public service values and extrinsic incentives such as recognition, career progression, and access to specialized training—are essential for sustaining engagement, operational readiness, and psychological resilience in demanding professional contexts. Third, alignment with European frameworks, particularly through participation in the Union Civil Protection Mechanism, facilitates the professionalization of civil protection services and promotes interoperability, standardized competencies, and shared operational cultures across national boundaries. Finally, HRM tools should be understood and utilized as strategic levers for organizational resilience, rather than as purely administrative or procedural requirements.

Building on these conclusions, a set of forward-looking recommendations can be articulated. First, further efforts should be directed toward strengthening the standardization and digitalization of performance evaluation systems, enabling more consistent assessment practices across organizational units and enhancing the quality and timeliness of feedback. Second, continuous training and professional development programs should be expanded, with increased participation in European-level exercises, joint operational modules, and training initiatives supported by DG ECHO, in order to reinforce interoperability and experiential learning. Third, motivation frameworks should be broadened through the development of structured and transparent career pathways, enhanced recognition mechanisms, and strengthened psychological support services for personnel exposed to prolonged operational stress and risk. Fourth, leadership development should be prioritized, with particular emphasis on crisis leadership competencies, emotional intelligence, ethical decision-making, and performance management under conditions of uncertainty. Fifth, cross-border harmonization of HRM practices within the Union Civil Protection Mechanism should be encouraged, supporting the development of shared competency frameworks and collective readiness across European civil protection systems. Finally, sustained investment in institutional learning mechanisms is essential to ensure that lessons identified from major emergencies are systematically integrated into future strategies, training curricula, and organizational reforms.

Overall, this paper demonstrates that performance evaluation and motivation are not merely operational instruments, but strategic foundations for building resilient civil protection organizations capable of anticipating, withstanding, and adapting to Europe's evolving risk landscape. By embedding these HRM dimensions within a coherent Strategic Human Resource Management framework, civil protection institutions can enhance both national and European capacities for effective crisis response and long-term resilience.

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INTERNATIONAL TRADE OVER THE PAST DECADE: THE EUROPEAN UNION'S ROLE IN THE GLOBAL ECONOMY

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Abstract *The international trade in goods experienced significant changes during the last 2013-2023 interval of available data - a decade marked by both growth and important shocks. On short, the first half of the interval stayed relatively stable trade flows while the other came with the Covid-19 pandemic, then the war in Ukraine and related international political tensions. Here considering the export side, the European Union region stays a top size actor in context, together with China – e.g. each of the two with its own international production chains, while the United States stays the top world importer. And so important differences of economic structure persist between individual great international trade in goods actors and not only. The world top-twelve international trade actors do evolve differently from one-another - e.g. emergent economies like India and Mexico do strengthen their such positions against other country examples with more volatile evolutions. Similarly divergent evolutions for trade balances: surpluses for the European Union and China, versus important trade deficits on the United States side. As taken together, these developments indicate a whole shift towards a more fragmented global trading framework, in which the European Union still retains an important role, but now, in a more complex environment and more sensitive to economic and geopolitical risks.*

Keywords: *international trade in goods, trade partners, European Union*

JEL classification: *F10, F13, F15, F40*

1. Introduction

Three major global events have reshaped the way the world economy is viewed, over the past three years, and raised critical questions about where we are headed. The first was the COVID-19 pandemic, which disrupted supply chains and exposed how vulnerable the economic system becomes when production is concentrated in a single geographic location. This was followed by growing concerns about over-reliance on China, amid government policies and insufficient protection of intellectual property rights.

The third event, Russia's invasion of Ukraine, changed the global perception of Russia as an economic partner, highlighted vulnerabilities related to oil and gas supplies, and reminded us of the fragility of international peace (Mexico News Daily,2024).

The core of world trade is currently made by the European Union, China and the United States, together accounting for over 40% of this (Eurostat,2024a). Over the past decade, China has consolidated its position as the world's largest exporter, the European Union has remained a diversified and competitive player, and the United States has increased its dependence on imports in strategic areas (Eurostat,2024a). At the same time, emerging countries such as India, South Korea and Mexico have increased their share in global trade, reflecting the repositioning of production networks and the intensification of regional integration.

This paper will analyse the place of the European Union (EU) in the global dynamics and therefore focuses on two main directions. The first concerns the evolution of the EU's international trade in the 2020-2022 interval, a period marked by unprecedented disruptions. The second focuses on the Union's main trading partners in the period 2021-2023, highlighting changes in the structure

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of export-import flows. And by correlating these elements, our study will highlight how the EU has repositioned itself in the global trade architecture over these recent years, all based on Eurostat data (Eurostat, 2024a).

2. Methodology and data collection

Once more, this analysis below is based on official statistical data provided by Eurostat on international trade in goods of the European Union and the main global economies for the 2020–2023 interval (Eurostat, 2024c). Datasets have been selected to allow the assessment of the EU's position in world trade in the context of recent economic and geopolitical shocks, such as the COVID-19 pandemic and the conflict in Ukraine. The same to analyse the evolution of trade relations with main external partners. Quantitative analyses of export and import flows, including both absolute values and relative shares in the global total, were carried out through yielding on the EU's position in world trade for this three-year time. The analysis was structured into two subsets: large exporters and large importers of goods, for which the absolute and percentage variations in trade flows were calculated, as well as the cumulative changes for a group of 38 states. In assessing the EU's relations with its main foreign (off-EU region) partners within the 2021-2023 period, the values of bilateral trade flows were compared, including subtotals, for 34 countries and total Extra-EU imports /exports. Such an approach allowed the identification of changes in position, dynamics of relative weights and structural trends in EU trade. The data were processed, harmonized and presented in the form of comparative tables to highlight annual variations in trade flows and major structural transformations. The interpretation of the results was carried out in the context of recent economic and geopolitical changes, with a focus on adjustments in trade dependencies, reconfiguration of supply chains and the EU's repositioning in international trade in goods.

3. Results and discussions

3.1 The European Union's place in World Trade in the years of the latest challenges, 2020-2022

It is the period 2020–2022 that could be considered both the defining one of the COVID-19 Pandemic and the stage that directly preceded Russia's invasion of Ukraine. A number of 38 global entities dominate world trade in both export and import sense flows by almost 95% (tables 1,2). We call them global *entities,* not countries, precisely with the inclusion of the European Union as such, i.e. its 27 member countries could help here consider a total of 65 world countries. But the problem would remain that not all EU member countries would fall into the same ranking of world trade by country.

World trade increased by about 56% during these three years, with the first 38 representative entities increasing their exports by 53.56% and imports by 58.2% (calculations based on Eurostat data). The group of 38 entities representative of world trade also leaves room for a subdivision in which the top four stand out -- China, EU, USA and Japan -- with 47.8-44.5% of world exports and 48.2- 47.55% of world imports, respectively, in the same range. The four leading entities also respect the rule of increasing export-import flows in absolute values, on the other hand, their shares in total world flows decreasing slightly in both exports and imports -- only the exports of the United States also increase their share in the world total in 2022, compared to 2020.

Table 1.a.b Major exporters of goods, 2020-2022

Tabel 1.a. Major exporters of goods, 2020

Ranking	Country	(€ billion)	Share (%)
1	China	2,268	18.0
2	EU-27	1,933	15.4
3	United States	1,253	10.0
4	Japan	561	4.5
5	Hong Kong	480	3.8
6	South Korea	449	3.6
7	Mexico	366	2.9
8	UK	354	2.8
9	Canada	342	2.7
10	Singapore	317	2.5
11	Taiwan	304	2.4
12	Russia	291	2.3
13	Switzerland	280	2.2
14	UAE	280	2.2
15	Viet Nam	248	2.0
16	India	242	1.9
17	Australia	219	1.7
18	Malaysia	205	1.6
19	Thailand	203	1.6
20	Brazil	184	1.5
21	Saudi Arabia	152	1.2
22	Turkey	149	1.2
23	Indonesia	143	1.1
24	South Africa	75	0.6
25	Norway	74	0.6
26	Chile	64	0.5
27	Philippines	56	0.4
28	Argentina	48	0.4
29	Iran	47	0.4
30	Qatar	45	0.4
31	Israel	44	0.3
32	Ukraine	43	0.3
33	Kazakhstan	41	0.3
34	Peru	37	0.3
35	Iraq	37	0.3
36	Kuwait	35	0.3
37	New Zealand	34	0.3
38	Nigeria	31	0.2
	Subtotal	11,933	94.9
	World exports	12,574	100.0

Tabel 1.b. Major exporters of goods, 2022

Ranking	Country	(€ billion)	Share (%)
1	China	3,413	17.6
2	EU-27	2,572	13.2
3	United States	1,960	10.1
4	Japan	709	3.6
5	South Korea	649	3.3
6	Hong Kong	579	3.0
7	Canada	569	2.9
8	Russia	559	2.9
9	Mexico	549	2.8
10	UAE	506	2.6
11	UK	504	2.6
12	Singapore	490	2.5
13	Taiwan	454	2.3
14	India	431	2.2
15	Australia	392	2.0
16	Saudi Arabia	390	2.0
17	Switzerland	382	2.0
18	Viet Nam	353	1.8
19	Malaysia	335	1.7
20	Brazil	317	1.6
21	Indonesia	277	1.4
22	Thailand	273	1.4
23	Turkey	241	1.2
24	Norway	237	1.2
25	Iraq	131	0.7
26	Qatar	124	0.6
27	South Africa	117	0.6
28	Kuwait	96	0.5
29	Chile	94	0.5
30	Argentina	84	0.4
31	Kazakhstan	80	0.4
32	Philippines	75	0.4
33	Iran	73	0.4
34	Israel	70	0.4
35	Oman	63	0.3
36	Nigeria	60	0.3
37	Peru	58	0.3
38	Algeria	58	0.3
	Subtotal	18,324	94.3
	World exports	19,432	100.0
	World export growth (2022-2020 interval)		54.54%
	Export growth 38 countries (2022-2020 interval)		53.56%

Source: Eurostat ,2023 (online data code: ext_lt_introeu27_2020) and UNCTAD

Table 2.a.b Major importers of goods, 2020-2022

Tabel 2.a. Major importers of goods, 2020

Ranking	Country	(€ billion)	Share (%)
1	United States	2,108	16.4
2	China	1,801	14.0
3	EU-27	1,717	13.4
4	Japan	556	4.3
5	UK	556	4.3
6	Hong Kong	499	3.9
7	South Korea	409	3.2
8	Canada	363	2.8
9	Mexico	344	2.7
10	India	326	2.5
11	Singapore	289	2.3
12	Switzerland	256	2.0
13	Taiwan	252	2.0
14	Viet Nam	230	1.8
15	Russia	210	1.6
16	UAE	198	1.5
17	Turkey	192	1.5
18	Australia	185	1.4
19	Thailand	181	1.4
20	Malaysia	166	1.3
21	Brazil	146	1.1
22	Indonesia	124	1.0
23	Saudi Arabia	121	0.9
24	Philippines	79	0.6
25	South Africa	74	0.6
26	Norway	70	0.5
27	Israel	61	0.5
28	Egypt	52	0.4
29	Chile	52	0.4
30	Nigeria	48	0.4
31	Ukraine	47	0.4
32	Bangladesh	46	0.4
33	Pakistan	40	0.3
34	Iraq	39	0.3
35	Morocco	38	0.3
36	Colombia	38	0.3
37	Argentina	37	0.3
38	Iran	34	0.3
	Subtotal	11,987	93 .0
	World imports	12,889	100.0

Tabel 2.b. Major importers of goods, 2022

Ranking	Country	(€ billion)	Share (%)
1	United States	3,206	15.8
2	EU-27	3,007	14.8
3	China	2,579	12.7
4	Japan	852	4.2
5	UK	782	3.9
6	South Korea	695	3.4
7	India	684	3.4
8	Hong Kong	634	3.1
9	Mexico	595	2.9
10	Canada	553	2.7
11	Singapore	452	2.2
12	Taiwan	414	2.0
13	UAE	399	2.0
14	Turkey	345	1.7
15	Viet Nam	341	1.7
16	Switzerland	339	1.7
17	Australia	294	1.4
18	Thailand	288	1.4
19	Malaysia	280	1.4
20	Brazil	278	1.4
21	Russia	266	1.3
22	Indonesia	225	1.1
23	Saudi Arabia	180	0.9
24	Philippines	139	0.7
25	South Africa	129	0.6
26	Israel	102	0.5
27	Norway	100	0.5
28	Chile	99	0.5
29	Bangladesh	84	0.4
30	Iraq	83	0.4
31	Egypt	82	0.4
32	Argentina	77	0.4
33	Colombia	74	0.4
34	Morocco	68	0.3
35	Pakistan	67	0.3
36	Peru	58	0.3
37	Nigeria	57	0.3
38	Iran	53	0.3
	Subtotal	18,959	93.0
	World imports	20386.02	100.0
	World imports growth (interval 2022-2020)		58.17
	Import growth 38 countries (interval 2022-2020)		58.17

Source: Eurostat ,2023 (online data code: ext_lt_introeu27_2020) and UNCTAD

The EU as a whole, in turn, decreases its share from 15.4% to 13.2% of world exports, but on the import side its share even increases from 13.4% in 2020 to 14.8% in 2022, with the advance between the third and the second positions (see both tables 1 and 2). It is this way that the EU associates to the top-4 dominant entities in world trade - i.e. with its advance of imports over exports - along the given interval.

Russia's situation, in the same picture, appears not only different, but even somewhat opposite to that of the EU region as a whole. Therefore, it is worth noting its position visibly lower than the top-four on both trade flows, but, along with this, the dominance of exports everywhere and their advance (dynamics), truly to the detriment of imports -- exports grow from 291 to 559 billion euros between 2020 and 2022, with the advance of their world share from 2.3% to 2.9%, thus from 15th to 8th place (table 1 a, b). Russia's imports increase only in absolute value from 210 to 266 billion Euros between 2020 and 2022, respectively, Russia's share in world imports decreases from 1.6% to 1.3%, the country dropping between 15th and 21st place in the world (tables 1,2).

3.2 The EU's main trading partners in 2023

The 27 EU member countries form a single territory for customs purposes since the customs union stage done -- i.e. no customs barriers between and a common customs tariff for imported goods from elsewhere. Furthermore, once customs duties have been properly paid and compliance with import conditions has been verified, imported goods can circulate freely in the rest of the EU without further customs controls (CE,2024). In 2023, the main destinations for the exports of goods from the European Union were the United States of America, which absorbed 19.7% of the total, followed by the United Kingdom (13%), China (8.8%) and Switzerland (7.4%).

Then, the list of EU trading partners was completed by markets such as Turkey, Japan, Norway, South Korea, Mexico and Canada (Eurostat, 2024b, EU Council,2024). In contrast, Russia has seen a significant decline, accounting for only 1.5% of total EU exports, compared to 4.1% in 2021, before the outbreak of the conflict in Ukraine. This reduction caused Russia to drop in the ranking of EU export partners, from 5th place in 2021 to 16th place in 2023. (Eurostat,2024c) (table 3 a,b).

Table 3. EU partners in goods exports, 2021-2023

Tabel 3a. EU partners in goods exports, 2021 (% of EU exports)	**Tabel 3b. EU partners in goods exports, 2023 (% of EU exports)**

Ranking	Country	(€ billion)	Share (%)
1	United States	399.4	18.3
2	UK	283.6	13.0
3	China	223.3	10.2
4	Switzerland	156.5	7.2
5	Russia	89.3	4.1
6	Turkey	79.2	3.6
7	Japan	62.4	2.9
8	Norway	56.5	2.6
9	South Korea	51.9	2.4
10	India	41.9	1.9
11	Mexico	37.7	1.7
12	Canada	37.3	1.7
13	Brazil	33.8	1.6
14	Australia	33.1	1.5
15	UAE	29.8	1.4
16	Taiwan	28.4	1.3
17	Ukraine	28.3	1.3
18	Singapore	27.3	1.3
19	Morocco	25.1	1.2
20	Saudi Arabia	25.0	1.1
21	Israel	24.2	1.1
22	Hong Kong	23.5	1.1
23	South Africa	22.0	1.0
24	Egypt	21.5	1.0
25	Serbia	18.4	0.8
26	Thailand	13.3	0.6
27	Algeria	12.6	0.6
28	Malaysia	11.8	0.5
29	Nigeria	11.2	0.5
30	Tunisia	10.8	0.5
31	Viet Nam	10.6	0.5
32	Chile	10.0	0.5
33	Qatar	8.1	0.4
34	Indonesia	8.0	0.4
	Subtotal	1955.8	89.7 %
	EU exports OFF the region	2180.5	100.0 %

Ranking	Country	(€ billion)	Share (%)
1	United States	502.14	19.7
2	UK	334.75	13.1
3	China	223.46	8.8
4	Switzerland	188.54	7.4
5	Turkey	111.32	4.4
6	Japan	63.97	2.5
7	Norway	60.96	2.4
8	South Korea	57.14	2.2
9	Mexico	53.06	2.1
10	Canada	48.64	1.9
11	India	48.32	1.9
12	Brazil	42.91	1.7
13	Ukraine	39.05	1.5
14	UAE	38.81	1.5
15	Australia	38.44	1.5
16	Russia	38.32	1.5
17	Saudi Arabia	34.32	1.3
18	Morocco	32.96	1.3
19	Singapore	32.08	1.3
20	Taiwan	30.49	1.2
21	South Africa	25.91	1.0
22	Hong Kong	25.65	1.0
23	Israel	25.55	1.0
24	Serbia	23.35	0.9
25	Egypt	21.15	0.8
26	Malaysia	15.58	0.6
27	Thailand	14.99	0.6
28	Algeria	14.91	0.6
29	Kazakhstan	12.14	0.5
30	Nigeria	12.02	0.5
31	Tunisia	11.83	0.5
32	Viet Nam	11.43	0.4
33	Indonesia	11.26	0.4
34	Chile	10.67	0.4
	Subtotal	2256.1	88.4 %
	EU exports OFF the region	2553.6	100.0 %

Source: Eurostat,2023 (online data code: ext_st_eu27_2020sitc)

In 2023, China was the main supplier of goods to the European Union, contributing 20.5% to total EU imports (Economedia, 2024), followed by the United States (13.7%), the United Kingdom (7.2%) and Switzerland (5.5%). The next places in the import ranking were Norway, Turkey, South Korea, Japan, India and Russia. From the perspective of EU member countries' imports, Russia has suffered a significant decline, accounting for only 2% of total EU imports in 2023, compared to 7.5% in 2021. This decreases also caused Russia to drop in the ranking of EU trading partners, i.e. for imports, from 3rd place in 2021 to 10th place in 2023 (table 4 a, b and Eurostat, 2024c).

Table 4. EU partners in the import of goods, 2021-2023

Table 4.a. EU Import partners in 2021 (% of EU imports)

ranking	Country	Imports (€ billion)	Share in extra-EU
1	China	472.2	22.4
2	United States	232.0	11.0
3	Russia	158.5	7.5
4	UK	146.0	6.9
5	Switzerland	123.6	5.9
6	Turkey	78.0	3.7
7	Norway	74.5	3.5
8	Japan	62.3	3.0
9	South Korea	55.4	2.6
10	India	46.2	2.2
11	Viet Nam	38.5	1.8
12	Taiwan	35.6	1.7
13	Brazil	32.9	1.6
14	Malaysia	29.2	1.4
15	Ukraine	24.1	1.1
16	Canada	23.4	1.1
17	Mexico	23.4	1.1
18	South Africa	22.1	1.0
19	Thailand	22.0	1.0
20	Saudi Arabia	20.8	1.0
21	Algeria	18.7	0.9
22	Morocco	18.0	0.9
23	Nigeria	17.6	0.8
24	Kazakhstan	17.5	0.8
25	Libya	17.3	0.8
26	Indonesia	16.7	0.8
27	Bangladesh	15.7	0.7
28	Singapore	15.6	0.7
29	Serbia	14.0	0.7
30	Iraq	12.9	0.6
31	Israel	12.6	0.6
32	Azerbaijan	10.4	0.5
33	Tunisia	10.3	0.5
34	UAE	9.4	0.4
	Subtotal	1927.3	91.3 %
	EU Imports from the rest of world	2111.5	100.0 %

Table 4.b. EU Import partners in 2023 (% of EU imports)

ranking	Country	Imports (€ billion)	Share in extra-EU (%)
1	China	514.4	20.5
2	United States	344.2	13.7
3	UK	179.8	7.2
4	Switzerland	138.3	5.5
5	Norway	119.1	4.7
6	Turkey	95.5	3.8
7	South Korea	72.8	2.9
8	Japan	70.2	2.8
9	India	64.9	2.6
10	Russia	50.6	2.0
11	Viet Nam	47.5	1.9
12	Taiwan	47.1	1.9
13	Brazil	44.6	1.8
14	Saudi Arabia	36.4	1.4
15	Algeria	35.6	1.4
16	Kazakhstan	30.3	1.2
17	Malesia	29.0	1.2
18	Mexico	28.5	1.1
19	Canada	27.6	1.1
20	Thailand	25.2	1.0
21	Morocco	23.4	0.9
22	South Africa	23.2	0.9
23	Ukraine	22.9	0.9
24	Libya	22.8	0.9
25	Nigeria	22.7	0.9
26	Singapore	20.3	0.8
27	Azerbaijan	19.1	0.8
28	Iraq	19.1	0.8
29	Bangladesh	18.9	0.8
30	Indonesia	18.3	0.7
31	Serbia	18.2	0.7
32	UAE	17.1	0.7
33	Israel	15.9	0.6
34	Australia	13.6	0.5
	Subtotal	2277.1	90.6 %
	EU Imports from the rest of world	2512.8	100.0 %

Source: Eurostat,2023 (online data code: ext_st_eu27_2020sitc)

Conclusions

The above short analysis reveals the surprise of world trade growing at a faster pace (over 50% in just three years) during the period marked by the pandemic and the beginning of the war in Ukraine, instead of dropping. This progress has strengthened the role of the largest global players, but at the same time, it has altered the internal balance between them. The European Union remained a major trading hub, with a balanced pattern between exports and imports. Even though its share of world exports fell slightly, the EU advanced on the import side, becoming the second largest global importer in 2022. This same evolution reflects both the resilience of the European

market and, correspondingly, its increased dependence on external suppliers, especially in strategic industries. The United States has strengthened its position as the world's largest importer, and China has strengthened its dominance in exports.

Emerging economies – particularly India and Mexico – have gained influence, taking advantage of the reconfiguration of global production chains. Their rapid growth suggests a gradual redistribution of shares in world trade, even if the large economic blocs remain dominant in absolute volume.

The EU's trade partnerships have also undergone significant changes. The United States has become the main destination for European exports, and China has consolidated as a key supplier in the European area. Russia, on the other hand, has rapidly lost ground in both EU exports and imports amid sanctions in 2022–2023 (European Commission, 2023).

Thus, this above paper highlights three defining features: the intensification of trade despite global shocks, the repositioning of the European Union among the world's three major players, and the rise of emerging economies supposed to gradually change the configuration of international trade.

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THE EUROPEAN GREEN DEAL, PART OF THE EUROPEAN STRATEGY FOR SUSTAINABLE GROWTH

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Abstract: *The increasingly rapid development, both economically, technologically and socially, represents a desire but also a challenge for all member states of the European Union.*
A sustainable growth strategy must include those development trajectories that allow achieving the objectives in the field by ensuring the efficient use of resources, limiting waste generation, rigorously controlling them, and reducing inequalities between people or regions.
In order to achieve these objectives, a long-term development strategy was proposed and adopted at the European Union level, which aims to significantly reduce pollution, so that, by 2050, member countries become neutral in terms of climate impact.
In this regard, based on the proposed investment program, the implementation of ambitious projects with the role of promoting a clean and circular economy is sought.
Romania, as a member country of the European community, has adhered to the concepts of the European Green Deal, and has assumed a series of sustainability policies.
This paper presents the current state of implementation of the concepts and actions specific to the European Green Deal, both at the community level and specifically in the case of Romania.

Key words: *sustainability, strategy, circular economy, European Union*

JEL Classification: F21, Q56, K32

1. Introduction

Regardless of the type of activity, it causes an increase in the average global temperature, affecting the climate and the ecosystem in general. It is increasingly noticeable that current economic and consumption models are no longer in line with what nature, the planet in general, can offer.

Climate change is evident and it refers to long-term changes in the climate, with a particular impact on the environment, people and all ecosystems. The implications are profound and therefore only a correct understanding of the causes can lead to effective measures to cancel the effects, applied at both the community and individual levels.

In this context, it is important that all nations use their capacities to manage these problems, now that it is still perhaps not too late, starting from the priority of identifying methods by which to put into practice the strategy of stopping the destruction of the planet.

The subject is particularly vast and important, which is why it has become a priority for the countries of the European Union for several years. In practice, this has materialized by defining the main strategy that aims to transform Europe into a climate-neutral area. The objective of climate neutrality involves ensuring an implementation framework aimed at facilitating the economic and social transition in a fair manner, adapted to the national particularities of the EU member states (Ștefănescu et al, 2022).

Concretely, all these desiderata were concluded in the European Green Deal, a complex agreement that contains a set of projects, laws and programs that aim to protect the environment, modernize the economy and improve the quality of life.

Romania, as a member country of the European community, has adhered to the concepts of the European Green Deal, and has assumed a series of sustainability policies.

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This paper presents the current state of implementation of the concepts and actions specific to the European Green Deal, both at the community level and specifically in the case of Romania.

2. The European Green Deal – from strategy to action

Launched at the end of 2019, the European Green Deal represents an ambitious initiative by the European Union to establish and implement a sustainable growth strategy.

Sustainability, a term that has already entered the current vocabulary, defines the capacity of society to develop without depleting resources for the future.

The European Sustainable Growth Strategy aims to create the framework, principles and policies through which European countries can respond to the major current and future challenges in terms of environmental issues.

2.1. Defining concepts of sustainable growth strategy

The European Sustainable Growth Strategy defined as having the capacity to integrate environmental concerns and climate objectives into all European Union policies.

According to the European Commission website, the Green Deal invests in innovation, clean technology and green infrastructure, while ensuring a just transition for the communities most affected (European Commission, Strategies and Policies)

Achieving climate neutrality cannot be achieved without a synergy of ideas, actions and community investment policies.

Starting from the proposed target, namely achieving climate neutrality in 2050, the basic concept of the European Green Deal aims to define the ways in which all European countries put into practice the commitments defined by this agreement. To achieve this goal, member countries have committed to reducing CO2 emissions by at least 55% by 2030, compared to the values reported in 1990.

A major contribution to achieving this goal is the share of green energies in global energy consumption. Reducing oil and natural gas consumption can help achieve the proposed target (figure no.1).

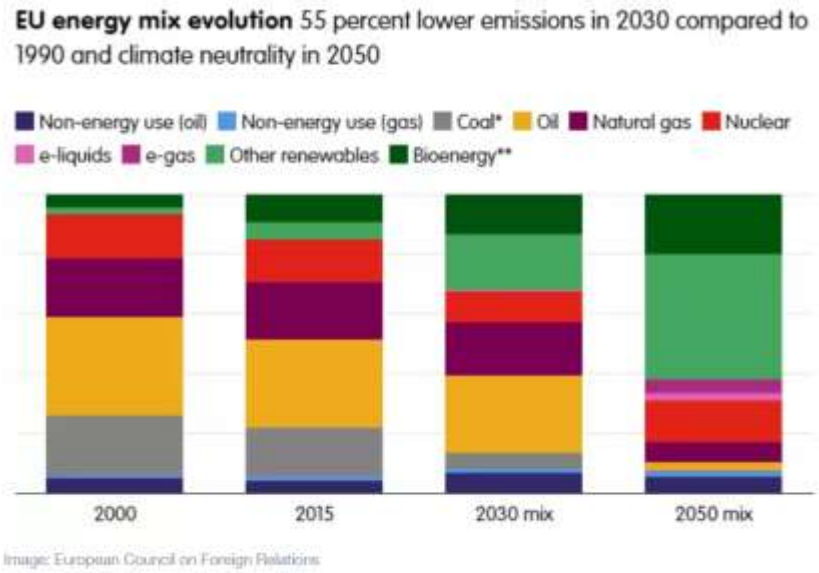

Figure no. 1. Evolution of the EU energy mix
Source: European Council on Foreign Relations

Considered one of the most ambitious European strategies, the Green Deal aims to transform the European economy into one that is sustainable, economically efficient and ecologically sound (Fetting, 2020).

The common approaches initiated at the central level of the European Union and taken up by the member states converge towards the concrete definition of the basic concept of this strategy, namely the development and implementation of national plans. Each country must align its strategy with the European one, so that the measures taken are followed by positive results.

To create the legal framework to achieve the proposed objectives, in 2021 the European Parliament and the Council of the European Union defined a regulation establishing the framework for achieving climate neutrality, known as the European Climate Law. The main provisions of this law refer to:

- progressive and irreversible reduction of anthropogenic greenhouse gas emissions and to increase carbon removals, in order to meet the long-term temperature objective
- making progress towards meeting the global adaptation objective

The ambitious EU Green Deal could not be implemented without adequate funding, with the European Commission wanting to allocate around one trillion for this plan, half coming from the EU budget and half from the Invest EU fund. The concept is based on the synergy of public and private funds through specific financial instruments.

2.2. Objectives and commitments

Without a doubt, the main objective of the European Green Deal, to transform the European Union into a climate-neutral region, represents a remarkable and ambitious goal.

However, achieving this climate state cannot be achieved in one "blow" but requires important steps, taken by all Member States, which together lead to the final target.

The main aspects highlighted in this European agreement can be categorized into long-term objectives, with a deadline set for achievement by 2050, and interim objectives, in the shorter term:

The long-term objectives mainly refer to achieving climate neutrality in 2050, and achieving economic growth in the Member States, without making this conditional on the use of new resources.

As interim, shorter-term objectives, the "Prepare for 55" package can be mentioned in particular, which specifies the obligation to reduce greenhouse gas emissions by at least 55% in 2030 compared to 1990.

In order to be achieved, all these objectives are based on the reduction, even elimination of pollution, the creation of zero-emission industries and the implementation of a circular economy.

All these statements must be proven in practice and that is why EU member states are making joint efforts to create the premises for achieving the proposed objectives. There are many areas in which corrections must be made, even changes in techniques, methods and mentalities.

From the use of ecological agricultural practices to the development and implementation of plans to restore the biosphere and ecosystems, all these aspects must be applied in a unified manner, based on joint efforts, supported by political, economic and social factors.

The objectives and directions of action, illustrated in Figure 2, also cover aspects related to:

- reduction and controlled collection of waste
- ensuring the circularity of production processes
- switching to the use of electric transport
- reducing the use of fossil fuels
- modernizing buildings
- Reducing pollution.

Figure no. 2. European Green Deal - objectives and directions of action
Source: https://euinasean.eu/

For the necessary steps to implement the European Green Deal to be successful, they must benefit from the involvement of all European citizens, organizations and institutions.

Creating a culture of sustainability must be achieved by involving everyone, this being based on an increase in awareness of the importance of the aspects embodied in European agreements on environmental issues and sustainable development.

3. Considerations on the status of implementation of the European Green Deal

The implementation of the action directions contained in the European Green Deal raises a series of challenges that must be overcome by all EU member states.

Starting from the analysis of studies and reports carried out by EU institutions and bodies, a series of aspects can be highlighted that mark the current stage of the implementation process but also create the premise for corrections where necessary (Acs, S., Barbero Vignola, G., Borchardt, S. et al., 2025).

3.1. Assessing progress at EU level

Identifying and analyzing the implementation status of the European Green Deal at the European Union level is a necessary step in order to establish the next directions of action and the necessary improvement measures.

5 years after the launch of this European strategy, specialists from the Joint Research Centre – JRC within the European Commission have produced a comprehensive report identifying the status of the implementation of the provisions of the agreement.

In order to give a clearer picture of all the aspects pursued, the report quantified 154 objectives based on 44 documents adopted between 2019 and 2024, in several sectors of activity (Acs, S., Barbero Vignola, G., Borchardt, S. et al., 2025).

According to the authors of this report, figure no. 3 graphically presents the results obtained from the analysis of all objectives, considering the assessment of the progress of the objectives by thematic area (right) and by document type (bottom). The overall color-coded assessment takes into account two common objectives between thematic areas 5 and 6.

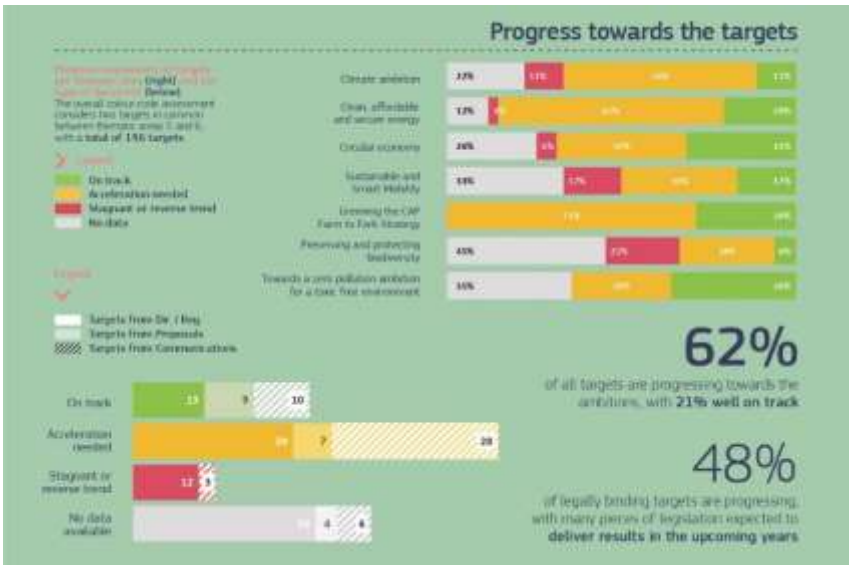

Figure no. 3. European Green Deal – progress report
Source: Acs, S., Barbero Vignola, G., Borchardt, S. et al., 2025),
Delivering the EU Green Deal : progress towards targets

The following results emerge from the analysis of the study:

- 32 objectives are achieved according to the initial specifications
- 64 objectives require additional efforts to be achieved
- 15 objectives are considered not to have progressed, or are even in regression
- The 43 objectives are not characterized by available data that would allow analysis.

Based on the important information provided by this official report, available to specialists but also to the public, it can be concluded that the member countries of the European Union have understood the need for effective involvement in the implementation of the European Green Deal. It is necessary to accelerate the pace of implementation in order to achieve the targets proposed for 2030 and 2050.

3.2. The European Green Deal in Romania - recent developments and obstacles

The European Green Deal brings a significant financial contribution to Romania's efforts to align with the European Commission's requirements in order to apply the concept of climate neutrality.

In a first phase, Romania was nominated as the third beneficiary of the funds allocated for this deal.

The particularities of European legislation have led, not infrequently, to difficulties for Romania in aligning with them. Nevertheless, a series of important achievements have taken place, such as (Cătuți, 2025):

- granting free certificates for the energy sector until 2020
- financing of new gas-fired power plants in Brazi and Iernut
- modernized groups of lignite-fired power plants in Rovinari and Işalnița
- Renovation of buildings.

According to analysts, Romania must accelerate the process of aligning with the requirements of the European Green Deal, the opportunities offered by it not being unlimited, and

postponing the necessary measures may lead to the irreparable loss of the opportunity offered (Cătuți, 2025).

The European Environment Agency website presents conclusive information about Romania's efforts and achievements, and the comparison with the level of the European Union as a whole.

One of the important indicators taken into account shows the trend of total greenhouse gas emissions, excluding those from the land use, land use change and forestry (LULUCF) sector. For comparison, two index lines are included (1990 value = 100): the first refers to country-specific emissions, while the second expresses total EU emissions (Figure 4).

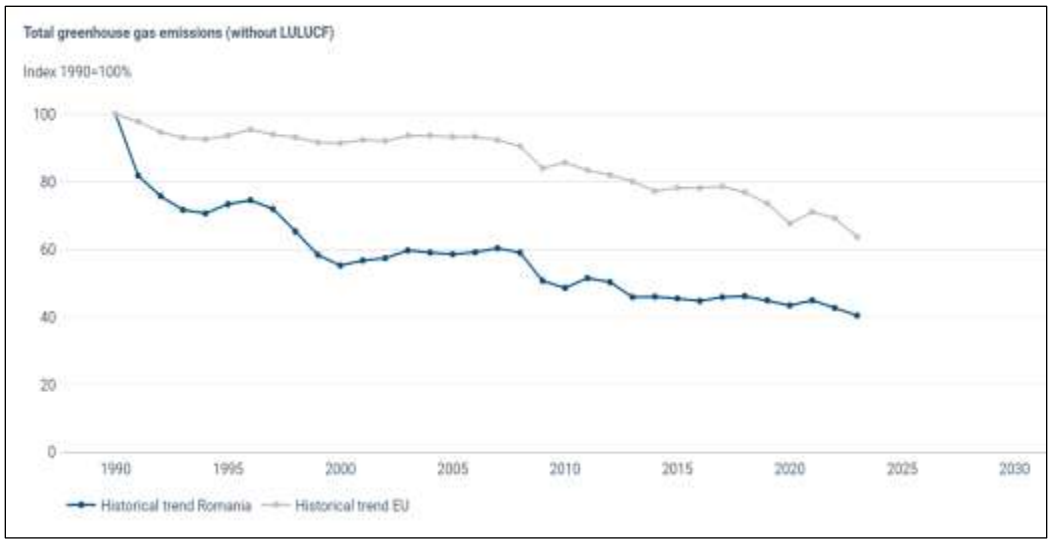

Figure no. 4. Total greenhouse gas emissions historical trend – Romania vs EU
Source: European Environment Agency - https://www.eea.europa.eu/en/europe-environment-2025/countries/romania

Unfortunately, Romania has to face a series of obstacles that make it difficult to implement the European Green Deal. Among them are:

- insufficient environmental infrastructure
- dependence on polluting energy sources
- reduced administrative capacity
- Delays in attracting European funds.

In order to overcome these barriers, it is necessary to combine the efforts of authorities, companies and all citizens.

4. Conclusions

The European Green Deal is and remains the most ambitious approach to transforming the European economy into a sustainable, circular and competitive one. The initiators have tried to set clear objectives so that all EU Member States are able to implement these objectives and strategies at national and local level.

The proposed targets, both the final ones for 2050, but also the intermediate ones, are bold and require concerted efforts from all the actors involved, local and regional communities, authorities, economic companies.

At no time should we forget that in order to combat the effects of climate change, an adaptation of the economic reality is necessary, and this differs from one region to another.

In the case of Romania, the authorities are making efforts to align with the requirements of the European Green Deal, but the existence of obstacles generated by the reduced administrative capacity, dependence on sectors of activity that still use fossil fuels, cause certain delays.

For the transition to a green, circular economy to become a reality, there is a need for effective implementation of the provisions of the European pact, even a correction of the targets, if they prove to be too ambitious and unachievable within the initially proposed deadlines.

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SOME ELEMENTS CONCERNING THE TRANSITION TOWARDS SMART CITIES

Florina Popa [1]

Abstract: *The increased interest in the development of smart and sustainable cities has emerged as a consequence of accelerated urban development and the effects generated by it. The development of smart cities is a process in continuous progress, as a result of the development of technology, novelties in working and learning methods, social and environmental aspects. The transformations that cities go through to become smart are perceived as socio-cultural processes, towards sustainable and inclusive urban development. Even if the urban transition aims at increased efficiency, attention must also be directed towards addressing social aspects that can be avoided, difficulties such as the emergence or exacerbation of inequalities, the marginalization of the disadvantaged or other unfavourable aspects. The transition towards smart cities offers opportunities for the development of urban areas at European level, but the social structure of cities must also be taken into account in order to ensure that all citizens can benefit from technological advances. Although the transition towards smart city has been successfully achieved through practices of introducing the population to digital technologies, there is a persistent lack of long-term strategies to ensure their sustainable nature. The paper presents aspects related to the transition towards smart cities, as a consequence of the new technologies getting through urban level, connections in the transition towards smart cities.*

Keywords:: *smart cities, transition, social aspects, connections, technologies*

JEL Classification: O33; O35; O38; O44, Q01, R11, R58.

1. Introduction

In addressing issues related to local development, it is relevant to observe the economic and social results at the level of urban communities, in the context of the transformations that cities go through while becoming smart cities. According to some authors (Ettlinger, N. 2001, eds. N.J. Smelser and P.B. Baltes, 2001), the meaning of the term "local" differs depending on the level of reference. Thus, in a regional context, a local unit can be a neighborhood, a city or a metropolitan area.

According to the New Urban Agenda of the United Nations, all citizens should benefit equally from the evolution of cities. The situation is not verified, in reality, because moments of uncontrolled development and planning occur, with the population having limited access to the developed projects (United Nations, 2017). In recent decades, this situation can be attributed, in large part, to the strong positions enjoyed by private developers. (Fields, 2017; Mosciaro, 2021) (quoted by Fisker, Müller, Eiliott, 2025, Chapter 6, Sageidet, Müller-Eie, and Lindland, edts. 2025). As a consequence, there is a risk of polarization of large urban areas, inhabited only by the wealthy. (Fisker, Müller, Eiliott, 2025, Chapter 6).

The increased interest in the development of smart and sustainable cities has emerged as a consequence of accelerated urban development and the effects generated by it, accompanied by environmental environmental problems. The term smart and sustainable cities is closely related to the provision of more efficient services, reducing environmental effects and increasing the quality of life in urban areas. (Sageidet, Müller-Eie, Lindland, edts. 2025).

The development of smart cities is a process in continuous progress, as a result of the development of technology, changes in working and learning methods, social and environmental aspects. Even if the urban transition aims at increased efficiency, it must be accompanied by

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increased attention in addressing social aspects, so that aspects such as the emergence or exacerbation of inequalities, the marginalization of the disadvantaged or other unfavorable aspects can be avoided (Frosinini, 2024; European Commission, European Social Innovation Competition).

2. Aspects concerning smart cities

The emergence of the term *smart city* occured, for the first time, in 1998, being introduced by Robert E. Hall, with an emphasis on information technology. (Hall et al., 2000) (quoted by Aunemo, Undheim, Sageidet, 2025, Chapter 1, Sageidet, Müller-Eie, and Lindland, edts. 2025). In Europe, the concept of smart city emerged in the context of the penetration of technology, digitalization and innovation in the urban environment (Angelidou, 2015). (quoted by Aunemo, Undheim and Sageidet, 2025, Chapter 1, Sageidet, Müller-Eie, and Lindland, edts. 2025).

In order to respond to the needs faced by cities, the Urban Transitions Alliance has initiated various policies and actions to ensure the transition to smart cities (Urban Transitions Alliance, Social Transition).

a) *Surveying citizens' opinions and taking into account their responses*. Applying strategies for involving citizens in the governance process, by developing policies that respond to the requirements and living conditions of urban communities:

- practicing collaborations between cities and community leaders, which provide the possibility of involving disadvantaged social groups (Urban Transitions Alliance, Social Transition);
- initiating workshops in collaboration with stakeholders, so that they are informed about the cities' transition strategies;
- studying new information possibilities, taking into account their limitations. For example, social media tools can ensure direct communication, but at the same time, they can lead to the exclusion of groups of citizens who are not familiar with social platforms. In this sense, the digital divide represents a challenge for the participation of various vulnerable groups, due to the lack of access to digital technologies or knowledge of how to work with them. (Colding et al., 2024; Jang & Gim, 2022, quoted by Fisker, Müller and Eiliott, 2025, Chpater 6, Sageidet, Müller-Eie, and Lindland, edts. 2025). The solutions to solve these shortcomings, as results from previous studies, could be technological design and promoting access to these groups, to the use of digital technologies (Giannoumis & Joneja, 2022; Kirklies et al., 2024). (quoted by Fisker, Müller, Eiliott, 2025, Chpater 6, Sageidet, Müller-Eie, and Lindland, edts. 2025)

b) *Shaping a common identity and perspective*. Concern for achieving objectives that eliminate some of the difficulties and limitations of cities, offering them an attractive framework for investment and qualified personnel. The existence of common views contributes to supporting social cohesion within the city and identification with the needs of the community. Cities that have inherited industrial development have new perspectives for urban development and a new identity of place (Urban Transition Alliance, Social Transition).

c) *Providing prospects for a better life*. In most cities that are members of the Urban Transition Alliance, the creation of new jobs contributes to professional development and opens new training possibilities, taking into account the need for higher qualifications and demographic challenges (Urban Transition Alliance, Social Transition). The requirements in education and professional training are different at the community level, which ask for their taking into account

in the formulation of support measures for strengthening the educational process, provide equal chances in the learning process and enhance social mobility. (Urban Transition Alliance, Social Transition). In this regard, it is necessary to collaborate with managers and institutions in the education system, in order to develop educational programs adapted to the needs of the community. To ensure the efficiency of these programs, they must be applied at the level of the entire education system. (Urban Transition Alliance, Social Transition).

d) *Ensuring social protection and anticipating future challenges.* An important aspect in the progressing on the journey towards social transition is the early observation of challenges and the establishment of support measures for vulnerable people who risk being left behind. Social protection systems — designed to mitigate the consequences of unemployment, accidents or poverty — contribute to strengthening social resilience, an inevitable element for achieving progress in urban communities. Collaboration with civil society organizations, trade unions can lead to the development of strategies that respond to community needs, as well as the development of financing mechanisms aimed at increasing the capacity of cities to ensure adequate social protection. Social resilience requires knowledge of future challenges, such as the aging of the urban population — a process that affects the availability of skills and qualifications necessary for local development. (Urban Transition Alliance, Social Transition).

Some cities within the Urban Transition Alliance can implement policies and strategies that respond to future transition challenges by cooperating in studying demographic and economic trends. (Urban Transition Alliance, Social Transition).

e) *Increasing the capacity of marginalized populations to participate*. The research aims to increase the capacity of marginalized populations to participate in urban development objectives. Objectives pursued: to identify and diversify participatory means, in order to capitalize on the skills and experiences of vulnerable marginalized citizens, in the urban planning process; to redefine the role of artists, researchers and urban planners, in urban planning, so as to ensure inclusive urban development, in the long term and to research the capacity and limits of smart city technologies, to achieve the objective concerning the inclusive urban development. (Urban Transition Alliance, Social Transition; Fisker, Müller, Eiliott, 2025, Chapter 6, Sageidet, Müller-Eie, and Lindland, edts. 2025).

The *Smart City* meant a new urban concept, considered a response to the urbanization process and the economic and social challenges that society must face, at a global level. Dameri, 2013; de Jong et al., 2015; UNHABITAT, 2022) (quoted by Müller-Eie, 2025). In approaching the concept of a smart city, elements from several fields are taken into account, such as: technology, planning, economy, governance and social inclusion. (quoted by Müller-Eie, 2025, Chapter 7, Sageidet, Müller-Eie, and Lindland, eds. 2025). Initially, the concept was developed to observe the extent to which the introduction of technologies can contribute to the improvement of urban spaces, regardless of the existing infrastructure (technical, energy, physical), safety, mobility. (Zheng et al., 2020 quoted by Lindland, 2025, Chapter 5, Sageidet, Müller-Eie, and Lindland, edts. 2025). At the heart of the concept of a smart city, technology is an important element of efficient and sustainable urban development. (Sageidet, Müller-Eie, Lindland, eds. 2025). Research and innovation in smart cities aim at the integration and exploitation of new technologies, organizational methods and practices, the development of the business environment. (Lindland, 2025, Chapter 5, Sageidet, Müller-Eie, and Lindland, edts. 2025). Also other elements, such as knowledge, socio-cultural heritage, citizen participation intervene in urban development. (Albino et al., 2015; Cizelj & Sinkovec, 2012; Keshavarzi et al., 2021; Sageidet & Heggen, 2021;

Zhao et al., 2021). (Bibri & Krogstie, 2017). (quoted by Sageidet, Müller-Eie, and Lindland, edts. 2025).

3. The introduction of technologies and other social aspects in smart urban development

Karvonen et al. (2020) (quoted by Sageidet, Müller-Eie, Lindland, eds. 2025), considers smart cities not only from the perspective of involving technology, but also of social, cultural, political aspects. Significant social, political and cultural changes are included, the impact of introducing smart technologies in the urban environment, which citizens have to cope with, the increasing importance given to aspects related to the sustainable development of cities: creating a clean, non-polluting environment, democracy, inclusion, justice and livelihoods, which are joined by culture and art, which strengthen the idea of sustainable cities. (Sageidet, Müller-Eie, Lindland, eds. 2025). The transition to a smart city is influenced by the specific conditions of each one (social and economic difficulties, institutional environment, specific local resources, cultural heritage, networks of urban actors). (Luque-Ayala & Marvin, 2015; Raven et al., 2019). (Raven et al., 2019). (quoted by Lee, Babcock, Pham, Bui, Kang, 2022)). The concept of a smart city also includes a set of interdisciplinary elements, such as democracy, inclusion, justice, standard of living, quality of life, culture, art, which make cities ensure a climate favorable to living conditions and sustainable development. (Sageidet, Müller-Eie, Lindland, eds. 2025).

The development of smart cities involves addressing the challenges that have arisen in urban areas, through the penetration of technologies and information. In the current context of socio-economic development, cities are increasingly considered as processes of social innovation, contributing to sustainable and inclusive urban development. (Lee, Babcock, Pham, Bui, Kang, 2022).

The transformations that cities go through to become smart are perceived as socio-cultural processes, towards sustainable and inclusive urban development (Giffinger & Lü, 2015; Meijer & Thaens, 2018; UN-Habitat, 2019b). The term "smart" refers not only to the penetration of innovative technology but also to social innovation. (Noori, Hoppe & deJong (2020); (de Lange & de Waal, 2019; 2018; McFarlane & Söderström, 2017). (Raven et al., 2019) (quoted by Lee, Babcock, Pham, Bui, Kang, 2022; Bernardino, Santos, 2017).

Social innovation, a growth factor

Innovation can be considered an important factor of growth, playing at the same time a key role in shaping inequalities and supporting well-being (Bernardino, Santos, 2017; OECD, 2014). "Social innovations are new ideas that meet social needs, create social relationships and form new collaborations. These innovations can be products, services or models addressing unmet needs more effectively**.**" (European Commission, Internal Market, Industry, Entrepreneurship and SMEs, Social Innovation, European Social Innovation Competition, https://single-market-economy.ec.europa.eu/industry/strategy/innovation/social_en; https://single-market-economy.ec.europa.eu/industry/strategy/innovation/social_en)

At the local level, a number of institutions consider social innovation, a tool of political initiative in increasing employment capacity, stimulating economic development and sustainability, solutions for solving other social problems. (Bernardino, Santos, 2017).

Social innovation differs from other types of innovation, as it primarily pursues social aspects, namely: social well-being, quality of life, safe housing conditions. Thus, social innovation

seeks solutions for the effective, solving of some long-term problems related to society, such as: exclusion, alienation and lack of well-being, marginalization, aiming to achieve well-being and development. (Edwards-Schachter, Matti and Alcântara, 2012 Murray, Caulier-Grice and Mulgan, 2010; Phills, Deiglmeier and Miller, 2008, quoted by Bernardino, Santos, 2017)

It is observed that in the case of social innovation, the priority is the problems of society, finding new methods of cooperation, increased participation of disadvantaged groups, to solve shortcomings.

The objective of the European Commission is to stimulate the introduction of innovative solutions on the market and increase employment. The actions carried out by the Commission are related to social innovation, through initiatives that aim to encourage, adopt and develop innovation solutions, among the objectives pursued being mentioned (European Commission, European Social Innovation Competition):

- → stimulating social innovation towards economic growth and new job creation;
- → transmitting ideas and learning from the experiences of others, regarding the development of social innovation, in European countries;
- → supporting innovative entrepreneurs and encouraging investors and public organizations.

The transition to the smart city depends on the particularities of each city: social and institutional environment, economic development, local resources, cultural heritage, connections between urban actors. (Luque-Ayala & Marvin, 2015; Raven et al., 2019) (quoted by Lee, Babcock, Pham, Bui, Kang, 2022)

Certain aspects related to smart citiy-sustainable citiy

At the European level, the concept of *smart city* gave rise to *smart urban development*, to which the term sustainability was later added, which aims at *aspects related to the creation of a sustainable urban environment, which provides solutions for the development of harmonious, healthy living conditions, with smart transport infrastructure and other solutions for the development of smart urban areas*. (European Commission, 2022, quoted by Aunemo, Undheim and Sageidet, 2025, Chapter 1, Sageidet, Müller-Eie, and Lindland edts, 2025).

Cowley and Caprotti (2019) show that, in the conceptual approach, the term smart is intertwined with "sustainable" elements and that the notion of smart city contains elements that bring it closer to sustainable urban development. (Aurigi & Odendaal, 2021). (quoted by Müller-Eie, 2025, Chapter 7, Sageidet, Müller-Eie, and Lindland edts, 2025). Cities are in a process of continuous development and transformation. (Echebarria et al., 2021; Zheng et al., 2020) (quoted by Lindland, Chapter 5, Sageidet, Müller-Eie, and Lindland edts, 2025.). The specific conditions of each city (social and economic difficulties, institutional environment, specific local resources, cultural heritage, networks of urban actors influence the transition to the smart city. (Luque-Ayala & Marvin, 2015; Raven et al., 2019). (quoted by Lee, Babcock, Pham, Bui, Kang, 2022).

The United Nations Sustainable Development Goals (United Nations, 2015) take into account environmental issues in the development of the smart city. Throughout its evolution, the development of the smart city has experienced a shift towards the concept of a sustainable smart city (Bibri, 2019; Duygan et al., 2022). Ahvenniemi et al. (2017) (quoted by Sageidet, Müller-Eie, Lindland, edts. Introduction, 2025) observes the proximity between the terms *sustainable development and smart development*, by moving from aspects related to urban performance to those of a *smart city.*

4. Connections in the transition to smart cities

A key aspect in studying the transformations that cities go through in the process of becoming smart cities is the emphasis on interdisciplinary studies and making connections in fields such as technology, sociology, and sustainable development at the urban level. The scientific literature identifies interconnections between technologies, citizen participation, and understanding of smart city development processes, basic factors in urban development.

Recent research (Sageidet, Müller-Eie, and Lindland, 2025, edts.) finds that smart cities are based not only on technology, but also on possibilities for increasing social inclusion, creating new neighborhoods, and urban development strategies. Addressing these connections leads to possibilities for perceiving the capacity of cities to develop connected to the needs of the community.

→ In urban planning, connections arise given by *the causal relationship* that arises between the achievement of a certain goal, the development conjuncture at the local level and initiatives that can be implemented to achieve the proposed goal. This form of planning bears the imprint of reason, the context in which it manifests itself and the norms that must be implemented. Urban planning and development, regardless of the form it takes, pursues objectives such as: stimulating efficiency, sustainable development, improving the quality of life and others. (Müller-Eie, 2025, Chapter 7, Sageidet, Müller-Eie and Lindland, edts., 2025).

→ In studying and developing smart cities, the specialized scientific literature (Sageidet, Müller-Eie and Lindland, eds. 2025) notes the possibility of making connections, such as:

- The implication of technologies in the sustainable development of cities; (Winkowska et al., 2019) (quoted by Sageidet, Müller-Eie and Lindland, edts., Introduction, 2025)

Citizen engagement, increasing social inclusion and sustainable development, by creating new neighborhoods;

- Understanding the development processes of smart cities (Cloutier & Langley, 2020) (Arin et al., 2023) (quoted by Sageidet, Müller-Eie and Lindland, edts., 2025, Introduction).

→ Also, the author Andrea Frosinini, (2024) identifies the approach to smart cities, taking into account a series of parameters related to social, economic and environmental aspects: (Frosinini, 2024; European Commission, European Social Innovation Competion).

- Smart and safe living conditions, by developing innovation that ensures an increase in the quality of urban life.
- Smart governance and e-citizenship, as a result of increased civic participation and quality of services at the municipal level.
- Smart urban mobility, by improving infrastructure and means of transport.
- Environmental protection, based on modern technologies to protect ecosystems.
- Development of a smart economic environment, through economic policies and strategies oriented towards equitable economic growth.

Connections are manifested between local development and involved actors (local government, business environment and residents) (Jakobsen, 2019) who act at the local level, through governance, democracy, education, culture, technology. (Jazz, Beats, Hugs and Bugs Kristoffer Berre Alberts and Petter Frost Fadnes, 2025, Chapter 9, Daniela Müller-Eie, 2025, Chapter 7, Sageidet, Müller-Eie and Lindland, edts., 2025). The *social aspects* present in the

concept of smart city are highlighted by the contemporary approach of the term smart city; this takes into account both the introduction of technologies and the emphasis on sustainable development and social policies at the center of which the individual is located, in order to avoid communities falling behind and their marginalization. Thus, the smart city can also be seen in terms of ensuring a better quality of life for its citizens. (Frosinini, 2024).

Although the transition to the smart city was successfully achieved through practices of introducing the population to digital technologies, with an increase in citizen participation, however, the lack of long-term strategies to ensure their sustainability persists. (Frosinini, 2024)

In the transition of cities to the condition of smart, it is important to consider economic, social and environmental aspects as well as actions towards inclusive urban development, so that all citizens can benefit from the advantages of smart cities. (Frosinini, 2024).

The transition to smart cities offers opportunities for the development of urban areas at European level, but *the social structure of cities* must also be taken into account so as to ensure that all citizens can benefit from technological advances. (Frosinini, 2024).

5. Social transition in smart cities

On the social front, there are currently a number of concerns related to increasing inequalities, increasing poverty rates, an unstable political framework, worsening human conditions, insecurity in the labor market and in terms of food and energy security. (OECD, 2023).

Attention is paid to the social context in which digital technologies are integrated in urban areas. An evolving process, the smart city is approached taking into account the social situations through which it develops. (Lindland, 2025, Chapter 5, Sageidet, Müller-Eie and Lindland, edts., 2025).

Social development is considered to be a process that leads to increased well-being, ensuring equitable social relations; it involves material, social, political and cultural aspects (UNRISD, 2015, quoted by OECD, 2023). Social sustainability refers to the joint participation of communities and societies, which collaborate to find solutions, in order to overcome difficulties, to ensure well-being at the level of the entire society (Barron et al., 2023). It includes elements such as: social cohesion, inclusion, resilience and legitimacy of processes. (Barron et al., 2023). (quoted by OECD, 2023).

Social cohesion refers to achieving a common goal and establishing trust between individuals and groups, but also between them and institutions. *Inclusion* means equal access to basic services and markets, as well as participation in decision-making. *The legitimacy of processes* is formed when, the authority, objectives, consequences and the way of applying political initiatives, strategies, programs, at the community level, are established. Smart urban transitions are conducive to creating an environment where citizens interact and collaborate to stimulate innovation to improve living conditions and develop the local economy (de Lange & de Waal, 2019). (Raven et al., 2019). (quoted by Lee, Babcock, Pham, Bui, Kang, 2022) (Fisker, Müller and Eiliott, 2025, Chapter 6, Sageidet, Müller-Eie, Lindland edts., 2025).

The European Mission on Smart and Neutral Cities (European Commission, 2020) believes that participation and innovation ensure the transition from a technology-driven to a citizen-centric approach. (Calzada, 2018). (quoted by Kaae, Müller, Eiliott, 2025, Chapter 6, Sageidet, Müller-Eie, Lindland edts., 2025). In the New Urban Agenda of the United Nations (2017) the objectives pursued are oriented towards the development of smart cities, access to citizen-oriented digital governance tools, in order to ensure participation and responsible governance practices. The

priority elements are participation and inclusion, in order to favor vulnerable citizens in urban environments (UN, 2017) (quoted by Fisker, Müller, Eiliott, 2025, Chapter 6, Sageidet, Müller-Eie, Lindland edts., 2025).

In the social transition towards inclusion and equity, four aspects are taken into account, such as: (Urban Transition Alliance, Social Transition).

1). *Citizen participation* - contributes to taking over opinions in the decision-making process and supporting social inclusion, through representation and participation of demographic groups. The process involves the interaction between local governments and citizens, as well as possibilities for participation in the governance process (Urban Transition Alliance, Social Transition). Citizen participation and the implementation of digital technology lead to increased inclusion and resilience of cities and consequently, increase their capacity to adapt more effectively to new changes. (Castelnovo, Misuraca, & Savoldelli, 2016), (Raven et al., 2019). (quoted by Lee, Babcock, Pham, Hien Bu, Kang, 2022).

Scholars are pursuing the participation of residents, and especially those of vulnerable groups, in the development of cities, so as to ensure the inclusion of vulnerable citizens (Datta, 2019; Fisker et al., 2019). (Fisker,, Müller, Eiliott, 2025, Chapter 6, Sageidet, Müller-Eie, Lindland edts., 2025) .

To this end, legislative reforms are needed to regulate the participation of planners, politicians, and owners in a citizen-controlled planning process, assisted by experts. (Fisker,, Müller, Eiliott, 2025, Chapter 6, Sageidet, Müller-Eie, Lindland edts., 2025)

Research and planning pursue elements such as (Fisker,, Müller, Eiliott, 2025, 2025, Chapter 6):

- → *Creating the possibility for planners, researchers, artists, and vulnerable populations* to act to limit the exclusion and marginalization of the disadvantaged in the urban area and to create perspectives for disadvantaged minorities. Given the power disparities, collaborative practices are needed to provide vulnerable citizens with favorable conditions to demonstrate initiatives for some aspects of the strategy in the planning process.
- → *Rethinking the role and positions of power in urban planning*, by researchers, artists and urban planners, considered as experts in the political-administrative decision-making process, or in architectural elements. These experts have the quality of stakeholders in the political and planning system.
- → *Promoting the social inclusion of vulnerable citizens, limiting social marginalization*, through participatory decision-making tools and through the penetration of digital technologies. To achieve this objective, it is necessary to know the level to which smart city technologies have the capacity to reverse or maintain *power asymmetries* (Cardullo et al., 2019). (quoted by Fisker. Müller, Eiliott, 2025, Chapter 6, Sageidet, Müller-Eie, Lindland edts., 2025) The term power asymmetries in Diversity, Equity, and Inclusion (DEI) is related to the dynamics of relations between large social groups and refers to situations in which imbalances occur (one group holds greater power, given better resources, in relation to other groups). (DEI Dictionary, Asymmetrical Power Relations – Definition and Explanation). (Fisker. Müller, Eiliott, 2025, Chapter 6, Sageidet, Müller-Eie, Lindland edts., 2025).

In the Future Workshop (Utopian)[1], the participatory process is structured in *three phases* (quoted by Fisker. Müller, Eiliott, 2025, Chapter 6, Sageidet, Müller-Eie, Lindland edts., 2025):

[1] *"The utopian future workshop method was developed in the field of participatory action research and has been used for decades as a tool for marginalised and vulnerable groups to develop a voice and vision of*

Criticism phase - shortcomings in existing urban spaces are observed, faced by various vulnerable, marginalized and excluded groups (Eiliott et al., 2023) (quoted by Fisker. Müller, Eiliott, 2025, Chapter 6, Sageidet, Müller-Eie, Lindland edts., 2025).

Utopian phase - qualitative aspects of alternative urban spaces are thought out, capable of ensuring conditions for planning, artistic and digital achievements, in order to correct the shortcomings.

Achievement phase - the visions thought out in the previous phase are translated into actions, in order to achieve the objectives. Collaboration takes place between the groups vulnerable, and experts, in order to put ideas into practice, through the planning process. (Jungk & Mullert, 1998) (quoted by Fisker. Müller, Eiliott, 2025, Chapter 6, Sageidet, Müller-Eie, Lindland edts., 2025)

2) *Formation of shared visions* - helps to orient towards common community objectives, social cohesion and trust in cities, increasing the sense of belonging in the community; possibilities for new investments. (Urban Transitions Alliance, Social Transition).

3) *Education and social capacity* development strategies - ensures increased participation of citizens in community life. Subsidies can contribute to reducing financial efforts and creating prospects for creativity and innovation. (Urban Transitions Alliance, Social Transition).

4) *Social protection programs* provide protection to the disadvantaged who cannot sufficiently benefit from emerging opportunities. (Urban Transitions Alliance, Social Transiton).

5.1. Challenges of social transition at the smart city level

In general, the urban transition to a smart city means a socio-cultural and organizational process, which involves collaborative relationships between urban actors, towards finding solutions to the problems faced by the city, using existing technologies and information. Through this, transitions to smart cities create possibilities for increasing the inclusion and resilience of cities. (Repette et al., 2021). (quoted by Lee, Babcock, Pham, Hien Bu, Kang, 2022). These processes are influenced by socio-economic policies, in the specific context of cities. (Castelnovo et al., 2016; Hollands, 2015; Kitchin, 2019) (Raven et al., 2019) (quoted by Lee, Babcock, Pham, Hien Bu, Kang, 2022)

Difficulties in social transition at the urban level

Cities function as locations where the organization and development of human activity takes place, the supporting element being the connection between community and the efficiency of resource use, the objective being sustainable development. (Raven et al., 2019, quoted by Lee, Babcock, Pham, Bui, Kang, 2022).

In the process of social transition, studies indicate some *difficulties* that manifest themselves during the evolution of cities.

Kern (2020) shows the tendency of cities to develop without taking into account social problems, which can lead to the emergence of exclusive cities; thus, not all cities achieve the objective of developing inclusive cities. Global South scholars note that, as smart city projects develop over the long term (Datta, 2019), they take on existing inequalities and may assimilate new ones, failing to eliminate discrepancies (Vanolo, 2014; Willis, 2019) (quoted by Fisker, Müller, Eiliott, 2025, Chapter 6, Sageidet, Müller-Eie, Lindland edts., 2025).

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their own"- NEB-STAR New European Bauhaus Stavenger, Tools Utopian Furure Workshops, https://nebstar.eu/tools/utopian-future-workshops/.

In the case of developed countries that, after a period of economic growth, suffered industrial decline, consequences have emerged in existing urban areas that have affected their evolution: increased unemployment, population migration, pollution, increased income inequality, social exclusion among former workers, the emergence of poverty - affecting vulnerable social groups even more. The decrease in tax revenues has led to a reduction in funds for the social protection of vulnerable, marginalized populations. In these circumstances, a contribution to the development of local economies, resistant to shocks caused by crises, can be made by local actors (stakeholders) together with other partners. They can help citizens to cope with the effects of the transition, in the long term. (Urban Transitions Alliance, Social Transition).

Poverty can amplify environmental degradation, through the effort of individuals who can resort to different actions, to ensure their livelihoods. Climate change can also have unfavourable effects for vulnerable communities, by increasing economic disparities (OECD 2023). Thus, *the social transition*, related to well-being and equity, is at the heart of the fundamental restructuring of cities with industrial heritage, worldwide. The triple transition (digital, environmental and social) provides a framework of the interconnections between transitions with an emphasis on the role of public policies in mitigating development disparities. (Urban Transitions Alliance, Social Transition, OECD 2023).

In the context of the challenges facing cities, the intensification of urbanization and increasing population density, climate change and increasing socio-economic disparities (Lee, Arts, & Vanclay, 2020; UNHabitat, 2019b), actions towards the development of smart cities are considered possible ways to respond to these current urban difficulties, by developing planning capacity, at a collective level. (Kang & Lee, 2015). (Raven et al., 2019). (quoted by Lee, Babcock, Pham, Bui, Kang, 2022),

In this sense, *participatory planning* has been introduced to create inclusive cities, through the *participation of citizens* in urban planning. The issue of limiting as much as possible, the marginalization of the vulnerable population, is topical. Participatory planning tools do not reach this segment of the vulnerable population, but rather a small segment of citizens who have resources, therefore, the goal of inclusion remains difficult to achieve (Albrechts et al., 2019; Umemoto, 2001) (quoted by Fisker, Müller, Eiliott, 2025, Chapter 6, Sageidet, Müller-Eie, Lindland edts., 2025).

The reason why urban developers fail to achieve the proposed objective in urban planning is *the lack of connection* between the local development context and the possibilities of achieving the proposed goal. For example, in the application of urban mobility, difficulties arise in ensuring *the connection* between the implementation of intelligent solutions for private car travel (e.g. automated and autonomous vehicles or intelligent route selection and parking systems) and political initiatives that aim to find new solutions for limiting private motorized urban mobility, by making public transport more efficient and reducing the use of private cars. In this context, it is necessary to rethink the approach to smart technologies in urban development, so that they meet the objectives of smart urban mobility, with a reduced impact on environmental pollution, equitable transport and ensuring better living conditions in the urban environment. (Müller-Eie, 2025, Chapter 7, Sageidet, Müller-Eie, Lindland edts., 2025).

The transition to smart cities is also accompanied by possible *disadvantages* that are reflected in urban life, starting with the city's governance system and reaching each citizen, in particular, such as aspects related to initiation into the use of digital tools, increased social isolation, disparities in the provision of services by private operators, these determining the preference for policies favorable to inclusion (Frosinini, 2024).

6. Conclusions

In the context of the challenges facing cities, intensification of urbanization and increasing population density, climate change and increasing socio-economic disparities, actions towards the development of smart cities are considered possible ways to respond to these current urban difficulties. (Lee, Arts, & Vanclay, 2020; UNHabitat, 2019b), (Kang & Lee, 2015). (Raven et al., 2019). (quoted by Lee, Babcock, Pham, Bui, Kang, 2022).

In approaching the concept of a smart city, several areas intervene, such as: environment, technology, quality of life, avoiding marginalization, social innovation, social inclusion, economy, governance. (Müller-Eie, 2025, Chapter 7)

The debates concerning smart cities consider the concept of a smart city as a tool for achieving several objectives: sustainable development of the city, safety, resilience, equity and ensuring better living conditions. (Brown și colab., 2020; Höjer și Wangel, 2015; Kelley și colab., 2020; Martin și colab., 2018; Soe, 2020). (quoted by Müller-Eie, 2025, Chapter 7, Sageidet, Müller-Eie, Lindland edts., 2025)

The social transition addresses aspects related to the impact of digital and ecological transitions on society and the role of social dynamics in development. In order to achieve the best possible social transition, decision-making processes are necessary, in order to ensure social cohesion and increase the well-being of individuals. This process involves an active role of the state in providing a wide range of policies. (OECD, 2023)

In studying and developing smart cities, the specialized scientific literature notes the possibility of making *connections*, such as (Sageidet, Müller-Eie și Lindland, eds. 2025):

- ✓ The implication of technologies in the sustainable development of cities; Winkowska et al., 2019, quoted by Sageidet Barbara Maria, Müller-Eie Daniela, and Lindland Kristiane M.F., 2025, *Introduction,* Sageidet, Müller-Eie, Lindland edts., 2025)
- ✓ The involvement of citizens, increasing social inclusion and sustainable development, by creating new neighborhoods;
- ✓ Understanding the processes of development of smart cities. (Cloutier & Langley, 2020); (Arin et al., 2023) (quoted in Sageidet Barbara Maria, Müller-Eie Daniela, and Lindland Kristiane M.F., 2025, *Introduction,* Sageidet, Müller-Eie, Lindland edts., 2025)

Connections are manifested between local development and involved actors (local government, business environment and residents) (Jakobsen, 2019), who act at the local level, through governance, democracy, education, culture, technology. (Alberts și Fadnes, Chapter 9, Daniela Müller-Eie Chapter 7, Sageidet, Müller-Eie, Lindland edts., 2025)

Acknowledgment: *This article is a part of the research paper achieved in the year 2025, by a research team of Institute of National Economy, Romanian Academy "Tripla tranziție a mediului urban din România - digitală, ecologică și socială. Identificarea nevoilor și analiza transferului de bune practici".*

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AI INTEGRATION IN ENERGY PROJECT MANAGEMENT

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Abstract *This article presents a systematic review of theoretical and empirical research on artificial intelligence (AI) integration in energy project management, with a specific focus on the relationship between AI assistance and project management performance. Based on 50 highly relevant studies selected from an initial pool of 714 publications, the review covers AI applications in scheduling, risk management, resource optimisation, predictive maintenance, decision support and supply chain coordination across renewable, non-renewable and hybrid energy projects. The analysis develops an integrated, multi-level conceptual framework linking AI capabilities, data infrastructures, organisational readiness and sustainability outcomes. The findings indicate that AI can significantly enhance project efficiency, schedule reliability, risk mitigation and environmental performance, especially in renewable energy and large infrastructure projects. However, these benefits are contingent on data quality, system interoperability, workforce skills and supportive governance. The review reveals a persistent theory–practice gap due to limited longitudinal and real-world validation of AI models in live energy project environments. It also highlights underexplored ethical, regulatory and environmental implications of AI itself. The article articulates a research agenda centred on explainable AI, hybrid human–AI decision structures, and integrated AI–blockchain–IoT–digital twin ecosystems, and proposes practical and policy guidelines for responsible and effective AI adoption in energy project management.*

Keywords: Artificial intelligence; energy; project management; predictive analytics; digital transformation

JEL Classification: H5; N7; O3; Q5.

1. Introduction

Artificial intelligence (AI) has become a central driver of digital transformation in the energy sector, reshaping how complex projects are conceived, planned and executed. In energy project management, AI promises improved efficiency, optimised resource allocation and support for sustainable energy transitions (Liu, 2024; Piwowar-Sulej et al., 2023; Gaci et al., 2025). The last decade has seen a shift from relatively simple predictive models to sophisticated machine learning, deep learning and hybrid neuro-fuzzy systems embedded in project management processes (Le et al., 2024; Rojek et al., 2025). This evolution coincides with intensifying pressures for decarbonisation and rapid deployment of renewable energy, where project success is tightly linked to cost, time, risk and sustainability performance (Piwowar-Sulej et al., 2023; Adewumi et al., 2024).

Despite these advances, the systematic integration of AI into energy project management remains uneven. Studies highlight significant challenges in aligning AI tools with traditional project management practices and with the institutional, technical and regulatory conditions of energy systems (Sarwar and Rahman, 2024; Zhang et al., 2024; Zhumatayeva and Mukashev, 2025). Key unresolved issues concern the balance between automation and expert human

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judgment, data governance, organisational readiness and the ethical deployment of AI in safety-critical infrastructures (Haque and Fahad, 2025; Al-Arafat et al., 2025; Kuzior et al., 2022).

Existing reviews tend either to examine AI in generic project management (Nenni et al., 2024; Mičić et al., 2025) or to focus on AI in energy systems without a project management lens (Le et al., 2024; Ozen and Gedikli, 2023; Lamichhane, 2025). This article addresses that gap by explicitly positioning AI at the intersection of energy systems and project management. It synthesises theoretical and empirical evidence on how AI assistance influences project processes and outcomes and develops an integrated conceptual framework for understanding AI's role in energy project management.

Energy sector context

Energy projects exhibit distinctive features that make them particularly relevant for AI integration. They are typically capital-intensive, long-lived and technologically complex, with stringent regulatory constraints and high social and environmental stakes (Langer and Neugebauer, 2020; Navarra, 2023). The growth of distributed renewable generation, smart grids and storage technologies adds further complexity and data intensity to planning and execution (Necula, 2023; Rojek et al., 2025).

Digitalisation initiatives—such as smart metering, IoT deployment, real-time monitoring and digital twins—are generating unprecedented volumes of operational and project data (Research on power grid infrastructure…, 2022; Agho et al., 2025). These developments create fertile ground for AI applications in forecasting, scheduling, risk analysis, resource optimisation and maintenance planning (Choi et al., 2021; Ruiz et al., 2024; Lakatuš, 2024).

At the same time, legacy infrastructure, fragmented data systems and regulatory sensitivity surrounding critical energy assets create substantial barriers to AI adoption (Zhang et al., 2024; Park and Kim, 2024). Understanding AI in energy project management therefore requires attention to both technical potential and sector-specific institutional conditions.

Research question

Against this backdrop, the article addresses the following overarching research question (RQ):

RQ1: How does AI assistance influence project management processes and performance in the energy sector, and what theoretical and practical mechanisms explain this relationship?

Sub-questions include:

- *What AI techniques and application domains dominate research on energy project management?*
- *How do AI tools affect project outcomes such as cost, time, risk and sustainability?*
- *What barriers and enablers shape AI adoption in energy project contexts?*
- *How well aligned are theoretical models with evidenced practice across energy sub-sectors and regions?*

2. Aim and Objectives

The **aim** of this article is to examine and synthesise theoretical and empirical research on AI integration in energy project management, focusing on how AI assistance correlates with project management performance across energy sub-sectors.

In line with this aim, the article pursues five specific objectives:

- **To evaluate current knowledge** on the application of AI techniques to energy project management processes and outcomes (Le et al., 2024; Liu, 2024).
- **To benchmark existing AI-driven methodologies** for risk management, scheduling and resource optimisation in energy projects (Ferreiro et al., 2025; Ruiz et al., 2024; Xu et al., 2025).
- **To identify and synthesise challenges and opportunities** associated with AI integration in energy sector project management, including socio-technical, regulatory and ethical dimensions (Zhumatayeva and Mukashev, 2025; Park and Kim, 2024; Haque and Fahad, 2025).
- **To compare theoretical models and practical implementations** of AI assistance across renewable, non-renewable and hybrid energy projects (Navarra, 2023; Necula, 2023; Maheshwari, 2025).
- **To deconstruct the role of predictive analytics and AI-enabled decision support systems** in enhancing project efficiency, resilience and sustainability (Adewumi et al., 2024; Bushuyev et al., 2024; Khaddam and Alzghoul, 2025).

A dedicated conceptual framework and multi-level analysis are developed to integrate these objectives and guide the subsequent synthesis.

3. Key Definitions and AI Taxonomy

3.1 Core definitions

To ensure conceptual clarity, the review adopts the following working definitions:

- **Artificial intelligence (AI)** is defined as a family of computational techniques—including machine learning, deep learning, neuro-fuzzy systems, optimisation algorithms and natural language processing—used to generate predictions, classifications, recommendations or automated actions from structured and unstructured data (Ferreiro et al., 2025; Le et al., 2024; Savaş, 2025).
- **AI assistance in project management** refers to the use of AI tools to support or automate project management processes such as planning, scheduling, risk identification, cost estimation, progress monitoring, document analysis and decision support (Nenni et al., 2024; Mičić et al., 2025; Sarwar and Rahman, 2024).
- **Energy project management** denotes the planning, coordination and control of projects related to energy generation, transmission, distribution and efficiency, including renewable and non-renewable infrastructure, smart grid initiatives and digitalisation projects (Liu, 2024; Langer and Neugebauer, 2020; Podile et al., 2024).
- **Digital twin technology** describes virtual replicas of physical energy assets or project systems that integrate real-time data to simulate, monitor and optimise performance and risk (Research on power grid infrastructure…, 2022; Agho et al., 2025).
- **Predictive analytics** refers to AI-enabled techniques that use historical and real-time data to forecast future conditions, including energy demand, equipment failure, schedule delays and cost overruns (Choi et al., 2021; Maheshwari, 2025; Adewumi et al., 2024).

3.2 AI taxonomy for energy project management

The reviewed literature points to a diverse, yet classifiable, set of AI approaches:

Table 1. ***AI taxonomy for energy project management***

Machine learning (ML)	Supervised and unsupervised models for forecasting, classification and clustering of project-related variables such as demand, failure probabilities or cost deviations (Le et al., 2024; Maheshwari, 2025; Xu et al., 2025).
Deep learning and neural networks	Multi-layer architectures used for complex pattern recognition, particularly in forecasting and image or sensor data analysis (Ferreiro et al., 2025; Rojek et al., 2025).
Neuro-fuzzy and hybrid computational intelligence	Combinations of neural networks, fuzzy logic and other optimisation heuristics for scheduling, resource allocation and control in construction and plant projects (Ruiz et al., 2024; Choi et al., 2021).
Optimisation and meta-heuristics	Algorithms such as genetic algorithms or swarm intelligence for multi-criteria optimisation in resource scheduling, portfolio planning and logistics (Ferreiro et al., 2025; ODEKUNLE et al., 2025).
NLP and knowledge-based systems	Techniques for extracting insights from unstructured project documentation, contracts and reports, and for codifying expert knowledge into decision support systems (Bibi et al., 2024; Sarwar and Rahman, 2024).
Digital twin and IoT–AI integration	Real-time data streaming from sensors into AI-enhanced twins for dynamic monitoring and predictive maintenance (Research on power grid infrastructure…, 2022; Agho et al., 2025; Lakatuš, 2024).
Blockchain–AI synergies	Integration of AI with distributed ledgers for secure data sharing, transparent transaction recording and trust management in energy supply chains and markets (Kuzior et al., 2022; Onukwulu et al., 2023).
Explainable AI (XAI)	Approaches aimed at increasing transparency, interpretability and accountability of AI models, especially relevant for safety-critical energy infrastructures (Lamichhane, 2025; Haque and Fahad, 2025).

Source: Authors' own research results

This taxonomy underpins later analysis of application domains and maturity levels across energy project contexts.

4. Theoretical Foundations and Conceptual Framework

Four main theoretical lenses inform the integration of AI in energy project management:

Table 2. ***Theoretical foundations***

Dynamic capabilities and strategic project management	AI is conceptualised as a digital capability that enhances organisations' abilities to sense, seize and transform opportunities and threats in complex project environments (Liu, 2024; Bushuyev et al., 2024; Samarah et al., 2024). Syncretic innovation project management models incorporate AI as a source of strategic agility and portfolio-level coordination (Bushuyev and Author_ID, 2024).
Socio-technical systems theory	AI is embedded within broader socio-technical systems encompassing technology, people, structures and institutions. Successful implementation depends on the alignment between AI tools, organisational processes, skills and governance mechanisms (Zhumatayeva and Mukashev, 2025; Khaddam and Alzghoul, 2025).
Sustainability and energy transition theories	AI is positioned as an enabler of sustainable energy transitions by facilitating integration of renewables, efficiency improvements and decarbonisation pathways (Piwowar-Sulej et al., 2023; Adewumi et al., 2024; Gaci et al., 2025; Lamichhane, 2025). AI applications are linked to broader sustainable innovation and energy system digitisation narratives (Navarra, 2023; Ozen and Gedikli, 2023).
Ethics, governance and responsible AI	Concerns about opacity, bias and accountability in AI models, particularly in safety-critical energy infrastructures, motivate emerging frameworks on responsible and explainable AI (Haque and Fahad, 2025; Al-Arafat et al., 2025; Kuzior et al., 2022; Gaci et al., 2025).

Source: Authors' own research results

The conceptual framework developed in this article connects four core elements:

1. **AI capabilities** (prediction, optimisation, automation, decision support).
2. **Project management processes** (planning, scheduling, risk management, monitoring, maintenance).
3. **Contextual enablers and constraints** (data infrastructure, organisational readiness, regulatory and ethical environment).
4. **Project performance outcomes** (cost, time, quality, risk, sustainability).

AI capabilities are deployed within specific project management processes (e.g. predictive scheduling, dynamic risk modelling), and their effects on performance are **mediated** by data quality and interoperability, and **moderated** by organisational readiness and governance arrangements. In turn, outcomes feed back into capability development and organisational learning, enabling dynamic capability building.

To capture the complexity of AI integration, the framework adopts a **multi-level perspective**:

- **Micro-level (project tools and processes):** AI-enabled scheduling, risk models, predictive maintenance and analytics embedded in specific projects (Ferreiro et al., 2025; Ruiz et al., 2024; Lakatuš, 2024).
- **Meso-level (organisational capabilities):** digital maturity, leadership support, competencies and culture shaping how AI is adopted and institutionalised within firms (Zhumatayeva and Mukashev, 2025; Khatib, 2024; Zulkieflimansyah et al., 2025).
- **Macro-level (regulatory, environmental and market forces):** data governance, safety standards, decarbonisation policies and market structures influencing incentives and constraints for AI use in energy projects (Park and Kim, 2024; Gaci et al., 2025; Navarra, 2023).

Building on the above, the article advances the following propositions:

Table 3. *Propositions*

P1	**Performance effect**	AI assistance in energy project management is positively associated with project performance (time, cost, risk and sustainability outcomes), conditional on adequate data infrastructure.
P2	**Data mediation**	Data quality, availability and interoperability mediate the relationship between AI adoption and project performance; poor data environments significantly weaken AI benefits (Freunek, 2024; Zhang et al., 2024; Park and Kim, 2024).
P3	**Human–AI complementarity**	The positive impact of AI is maximised when AI systems are embedded within hybrid decision-making processes that combine algorithmic insights with expert judgment (Al-Arafat et al., 2025; Haque and Fahad, 2025).
P4	**Organisational readiness**	Organisational readiness—comprising leadership support, digital maturity and workforce competence—moderates the effectiveness of AI integration in energy project management (Zhumatayeva and Mukashev, 2025; Zulkieflimansyah et al., 2025).
P5	**Sustainability alignment**	AI deployments aligned with sustainability and ESG strategies generate more enduring value than isolated efficiency-oriented applications (Khaddam and Alzghoul, 2025; Mauro, 2024; Podile et al., 2024).

Source: Authors' own research results

These propositions structure the interpretation of empirical findings and guide the proposed research agenda.

5. Methodology

The study adopts a **systematic literature review** combined with **narrative synthesis**, focusing on peer-reviewed publications and scholarly outputs on AI in energy project management from 2010 to 2025 (Kozhakmetova et al., 2024; Nenni et al., 2024). Both theoretical and empirical contributions are considered, including journal articles, conference papers and book chapters.

The core research question—*"**Theoretical and academic insights on AI in energy project management, focusing on the correlation between project management in the energy sector and AI assistance**"*—was decomposed into several targeted search statements covering:

- *AI applications in sustainable energy project management;*
- *AI's influence on project management methodologies in energy;*
- *AI for optimisation of project management processes (efficiency, risk, predictive analytics);*
- *Integration of digital twin, IoT and real-time analytics in energy project management.*

These queries were applied to major academic databases. The initial search yielded **672** candidate publications.

A multi-stage screening protocol was employed:

1. **Title and abstract screening** to exclude items lacking explicit relevance to both energy/energy projects and AI.
2. **Full-text screening** using inclusion criteria requiring:
   - an explicit link to project management (processes, methodologies or outcomes);
   - application or conceptualisation of AI, as defined above;
   - sufficient methodological transparency.
3. Exclusion of purely technical AI studies without project-level implications and generic AI–PM work with no energy focus.

After screening and refinement, **714** papers were deemed relevant, of which **50** were classified as **highly relevant** based on conceptual centrality and methodological depth.

Backward citation analysis (scanning reference lists) and forward citation tracking (identifying papers citing the core set) yielded an additional 66 studies (Kozhakmetova et al., 2024; Nenni et al., 2024).

Relevance scoring considered:

- centrality of AI and energy project management to the study;
- richness of conceptual or empirical contribution;
- methodological robustness and clarity.

The 50 most relevant studies comprise the core analytical corpus, while the remainder support contextualisation and triangulation.

The analysis proceeded in three steps:

- **Descriptive mapping** of AI techniques, energy sub-sectors, project management domains and methods.

- **Thematic coding** to identify recurrent themes and cross-cutting issues (e.g. risk management, scheduling, adoption barriers, sustainability).
- **Multi-level integration** of findings into the conceptual framework, linking micro-, meso- and macro-level dynamics and deriving propositions and research gaps.

6. Main Findings

6.1 AI application domains in energy project management

The 50 core studies reveal a broad spectrum of AI applications:

- **Scheduling and planning:** AI is widely used for construction and installation scheduling, particularly in photovoltaic and large plant projects (Ruiz et al., 2024; Ferreiro et al., 2025; Choi et al., 2021). Neuro-fuzzy and optimisation models generate more reliable schedules under complex constraints.
- **Risk management:** Machine learning and predictive analytics support dynamic risk identification and mitigation in complex infrastructure and energy projects (ODEKUNLE et al., 2025; Nenni et al., 2024). Risk models integrate technical, financial and environmental parameters.
- **Resource optimisation and supply chains:** AI-enhanced frameworks optimise energy supply chains, logistics and inventory decisions, improving resilience and responsiveness (Onukwulu et al., 2023; Agho et al., 2025).
- **Predictive maintenance and asset management:** AI models predict equipment failures and optimise maintenance schedules, reducing downtime and improving asset performance (Lakatuš, 2024; Buchan and Abdullah, 2024).
- **Strategic and sustainability-oriented decision support:** AI-driven business intelligence platforms support strategic energy planning, ESG reporting and sustainability-oriented decision making (Khaddam and Alzghoul, 2025; Podile et al., 2024; Mauro, 2024).

Applications are most mature in **renewable energy** contexts—especially solar and wind—and in **smart grid** projects, reflecting the data-rich nature and policy relevance of these domains (Piwowar-Sulej et al., 2023; Adewumi et al., 2024; Necula, 2023; Rojek et al., 2025).

6.2 Project management outcomes

Most reviewed studies report positive project management outcomes associated with AI adoption:

- Improved **schedule adherence** and reduced project delays through more accurate planning and real-time rescheduling (Ferreiro et al., 2025; Ruiz et al., 2024).
- **Cost reductions** via improved forecasting, efficient resource utilisation and predictive maintenance (Buchan and Abdullah, 2024; Maheshwari, 2025; Lakatuš, 2024).
- Enhanced **risk mitigation**, with earlier detection of hazards and scenario-based contingency planning (Nenni et al., 2024; ODEKUNLE et al., 2025; Haque and Fahad, 2025).
- **Sustainability gains**, including improved integration of renewables, reduced emissions and energy losses, and more robust ESG performance (Adewumi et al., 2024; Mauro, 2024; Gaci et al., 2025; Lamichhane, 2025).

Nevertheless, some studies highlight residual schedule errors, high computational costs or limited transferability across contexts (Ferreiro et al., 2025; Lamichhane, 2025). AI impacts are thus positive but contingent.

6.3 Adoption challenges and organisational barriers

The literature converges on several key barriers to AI integration:

- **Data quality and interoperability:** Insufficient, fragmented or low-quality data limit model accuracy and scalability (Freunek, 2024; Zhang et al., 2024; Park and Kim, 2024).
- **Legacy systems and integration complexity:** Difficulties integrating AI solutions with existing information systems and operational technologies create delays and cost overruns (Khandelwal, 2025).
- **Workforce skills and organisational readiness:** Skills gaps, limited AI literacy among project professionals, and cultural resistance impede adoption (Zhumatayeva and Mukashev, 2025; Khatib, 2024; Zulkieflimansyah et al., 2025).
- **Ethical and regulatory uncertainties:** Data privacy, cybersecurity, transparency and accountability concerns are insufficiently addressed (Haque and Fahad, 2025; Kuzior et al., 2022; Gaci et al., 2025).

These barriers operate across micro, meso and macro levels, reinforcing the need for a multi-level integration perspective.

6.4 Methodological approaches and theory–practice alignment

Methodologies range from bibliometric and scientometric analyses (Kozhakmetova et al., 2024; Nenni et al., 2024; Navarra, 2023) to empirical case studies, surveys, econometric models and algorithm comparisons (Ferreiro et al., 2025; Ruiz et al., 2024; Buchan and Abdullah, 2024; Maheshwari, 2025). Hybrid designs are increasingly prevalent.

However, many studies remain cross-sectional, simulation-based or reliant on expert opinion, with limited longitudinal validation in operational project environments (Savaş, 2025; Lamichhane, 2025). This contributes to a persistent **theory–practice gap**, where robust conceptual frameworks are not fully grounded in diverse real-world evidence.

7. Literature Synthesis

Thematic integration

Thematic analysis reveals several dominant themes:

Table 4. ***AI dominant themes***

AI-driven decision support and risk management	AI enhances decision quality and risk mitigation through predictive analytics, scenario analysis and real-time monitoring (Liu, 2024; Haque and Fahad, 2025; Bushuyev et al., 2024; ODEKUNLE et al., 2025).
Scheduling and resource optimisation	Neuro-fuzzy systems, optimisation algorithms and ML models improve scheduling accuracy and resource allocation, particularly in renewable construction projects (Ferreiro et al., 2025; Ruiz et al., 2024; Xu et al., 2025).
Integration challenges and adoption barriers	Technical, organisational and regulatory barriers constrain AI's potential, highlighting the importance of socio-technical alignment (Zhumatayeva and Mukashev,

	2025; Park and Kim, 2024; Khaddam and Alzghoul, 2025; Kuzior et al., 2022).
Renewable energy and sustainability	AI plays a critical role in forecasting, grid management and efficiency improvements in renewable projects, supporting sustainability and transition agendas (Piwowar-Sulej et al., 2023; Adewumi et al., 2024; Gaci et al., 2025; Lamichhane, 2025).
Digital and supply chain transformation	Integration of AI with digital twins, IoT and blockchain enhances transparency, coordination and resilience in energy supply chains and project ecosystems (Onukwulu et al., 2023; Agho et al., 2025; Kuzior et al., 2022).

Source: Authors' own research results

A temporal reading reveals an evolution across four phases:

Table 5. Chronological development

Phase I	Phase II	Phase III	Phase IV
2020–2021	**2022–2023**	**2024**	**2025**
Foundational applications of AI in infrastructure and plant projects, focusing on risk management, planning and big-data-driven project control (Langer and Neugebauer, 2020; Choi et al., 2021).	Expansion towards energy management systems, smart grids, renewable integration and sustainability-oriented frameworks (Ozen and Gedikli, 2023; Necula, 2023; Navarra, 2023).	Consolidation of optimisation-driven approaches, empirical case studies and systematic reviews clarifying adoption barriers and critical success factors (Ferreiro et al., 2025; Ruiz et al., 2024; Park and Kim, 2024; Kozhakmetova et al., 2024).	Strategic and integrated perspectives focusing on digital twins, AI–IoT ecosystems, energy transition and ESG-aligned management (Agho et al., 2025; Rojek et al., 2025; Gaci et al., 2025; Lamichhane, 2025).

Source: Authors' own research results

Agreement, divergence and limitations

The literature largely agrees that AI enhances project efficiency, risk control and sustainability (Ferreiro et al., 2025; Nenni et al., 2024; Haque and Fahad, 2025). However, divergences arise regarding:

- the magnitude of benefits versus computational and implementation costs (Ferreiro et al., 2025; Lamichhane, 2025);
- the dominance of technical vs organisational barriers (Park and Kim, 2024; Zhumatayeva and Mukashev, 2025);
- the desirable balance between automation and human oversight (Al-Arafat et al., 2025; Lamichhane, 2025).

Limitations cluster around: limited empirical validation; sectoral and regional biases; data quality and availability; integration and interoperability challenges; ethical and regulatory under-specification; workforce skill gaps; and narrow focus on particular AI techniques (Freunek, 2024; Zhang et al., 2024; Khandelwal, 2025; Adewumi et al., 2024).

8. Discussion

The synthesis confirms that AI has moved from a peripheral tool to a core enabler of energy project management, particularly in renewable and digitally advanced settings (Adewumi et al., 2024; Rojek et al., 2025). In relation to **RQ1**, evidence indicates that AI assistance **positively influences project management performance** through more accurate forecasting, proactive risk mitigation, optimised scheduling and enhanced sustainability (Ferreiro et al., 2025; Nenni et al., 2024; Buchan and Abdullah, 2024).

However, the findings also strongly support a **contingent** view consistent with propositions P2 and P4. AI's benefits are mediated by data ecosystems and moderated by organisational readiness. Where data are fragmented or of low quality, and where organisations lack the skills and governance structures to exploit AI, gains are limited and sometimes offset by complexity and cost (Freunek, 2024; Zhumatayeva and Mukashev, 2025; Park and Kim, 2024).

The multi-level framework shows how micro-level AI tools are nested within meso-level organisational capabilities and macro-level regulatory environments. This explains cross-regional and cross-sectoral variation in AI maturity: Europe tends to emphasise smart grid and renewable integration; Asian and Middle Eastern contexts often focus on large-scale infrastructure and digitalisation; and emerging economies face infrastructural and institutional challenges but may also leapfrog through targeted digital projects (Piwowar-Sulej et al., 2023; Gaci et al., 2025; Langer and Neugebauer, 2020; Park and Kim, 2024).

The review also surfaces a **theory–practice gap**: strategic and sustainability-oriented frameworks are relatively sophisticated, but empirical validations, especially longitudinal and cross-sectoral, are limited (Savaş, 2025; Lamichhane, 2025; Bushuyev and Author_ID, 2024). This gap underscores the need for closer collaboration among project management scholars, energy technologists and practitioners.

Finally, the debate on automation versus augmentation confirms proposition P3: AI is most effective when it augments rather than replaces human expertise, particularly in high-risk, politically sensitive and socially salient energy infrastructures (Al-Arafat et al., 2025; Haque and Fahad, 2025).

9. Contributions and Implications

This article offers several contributions to the project management and energy literature:

- It delivers a **comprehensive, explicitly tri-domain review** at the intersection of AI, energy and project management, integrating literatures that are often treated separately (Nenni et al., 2024; Ozen and Gedikli, 2023; Navarra, 2023).
- It develops an **integrated conceptual framework and multi-level model** linking AI capabilities, data infrastructures, organisational readiness and sustainability outcomes in energy projects, extending dynamic capabilities, socio-technical and energy transition theories (Liu, 2024; Bushuyev et al., 2024; Gaci et al., 2025).

- It articulates a set of **testable propositions** (P1–P5) that specify mechanisms and contingencies in AI–performance relationships in energy project management.
- It provides a **structured research agenda** addressing empirical validation, explainable AI, human–AI collaboration, integrated digital ecosystems and the environmental footprint of AI.

For practitioners in energy firms and project-based organisations, the review suggests several actionable implications:

Table 6 ***Managerial implications***

AI adoption roadmap	Organisations should treat AI integration as a staged transformation, beginning with data quality and governance improvements, followed by pilots in high-value domains (e.g. predictive maintenance, scheduling), and later scaling to portfolio-level decision support.
Data infrastructure standards	Investment in data standardisation, interoperability and secure data platforms is a prerequisite to realising AI's potential (Freunek, 2024; Zhang et al., 2024).
Workforce upskilling and competence models	Project managers and engineers require AI literacy, including understanding of model limitations and interpretive skills. Upskilling programmes and recruitment strategies are therefore central (Mičić et al., 2025; Khatib, 2024; Zhumatayeva and Mukashev, 2025).
Integration into PMO structures	AI tools should be embedded into Project Management Offices (PMOs) and standard processes, with clearly defined roles for human oversight and escalation.
Risk and governance frameworks	Energy firms should develop AI governance structures that address model validation, bias detection, cybersecurity and responsibilities for AI-assisted decisions (Haque and Fahad, 2025; Kuzior et al., 2022; Khaddam and Alzghoul, 2025).

Source: Authors' own research results

For policymakers and regulators, the findings highlight the need to:

- Establish **sector-specific guidelines** on AI transparency, safety, data protection and accountability in energy project contexts (Zhang et al., 2024; Gaci et al., 2025);
- Support **testbeds and regulatory sandboxes** enabling experimentation with AI in critical infrastructures under controlled conditions (Navarra, 2023; Rojek et al., 2025);
- Encourage **standardisation initiatives** and interoperable data frameworks to lower entry barriers and enable cross-project learning.

10. Conclusion and Future Research

This article has reviewed and synthesised theoretical and empirical research on the integration of AI in energy project management, focusing on how AI assistance influences project processes and outcomes. The evidence indicates that AI can substantially improve scheduling, risk management, resource optimisation and sustainability in energy projects, particularly when deployed within supportive data, organisational and regulatory environments.

At the same time, the review reveals that these benefits are neither automatic nor universal. They depend on high-quality, interoperable data; on organisational readiness, including leadership and skills; and on robust governance frameworks that ensure ethically sound and accountable AI use. The literature exhibits a structural theory–practice gap, with sophisticated conceptual models but limited longitudinal, cross-sectoral validation in live projects. Addressing this gap is crucial if AI is to contribute meaningfully to sustainable, resilient and efficient energy systems.

Based on the identified gaps, we consider that future research should prioritise:

- **Empirical validation of AI models in live projects:** Longitudinal case studies, field experiments and quasi-experimental designs are needed to test AI frameworks across diverse energy sub-sectors and regions (Savaş, 2025; Nenni et al., 2024; Bushuyev and Author_ID, 2024).
- **Integrated AI–blockchain–IoT–digital twin ecosystems**: Research should develop and evaluate architectures that combine AI with blockchain for secure data sharing, IoT for real-time sensing and digital twins for simulation and optimisation (Kozhakmetova et al., 2024; Agho et al., 2025; Kuzior et al., 2022).
- **Data quality, privacy and interoperability solutions**: Future work should propose and test standardised data protocols, privacy-preserving AI techniques and scalable integration architectures tailored to energy project management (Savaş, 2025; Zhang et al., 2024; Park and Kim, 2024).
- **Human–AI collaboration and organisational change**: Cross-regional empirical research is needed on workforce skills, leadership styles, cultural factors and change management strategies that facilitate AI adoption (Zhumatayeva and Mukashev, 2025; Zulkieflimansyah et al., 2025; Park and Kim, 2024).
- **Explainable and trustworthy AI**: Development and testing of explainable AI tailored to safety-critical decisions in energy projects should be prioritised to strengthen accountability and stakeholder trust (Lamichhane, 2025; Haque and Fahad, 2025).
- **Sectoral and regional broadening**: More attention should be given to non-renewable and hybrid energy projects, and to under-researched regions, to improve generalisability and comparability (Piwowar-Sulej et al., 2023; Necula, 2023).
- **Environmental footprint of AI itself**: Future research should quantify the energy consumption and emissions associated with AI deployments in energy projects and develop energy-efficient AI models aligned with sustainability goals (Gaci et al., 2025; Lamichhane, 2025).
- **Alignment of AI-driven decision support with human judgment**: Hybrid decision-making frameworks that balance AI automation with human expertise, and training for project managers in interpreting AI outputs, represent a high-priority research area (Al-Arafat et al., 2025; Haque and Fahad, 2025).

Pursuing these directions will help move the field from conceptual promise towards robust, responsible and impactful AI integration in energy project management.

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METHODS FOR ANALYZING THE PERFORMANCE OF PROPERTY MANAGEMENT SYSTEMS

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Abstract. *A property management system (PMS) is a software that facilitates the management of reservations and administrative tasks of a hotel. In essence, a hotel PMS automates and streamlines operations, saving time and achieving guest service. A modern property management system combines several work sections into a single software. Depending on the vendor, the combination of modules and their functions can vary. By integrating all hotel functions into a single system, PMS also helps reduce human errors and interventions, providing hotels more efficient ways to manage guest experiences and back-end processes. Selecting the right Performance Management System (PMS) is a strategic decision that significantly impacts organizational efficiency, employee engagement, and overall performance outcomes. This paper discusses the key criteria and systematic approach hotel managers should adopt in selecting an appropriate PMS to enhance productivity and achieve strategic success.*

Keywords: *Property Management System (PMS), hotel management, organizational performance*

JEL Classification: M15

1. Introduction

In the modern hotels, computer applications represent a particularly useful support for the development of activities, so that, practically, the development of hotel activities cannot be conceived outside the use of computer systems. They facilitate all the activities that take place within the hotel organization: managing reservations, collecting money, managing arrivals and departures, preparing records, managing restaurant activities, security systems, stocks, customer management etc. The set of computer applications and the hardware system used to obtain the information necessary to manage the activity of a hotel is called Property Management System (PMS).

There are many such software on the market with different characteristics and that is why it is very important to analyze the necessary information, in order to choose the closest computer program in relation with the characteristics of the hotel and of the management team. For this, the management team must have a clear vision of the flow of tourists within the hotel, of the information needs that the management has for an efficient decision-making process and of the needs for interdepartmental communication. Given the need to use computer applications in order to manage the hotel's activity, it is important that in the selection process of personnel, to be assess their digital competences an their ability to use computer programs.

In this paper, we present a critical analysis of the PMS used within a hotel located in the Mamaia Resort.

2. Presentation of the Property Management System used within a hotel located in the Mamaia Resort.

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The hotel we are analyzing during this work (rated at 3 stars) has been operating since 2022. The hotel is located right on the beach in the Mamaia Casino Area, Constanța, Romania and has the advantage of being right in the heart of this holiday resort. The hotel has 124 accommodation places, distributed in 48 Economy rooms, 7 studios and 2 apartments, all with a terrace overlooking the sea, wireless internet, access to a restaurant with international cuisine/self-service with a number of 200 seats indoors and 100 seats outdoors/terrace, parking, within the limit of available places.

The hotel has a tradition on the market, managing to create a group of loyal customers. Among the reasons for the travel and stay of the hotel guests can be listed: business, vacation (stay and transit), sports trips. The most numerous customers are those whose main reason is vacation. Regarding the occupancy rate, the situation is as follows in the period 2022 - 2024:

Table 1. Evolution of the hotel occupancy rate 2022-2024

	2022	**2023**	**2024**
Days of opperation	107	113	115
Total accommodation capacity (beds) during the operation period (no of beds x no of days of operation)	13.268	14.012	14.260
Room-days occupied	3196	5594	6072
Occupancy rate	24,09%	39,92%	42,58%

Source: Internal documents of the Hotel

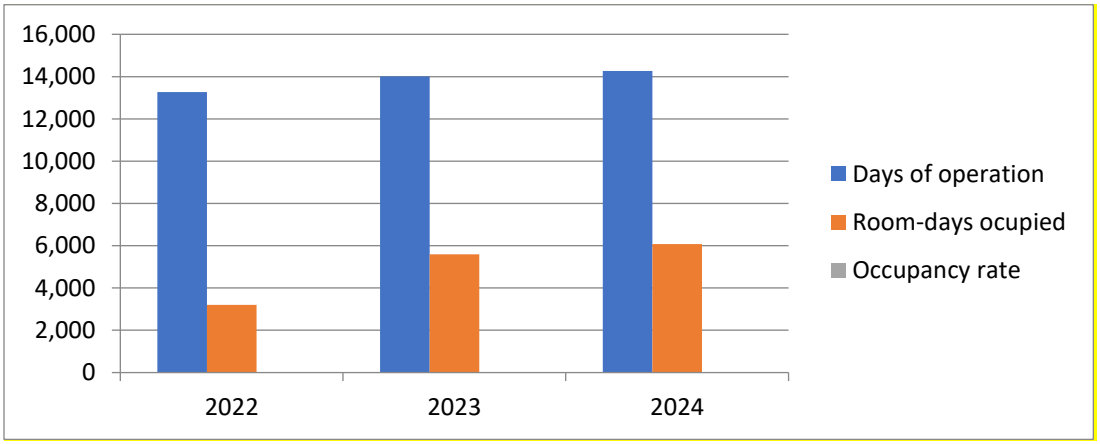

Figure 1 – Occupancy rate evolution during 2022 – 2024

As can be seen, the occupancy rate has increased every year. Thus, the occupancy rate has had a permanent increase during the analyzed period: in 2023 compared to 2022, the increase in occupancy rate was approximately 65.71%, and in 2024 compared to 2023, the increase in occupancy rate was approximately 6.66%.

Regarding the financial indicators of the hotel, the situation is as follows:

➢ ***Turnover:***

Table 2 Turnover evolution during 2022 – 2024

Year	Turnover (lei)
2022	444.127
2023	582.884
2024	634.504

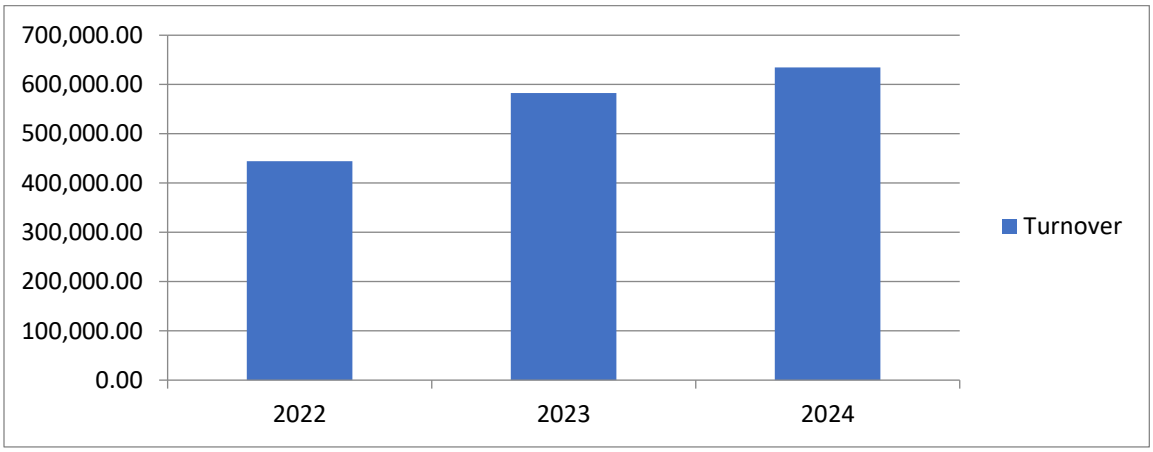

Figure 2 – Turnover evolution during 2022 – 2024

The evolution of turnover over the last three years highlights an increase of approximately 31% in 2023 compared to 2022, followed by an increase of approximately 9% in 2024 compared to 2023.

➢ ***Profit:***

In the three years analyzed, profit experienced the following evolution:

Table 3 – Gross profit evolution during 2022 – 2024

Year	Gross profit (lei)
2022	57.984
2023	169.880
2024	256.132

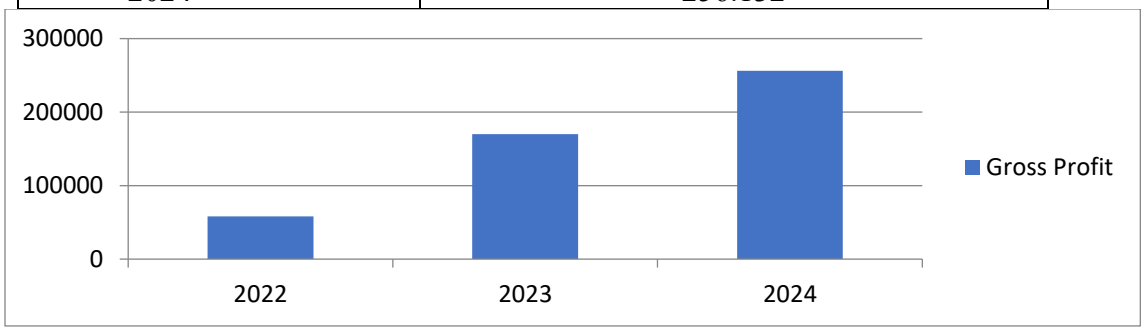

Figure 3 – Gross profit evolution during 2022 – 2024

It is noted that the company did not record losses, and during the analyzed period, profit increased constantly, by 192% in 2023 compared to 2022 and by approximately 50% in 2024 compared to 2023.

To streamline the management activity, a PMS solution is used. This software solution aims to provide support to the hotel management by providing data and information that will ensure the automation of specific operations, improve interaction with guests and, on this basis, increase revenues and streamline the activity.

The structure of the property management system used within the hotel is as follows:

I. *Property Settings* – includes the following subsections: General hotel and property identification data; Operational specifications regarding the hotel's operation; Invoices; Terms and policies; Dining plans; Property information; Room types; Room configuration; Online payment processors.

II. *Administration* – includes the following subsections: Users/Team; Guests; Companies; Extra products and services; Contracts, allocations and discounts; Reservation sources; Email and SMS automations; Customizable SMS

III. *Reservations* – includes the following subsections: Reservation calendar; Reservation listing; Reservation status-today; Group reservations; Reservation reports; Guest statistics; Night Audit; Card data view; Reservation; Reservation cancellation

IV. *Financial* – includes the following subsections: Invoices; Invoice list; Customer sheet; Collections; Hotel taxes; Accounting export; Tax reports; Detailed invoice report

V. *Reports* - includes the following subsections: Meal plan; Housekeeping; SMS report; Manager report; Rates report; Availability report; Comparison report

VI. *Self-Service application* - allows tourists to access the hotel application, providing quick and easy access to managing reservations directly from their mobile phone.

VII. *Website generator* - helps create a professional website for the hotel

VIII. *Booking information* - helps develop ads for the Booking.com platform

IX. *Service distribution systems* - allows you to configure the tariff plans for hotel rooms, offering flexibility depending on the room types, cancellation policies and commissions specific to each travel agency with which the hotel has collaborative relationships

X. *Events* - allows you to manage events organized by the hotel

XI. *Identity documents* - ensures the archiving of scanned identity documents of hotel guests

XII. *Hotel access control* - managing access to the hotel if it is done with cards, access bracelets etc.

The use of a Property Management System is necessary for the management team to provide realistic, multilateral, synthetic and concise, accurate and reliable, dynamic, prospective and timely information. Thus, it is evident that the use of a hotel management systems is no longer a management decision, they have become an essential tool for the efficient management of the daily operations of a hotel and to provide guests with an experience that they will be delighted with. As a result, hotel managers must identify the software that best suits the operational and management needs of the hotel. The hotel management system must allow the simplification of workflows, increased productivity and improved quality of guest interactions, while evolving financial performance.

3. Managerial analysis of the Property Management System used in hotel management

Following the use of the PMS solution for three years, an open-ended question interview with the hotel manager, revealed a series of observations, regarding the aspects that must be considered to substantiate the decision to choose a specific PMS (Property Management System) for a hotel. A software used for hotel management must meet the following requirements:

- *User-friendly interface* – the design must be intuitive, easy to use, allow for quick staff training and ensure a low risk of registration errors. After using the presented IT solution, the manager noticed that some sections collect redundant information, which makes it, sometimes, difficult to use – example: *General identification data of the hotel and the company that owns the hotel Section* and *General information Section* request similar information
- *Presence of a centralized section for managing the accommodation activity* - this is necessary to manage and modify reservations according to needs, to update guest information, to add and read notes, to block rooms and to update room rates and inventory. The IT system used allows all these operations, but from two distinct sections: *Guests (within the Administration section) Section* and *Reservations Section*.
- *Simplifying check-in and check-out processes* – in the current technological context, it is essential that hotel guests do not have to wait in front of the Reception, and for this, they must be able to check-in and check-out digitally. The PMS solution analyzed enables these processes through the *Self-Service Application Section*
- *Presence of a centralized dashboard* – namely, a section that provides instant access to the most important daily information as well as access to key indicators regarding the hotel's activity, updated in real time. The PMS solution analyzed does not provide a synthetic report of all essential information, but only detailed reports and does not ensure the automatic calculation of performance indicators relevant to hotel management.
- *Providing various reports* – the IT solution used must allow the generation of managerial reports, including detailed operational and financial information. The PMS system used by the hotel, provides, in the *Reports Section*, access to relevant information regarding the hotel's activity.
- *Open Application Programming Interface (Open API)* – refers to the need for the IT solution used to allow real-time data exchange, by integrating with other operational softwares. The PMS solution used, meets this requirement.
- *Mobile accessibility* – modern IT systems must allow the manager access from any device, not "oblige" him to always be at the reception or in the physical back office to manage the activity. The analyzed PMS system offers this facility.
- *Communication with hotel guests* – the IT solution must allow automatic communication with guests, both before and after their stay. The analyzed PMS provides support for communication with hotel guests through the *Email and SMS Automations and Customizable SMS Sections*, which can be found in the *Administration Section*
- *Financial and fiscal integration in accordance with legislation* – the hotel management system must ensure support for compliance with legislation. Through the *Financial Section*, the analyzed PMS offers this facility.

- *Ability to apply personalized rates and taxes* – the system must allow the management of taxes, fees, cancellation policies so that, at the hotel level, the most favorable combination can be chosen. The analyzed PMS provides this requirement, through various sections such as, for example, *Guests, Contracts, Allocations and Discounts* and others. The main drawback is that customizing rates and taxes is a laborious process.
- *Integration with other software necessary for efficient management* – there are 3 such software: Channel Manager (integration with the reservation systems of the agencies with which the hotel collaborates – if such integration does not exist, the risk of overbooking arises); Revenue Management System (Revenue management systems extract structured historical data from the PMS to make price recommendations in real time); Customer Relationship Management (CRM systems support the smooth functioning of the relationship with customers, providing information necessary for customer loyalty). The analyzed PMS offers integration with Channel Manager, which ensures synchronization with various reservation systems.

Conclusions

Selecting the right hotel management software is a critical decision that can have a significant impact on a property's operations and guest satisfaction. In the dynamic and ever-evolving hospitality landscape, choosing a PMS is a critical decision for hotel management. It is a choice that can shape the future of a hotel, impacting everything from operational efficiency to guest satisfaction.

In this paper, we have outlined a number of characteristics of a PMS system and the requirements that, from the perspective of a hotel manager using a PMS system, an effective software must meet.

When evaluating PMS options for a hotel, managers should consider how well each system aligns with the unique requirements and long-term goals of the property. A well-chosen hotel management software solution can help improve efficiency, provide a better guest experience, and position the property for current and future success.

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THE REFLECTION OF THE IMPORTANCE OF ACCOUNTING TOOLS IN PRE-UNIVERSITY EDUCATIONAL INSTITUTIONS

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Abstract *This article highlights the role of the accounting information system and accounting tools in providing an accurate image of how pre-university educational institutions manage their resources. It presents the accounting tools used by these institutions and examines the methods through which the accounting information system is evaluated.The accounting information system and its tools form the informational foundation of pre-university educational institutions, as they generate data that reflect how resources are managed and offer essential insights for analyzing institutional activities and performance. The existence of the information–accounting system and its components (accounting, statistics, and operational records) within pre-university educational institutions is justified by the need to supply data that support appropriate management decisions and ensure effective governance of educational processes and phenomena. Information regarding the operations, financial position, and performance of pre-university educational institutions during a financial year is provided through financial statements and other financial or accounting documents.*

Key words: *accounting information system, accounting tools, components of the accounting information system, educational phenomena and processes, financial position*

JEL Classification: G3; G32; G34

1. Introduction

The foundation of any entity lies in its activity, and understanding its status as well as substantiating decisions within economic processes aimed at achieving organizational objectives is made possible through the information provided by the economic information system. In pre-university education, presenting the sources of financing and their utilization through accounting information constitutes an undeniable advantage. Although the provision of accounting information is influenced by various factors, its continuous improvement remains a key objective that must be consistently pursued. The need for information is a concern for taxpayers, members of the legislature, creditors, suppliers, the media and employees. Thus, all users of information will be interested in the credibility (absence of errors), intelligibility (easy to understand), relevance (ability to be useful to beneficiaries in making decisions) and comparability of the information.

The information society, as an aggregate of the heterogeneous disciplinary components it encompasses, increasingly tends to assign to management sciences the social role of mediating between providers and users of accounting information. For pre-university education institutions, as well as for other types of organizations, characterizing their activity, obtaining the information needed to develop operational plans and programs, monitoring and controlling their implementation, and ensuring the integrity of the patrimony are all possible only through the accounting information system.

Understanding the condition and functioning of public institutions, including pre-university education institutions, is essential for organizing and managing economic activity, and this is achieved solely through the economic information system.

The efficiency of the information provided by the accounting information system is assessed through indicators such as: operability (approximate information obtained in a timely manner is considered better than accurate information obtained late) and efficiency (when the cost of obtaining information does not exceed its effects).

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The primary source of information for the accounting information system is the body of economic records (accounting, statistical, and operational), which arises from the need to present the operations carried out by economic entities in an orderly and systematic manner. The republished accounting Law 82/91, with subsequent amendments and completions, defines accounting as the specialized activity in the measurement, evaluation, knowledge, management and control of assets, liabilities and equity, as well as the results obtained from the activity of legal entities and individuals who are required to organize and maintain their own accounting and who must ensure the chronological and systematic recording, processing, publication and preservation of information regarding the financial position, financial performance and cash flows, both for their internal requirements and in relations with current and potential investors, financial and commercial creditors, customers, public institutions and other users.

2. The importance of the accounting information system in providing a real image of the way resources are managed at the level of pre-university education institutions

Accounting is the main data source of the economic information system but also its basic component. It has been found that out of the total information circulated in an entity, approximately 80% is economic information, and 47% of this, is accounting information. Accounting information contributes to ensuring the functionality of the economic information system by presenting the attribute of flexibility, the possibility of modification depending on the circumstances generated by the increase in the need for information, especially for decision-makers, who will have to extrapolate the past, atomize the present, in order to correct any errors and to identify the ways and means necessary to avoid them in the future. Some authors consider that there are three principles for organizing the information system within an organizational entity: the principle of rectangular information (transmission of the same type of information to all organizational levels), the principle of pyramidal information (gradual decrease in the volume of information, as the information path is closer to management) and the principle of information "by exception" (informing management only on events that represent deviations from the entity's normal activity).

Compared to the other two components of the economic information system, accounting presents a series of particularities, namely: includes, within the scope of knowledge, only means, resources, processes and results expressed in monetary terms, operations are recorded only on the basis of documents, the heritage is represented both in terms of material existence and provenance, and the expression in monetary terms allows for the exact measurement of its object, which brings it closer to its true image. Although it has undeniable advantages, accounting must be adapted to respond to contemporary, complex, economic, social and legal challenges, in order to avoid the information deprivation of institutions, including pre-university education institutions.

At the level of pre-university educational institutions, accounting is the main element of the accounting information system because most decisions are made based on the data it provides, offering an image of the entity, and it establishes the connection with the other components of the entity's information system.

Thus, it must be seen as a powerful source of information and not as a way of processing data, that tracks the existence and movement of the patrimonial elements of pre-university educational institutions. The complexity of economic, social and legal structures requires the adaptation of accounting to the new challenges of social transformations and internationalization.

In a world of spectacular changes in a relatively short period of time, accounting in general and financial accounting in particular, must adapt to the new requirements of the international landscape. The communication of information relevant to the decision-making process allows

decision-makers to identify corrective measures and ways and means necessary for long-term financial sustainability. In quantifying the role of accounting, the effects it generates, the financial situation and results are particularly targeted, affecting a vast set of institutions, including pre-university education institutions, whose requirements are different.

The national education system is made up of a set of educational units and institutions of different types and forms of organization, of training and education activity. It is organized on levels, ensuring the coherence and continuity of training and education, in accordance with age and individual peculiarities. The educational process must ensure the development of adaptation and self-improvement skills in the workplace, simultaneously with the development of high professional mobility.

The existence of an informational-accounting system at the level of pre-university education institutions is urgently needed in order to provide data on the approach and actions taken by them. The main elements used in this regard are accounting, statistics and operational records. Operational records register, track and control those parts of the economic activity that are of immediate importance (employees' use of working time, consumption of materials, energy, etc.). Thus, through operational records, pre-university education institutions can monitor whether employees make good use of their working time to accomplish their tasks, whether material and energy resources are managed appropriately so that institutions benefit from quality and efficient services, services that lead primarily to educational performance and the formation of values for society.

At the level of pre-university education institutions, statistics can be used to highlight the evolution of a number of students, the share of certain elements within the population, the correlations between various components in the educational process. Through these studies, statistics offer the possibility of knowing the current situation but also of indentifying the problems that may affect the good work of pre-university education institutions, while offering the chance to improve the situation by correcting any difficulties noted.

Accounting holds the largest share in the structure of the informational-economic system because it allows for objective knowledge of reality, demonstrable and verifiable through the existence of supporting documents. Among the valences of accounting we mention: the provision of real, comparable, synthetic and analytical information, the communication of information from the place where it originated to that of its use, the amplification of the control function over economic phenomena and the considerable increase in the predictive role.

Proper or current accounting is kept at the level of pre-university educational institutions. This is organized at the level of a distinct compartment by the chief accountant who is responsible for organizing and managing accounting. Ensuring accurate records of how activities are carried out, of the settlement of relations between pre-university educational institutions and students in their capacity as third-party debtors or creditors, but also with other third parties, can only be achieved through accounting. All data recorded with the help of accounting must be found in supporting documents to provide a support base for accounting records.

Thus, through accounting, pre-university education institutions, in addition to keeping records of goods, salaries, material resources, expenses and other elements, also ensure a record of settlements with students. This record takes into account services offered to students other than educational ones, namely: subscription payments, high school fees, and textbook payments.

The settlement of transportation for commuting students is based on the number of students and the number of kilometers. The settlement of subscriptions is mandatory to be carried out in the month in which the educational unit receives budget credits. Students whose families have

incomes exceeding a certain level per family member, do not have income from agricultural areas or other activities above a certain level, benefit from social assistance. All gross family income that is permanent is considered. This amount is received on the condition that the student attends classes and does not exceed a number of 20 unexcused absences during the school year. If the number of absences is exceeded, students lose the allocated high school money.

For 11 and 12 grades students, the amount needed for settlement were estimated, taking into account the need for textbooks based on the number of students who submitted their applications along with the accompanying invoices and receipts. The amount the state intervened in support of the students is a modest amount compared to their real needs.

At the level of educational institutions, the informational-accounting system ensures, through its components, a correct management of phenomena and processes, as well as the carrying out of studies regarding the current state, population size and their evolution trends.

3. Accounting tools used by pre-university education institutions

The presentation of data regarding the activity carried out by pre-university education institutions, their financial position and performance during a financial year is possible by preparing summary documents embodied in financial statements. The purpose of preparing financial statements by public institutions, including pre-university education institutions, is to obtain and provide information necessary to substantiate decisions and justify the use of financial resources. Next, we will present the content of financial statements and documents prepared at the level of pre-university education institutions.

Reflecting, monitoring and controlling the economic and financial situation of public institutions requires the dual presentation of the financial situation through the balance sheet. The balance sheet is considered a two-tiered balance sheet where the two structures of the patrimony are found, namely the material and monetary means called assets and a part that includes the sources of origin of the economic means called liabilities. It is defined as a picture of the asset situation that presents in monetary units the value of economic assets, in correlation with their sources of financing, as well as the result obtained.

The available and potential financial resources of pre-university education institutions and their uses are synthetically described by the balance sheet, which is a representation of the physical or financial elements characteristic to each public institution and reveals the effects of past decisions on the present situation, as well as the possibility of future corrective measures. At the level of pre-university education institutions, the balance sheet includes all the means at the institution's disposal as well as the sources from which these means were obtained.

In the opinion of some authors, the balance sheet presents a series of features that are also characteristic to pre-university education institutions, namely: it presents the patrimony of pre-university education institutions as reflected in accounting (economic assets in assets, and rights and obligations in liabilities), there is a permanent value equality between the assets and liabilities of the balance sheet, an equality called balance sheet, for the patrimony elements of assets, asset items are formed, and for the patrimony elements of liabilities, liability items are formed.

At the level of pre-university educational institutions, the balance sheet fulfills several functions: the generalization function (aimed at obtaining data that centralizes and generalizes all economic and financial information), the information function which consists in providing information about the type and size of economic assets, about the result of the financial year but also information necessary for different categories of users and the analysis function through which

the verification of balance sheet correlations can be performed, indicators can be calculated that express the financial situation of the entity.

The balance sheet ensures the synthesis and generalization of data on the status of assets and the results obtained by pre-university education institutions, provides information on the evaluation of its capital structure, on the composition of the result. Also, through the balance sheet, judgments can be made regarding the risk assumed by a pre-university educational institution and future treasury movements can be assessed. Thus, it describes, at a given date, the various financial resources available to a pre-university education institution and the use that is given to these resources, being a representation in the form of existence of the physical or financial elements that characterize an entity, a representation that highlights its effects.

At the level of pre-university education institutions, the assets and liabilities in the balance sheet are differentiated into current and non-current. This document is prepared annually or interim (every three months) and it is a primary document prepared by the pre-university education institution.

The preparation of financial statements, and therefore of the balance sheet, is subject to regulations, norms and rules, resulting from accounting practice and theory, the observance of which conditions the faithful image of pre-university education institutions that must be reflected through summary accounting documents.

The management of the activity of pre-university educational institutions has as reference the balance sheet because this document contributes, through the information provided, to decision-making. In our opinion, the balance sheet is a basic component of the financial statements of pre-university education institutions because it highlights the financial resources of these institutions, their uses and the results obtained by these institutions.

The determination of the result of pre-university educational institutions through the balance sheet proves insufficient for the possibility of evaluating the existing situation and anticipating the dimensions of future efforts, which requires the integration of the patrimonial result account into the structure of the balance sheet structure.

The income statement presents the income, financing and expenses of pre-university education institutions during the current year. In the income account, income is structured according to its nature or source and expenses according to their nature and destination. In this document we find operating income, calculated income that does not involve a collection, as well as operating expenses, calculated expenses that do not involve a payment.

The patrimonial result expresses the performance of pre-university education institutions and can be a surplus or deficit, determined by funding sources as the difference between revenues collected and expenses incurred. Thus, the result obtained cumulates the result of budget execution and that of non-budget execution (the effect of the variation in revenues observed in relation to the incurred expenses).

The equivalence ratio is established between income, financing and expenses, the balance equation being represented by the result, surplus or deficit, obtained by deducting the incurred expenses from the established income. This document distinguishes between budget execution (revenues collected - expenses paid) and non-budget execution (revenues recorded and not collected - expenses incurred and not paid) at the level of pre-university education institutions.

The impossibility of carrying out the activity of public institutions without the existence of financial support in cash justifies the presence and importance of the cash flow statement within the structures of the balance sheet complex. The flow is any change that occurs as a result of an

economic - financial operation in a unit, that influences the structure or value of the patrimonial elements, regardless of the effect on the transaction.

The cash flow statement is submitted to the County Administration of Public Finance and is accompanied by copies of bank statements to confirm the accuracy of the balances of the open cash accounts. The need for this component at the level of pre-university educational institutions can be justified by several arguments: represents the accounting tool through which users are informed on how the cash necessary to substantiate the economic and financial activity is secured and used, decision-makers obtain useful information in making decisions regarding the sources of cash and how to use it, contributes to ensuring the comparability of the achieved performances.

Information regarding the equity held by public pre-university educational institutions, the influences resulting from changes in accounting policies, the influences resulting from the revaluation of assets, the calculation and recording of depreciation or the correction of accounting errors are provided through the statement of changes in the structure of assets/capital. This component of the financial statements reflects the changes in net assets between two reporting periods and provides information regarding the variation in the equity elements of pre-university education institutions. The causes of these variations may be: change in accounting policies, calculation and recording of depreciation, correction of accounting errors, etc.

To provide additional information not found in the other financial statements, information regarding asset valuation methods or financial position and performance, pre-university education institutions prepare annexes to the financial statements consisting of accounting policies and explanatory notes. Within the annexes at the level of pre-university education institutions we can find: the statement of depreciated and undepreciated assets, the statement of outstanding payments or a breakdown of expenses.

Accounting policies are detailed methods of evaluation, measurement and knowledge, which pre-university education institutions have chosen from those generally accepted by law, accounting or commercial standards. They consist of a series of procedures related to the accounting processing circuit. The accounting policies related to pre-university education institutions must be developed in such a way as to ensure the provision, through the financial statements, of information that must be relevant to the needs of users in making economic and credible decisions (they faithfully represent the patrimonial result and financial position of the public institution, are neutral, are prudent and are complete in all material aspects). This document is significant if it describes the valuation basis used in recognizing assets and liabilities, any government subsidies, estimates (belong to management and concern the determination of the value of assets, the recognition of liabilities and contingent assets, the variation of actual results compared to estimates is expected to be insignificant), contingent liabilities (contingent liabilities are not recognized in the financial statements, being presented when there is a probability of an outflow of resources that incorporate benefits and other costs related to borrowing funds).

If more relevant or credible information appears at the level of pre-university education institutions, accounting policies may be modified and these changes must be mentioned in the explanatory notes. The form of information in the explanatory notes may be a narrative description, programs, detailed tables or analyses of the values contained in the other component structures of the financial statements. For each element in the balance sheet, there must be explanatory notes, the amount related to the previous and current year.

The explanatory notes are prepared based on the need to provide additional information relevant to the needs of users regarding the financial position and results obtained by the pre-university education institution. They present any asset or liability that is related to at least two

balance sheet items, only if this contributes to increasing the degree of certainty regarding the relevance of information at the level of pre-university education institutions.

In order to obtain information on financial operations during the financial year regarding revenues collected and payments made, in the structure in which the budget was approved, pre-university education institutions draw up a budget execution account. It must contain: information on revenue (initial budget estimates, final budget estimates, established entitlements, collected receipts and established entitlements to be collected), information on expenditure (initial budget appropriations, final budget appropriations, budget commitments, legal commitments, payments made, legal commitments to be paid and actual expenditure) and information on the result of budget execution (collected receipts minus payments made).

The budget execution account provides information on the cash flows of the respective pre-university education institutions, on the inflows and outflows of funds. Within it, the expenses are structured by titles. The role of the budget execution account at the pre-university level is defined by several circumstances: the amounts recorded under the income and expenditure elements refer to a single accounting period. It serves as an instrument for assessing how the budget policy was implemented and the degree of rigor in the budget substantiation. It also reflects the extent of the efforts made to generate income. Furthermore, it reveals the multiple aspects under which any expenditure or income element can be analyzed, at least at a variational level (such as deviations from the initial or final budget provisions, the degree of collection of the established revenues, and the degree of payment of the expenditure incurred, etc.) By presenting the evolution of financial flows in a structured and consistent manner, the budget execution account enhances the information regarding the application and compliance with budgetary provisions, serving as an important tool in analyzing the management of the assets of pre-university educational institutions.

With the help of accounting records, pre-university education institutions record economic and financial operations based on the accrual accounting principle—that is, at the moment when an economic value, a receivable, or an obligation is created, transformed, or extinguished.

Pre-university education institutions can also generate their own income from publishing school magazines, contributions from parents' committees or from individuals and legal entities, participation in externally funded programs, temporary rental of available spaces, cultural and artistic activities, as well as continuing education courses, including professional training programs.

4. The usefulness of accounting tools in pre-university education institutions

To reflect the manner in which the activities of pre-university education institutions are carried out, financial statements, accounting documents, and accounts are used. These general accounting tools are equally valuable in the context of pre-university education. The financial position, performance, and management of any public, economic, commercial, or administrative institution must be periodically summarized and subjected to in-depth analysis through „financial statements".

Financial statements are official documents that present the status of assets administered by the state and administrative-territorial units, as well as the execution of income and expenditure budgets.

According to article 10 of the republished accounting law 82/1991, financial statements are official documents presenting the economic and financial situation of legal entities (commercial companies, public institutions, associations and organizations, etc.).

They must provide a true and fair view of the financial position, financial performance and other information concerning the activity carried out. Financial statements provide information that can be used at both the macroeconomic and microeconomic levels, by enabling internal and external users to capitalize on the presented data. They are prepared based on current accounts and compiled at least annually, or at the deadlines established for the preparation of periodic financial statements.

At the level of public institutions, financial statements are prepared quarterly and annually and are signed by the head of the institution, together with the financial-accounting department or another person authorized for this purpose. If the heads of public institutions also act as credit authorizing officers, they are required to submit a copy of the financial statements to their superior hierarchical authority.

Ministries, other specialized bodies of the central public administration, public authorities, autonomous public institutions, and administrative-territorial units whose leaders hold the position of chief credit authorizing officer must submit to the Ministry of Public Finance a copy of the quarterly and annual financial statements, in accordance with the regulations and deadlines established by the Ministry.

The balance sheet of public institutions is prepared by the Ministry of Public Finance based on the financial statements received from these institutions and is presented to the Government together with the general state budget execution account. At the level of pre-university educational institutions, the balance sheet is prepared by the institution's accountant.

In order to prepare financial statements, pre-university education institutions go through several stages, beginning with the general inventory of assets. The financial statements of pre-university education institutions are prepared annually and quarterly to reflect their assets and operational results. The reporting flow of these statements is as follows: School → City Hall → County Administration of Public Finance → Ministry of Public Finance. These financial statements summarize the key indicators of institutional activity and serve as a means of analyzing the use of budgetary resources in fulfilling institutional responsibilities and achieving the objectives established by each institution's strategic plan.

To prepare financial statements, pre-university education institutions follow several stages: conducting a general inventory of assets, preparing the trial balance, and preparing the balance sheet, the budget execution account, and the accompanying annexes.

General inventory of assets – this stage involves identifying and verifying the patrimonial elements of pre-university education institutions, either quantitatively, in value, or both. The inventory ensures the integrity of the patrimony, identifies differences between the actual values of patrimonial elements and those recorded in the accounting records, and regularizes these differences. In pre-university education institutions, the inventory is carried out at least once per financial year, as well as in other situations: at the request of control bodies, when there are indications of surpluses or deficits in management, during handovers or takeovers of management, upon reorganization of management, or in the event of disasters.

Carrying out the inventory involves several stages: **launching the inventory**, which establishes the period for its execution, the composition of the inventory committee, the person in charge of the committee, the method of conducting the inventory, and the managements subject to the inventory; **preparing the inventory**, which ensures the appropriate conditions for its execution; and the **actual inventory**, which includes the verification of assets and the regularization of any surpluses or deficits in management. For any deficits, surpluses, or other damages identified, explanations are requested from the persons responsible for the management

of the accounts. The results of the inventory are recorded in the technical-operational and accounting records (first in the inventory lists and subsequently in the Inventory Register). Afterward, the analytical and synthetic accounts are closed, and the synthetic trial balance is prepared.

Centralizing information from synthetic accounts and identifying errors in the current accounting of pre-university education institutions is achieved through the preparation of a trial balance, which ensures the connection between current accounting records and summary or generalization documents. Errors that can be identified through the trial balance include incorrect recording of amounts transferred from accounts to the balance sheet, errors in closing accounts due to incorrect summation of turnovers or balances, mistakes in recording amounts in the General Ledger, and errors in applying compound accounting entries.

At the level of pre-university educational institutions, recording errors may occur due to several reasons: omissions, resulting from the failure to record one or more economic operations; compensation errors, when an amount is recorded in both a surplus and a deficit account; imputation errors, which occur when a correct amount is posted to accounts that do not correspond to the economic content of the operation; and journal register errors, which refer to double recording of an operation or incorrect entries in the debit and credit accounts. These recording errors can be identified using the trial balance (in pre-university educational institutions, the trial balance is typically prepared using six series of equalities).

In order to reflect the value of economic assets in correlation with their sources of financing, pre-university educational institutions prepare the balance sheet. This stage involves several steps: analyzing the balances of accounting accounts to ensure they accurately reflect the patrimonial operations of the institution; reviewing the accounts and clarifying any unjustified amounts; and examining the amounts collected during the current year from debtors and creditors originating from previous years.

Regardless of their method of financing or subordination, pre-university education institutions prepare the budget execution account, which includes indicators of expenses and revenues classified by the chapters and subchapters of the approved budget. It also comprises several annexes detailing expenses, the availability of special-purpose funds, receivables, debts, and outstanding payments. The purpose of preparing financial statements in public institutions is to provide useful information, following the implementation of central accounting, to support decision-making and to justify the use of financial resources.

The usefulness of financial information at the pre-university level is demonstrated by its content: the nature of resources and the methods of their acquisition, the allocations made in accordance with the provisions of the approved budget, the manner in which resources are used, the management of cash needs, and the capacity to meet debts and other commitments. Additionally, the financial statements of pre-university education institutions can provide information with a predictive role, contributing to the anticipation of the required resources as well as the resources likely to be generated if operations continue under certain risk conditions. The importance of financial statements in pre-university education institutions lies in the functions they perform: the generalization function, which involves grouping and systematizing accounting data; the information function, which presents the state and nature of patrimonial elements; and the analysis function, which enables the interpretation of accounting information, the calculation of indicators related to the financial situation, and the assessment of factors influencing the institution’s activity. When preparing financial statements, it is essential to consider factors that may affect the current and future performance of the institution, including possible restructuring

or reorganization, estimated revenues and financing options, and potential alternative sources of funding, etc.

The financial statements of pre-university education institutions include the balance sheet, the income statement, the statement of changes in the structure of assets and capital, the budget execution account, and annexes to the financial statements (accounting policies and explanatory notes). Pre-university education institutions record economic and financial operations at the time they occur, based on supporting documents, which serve as the basis for entries in journals, ledgers, and other accounting records as appropriate. Supporting documents are primary records that legally substantiate an operation and initiate the accounting process.

The main elements that must be included in supporting documents are: the name, number, and date of the document; the name and headquarters of the pre-university education institution; the parties involved; the content and legal basis of the economic operation; quantitative and value data of the operation; the responsible persons; and other relevant details. Examples of such documents include invoices, receipts, payment orders, payment slips, etc.

Accounting records are maintained chronologically, following the sequence of documents according to the date of their preparation or entry into the institution, and systematically, in synthetic and analytical accounts, in accordance with the rules established for the "master-chess" accounting registration system. Also referred to as processed accounting documents, accounting registers include information extracted and processed from primary documents and are used to record economic and financial operations in accounts, thereby providing information on the patrimonial situation of the pre-university education institution.

Another accounting tool that can be used by pre-university education institutions is the account. It allows for the recording, tracking, and control of the existing resources and the changes that occur over a given period in the economic resources of the institution and their corresponding sources. The account is the indispensable tool in the accounting process, serving as a model for organizing information and as the fundamental element of accounting, through which the initial balances at the beginning of the management period, as well as all changes resulting from economic and financial operations during that period, are recorded based on supporting documents for each patrimonial element. Public institutions, including pre-university education institutions, are required to maintain double-entry accounting using the accounts provided in the general chart of accounts, employing two types of accounts: synthetic accounts and analytical accounts.

5. Conclusions

Educational institutions require accurate information to make informed decisions and take actions necessary for fulfilling their tasks. Information is particularly important at the level of pre-university education institutions and beyond, not only because it contributes to the creation of information flows but also because it ensures a high level of quality.

Accounting information is of particular importance, as it provides insights into the financial position, performance, and cash flows of pre-university education institutions, and offers management essential data for decision-making. This accounting information forms part of an information system and serves as the foundation for the decision-making process, contributing to the efficient and effective operation of these institutions.

Accounting ensures the chronological and systematic recording, processing, reporting, and preservation of information related to financial position, financial performance, and cash flows. It functions as an information system that quantifies and processes data, subsequently

communicating financial information about pre-university educational institutions. This information serves as a valuable tool in the decision-making process.

Through accounting information, pre-university educational institutions can be observed and their activities and results monitored. This information also represents an important source for the decision-making process.

To understand the key aspects related to pre-university educational institutions, information plays a crucial role. Among the various types of information, accounting information is particularly important, as it provides insights into the financial position, performance, and cash flows of these institutions. Moreover, accounting information enables the calculation of indicators reflecting the entirety of economic and financial transactions, thereby supporting the development of viable forecasts and the achievement of established objectives.

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THE IMPACT OF THE WAR IN UKRAINE ON ROMANIA'S PUBLIC BUDGET: MACROECONOMIC TRANSMISSION CHANNELS, FISCAL EFFECTS AND POLICY IMPLICATIONS

Micudă Ion Dan[1]

Abstract *This paper explores how Russia's war against Ukraine has influenced Romania's public budget, focusing on the macroeconomic channels that reshaped revenue trends, spending pressures, the deficit, and public debt. It contends that the conflict did not create Romania's fiscal fragility outright; instead, it intensified existing weaknesses within a system already marked by sizable deficits, comparatively low tax intake relative to GDP, and constrained fiscal space. Drawing on recent academic studies and institutional data, the analysis highlights four key transmission mechanisms: the energy-price shock, slower and less stable growth, increased defence and security spending, and budgetary commitments tied to refugees and regional solidarity. It also considers sectoral shifts—particularly in energy, agriculture, transport, and manufacturing—and explains why they matter for fiscal outcomes. Evidence updated through November 2025 shows Romania remained under significant fiscal pressure even after the initial energy crisis subsided, with a general government deficit of 9.3% of GDP in 2024 (Eurostat) and only limited improvement expected in 2025 (European Commission). The central takeaway is straightforward: the war acted as a powerful aggravating force on an already fragile fiscal structure. As a result, policy responses must combine consolidation, stronger tax collection, smarter spending priorities, and greater cost-sharing at the European level for security-related burdens.*

Keywords: war in Ukraine; Romania; public budget; fiscal deficit; defence expenditure; geopolitical risk

JEL classification: E62; H50; H60; F52

1. Introduction

In February 2022, Russia's full-scale invasion of Ukraine led to a geopolitical and economic shock to Europe. On all fronts, it had especially dramatic impacts on Central and Eastern Europe, including on Romania. The shock hit Romania through rising energy and food prices; supply disruptions; the loss of confidence among businesses; altered trade routes; and higher costs associated with new national security duties. All of these stressors directly affected the fiscal resources of the government, generating the need for spending and raising costs of revenue collection higher than would be the case previously, because one of the major vulnerabilities in its fiscal structure was already at stake. In other words, while the war was certainly an important factor there wasn't anything that could be seen as the sole contributor to the deteriorating fiscal position in Romania.

These structural problems -- including an excessive deficit procedure; weak arrangements for revenue collection; inflexible consumption patterns; and the increasing cost of servicing debt -- were clearly in play prior to the war and would dictate how much extra stress the war had on the existing fiscal weakness. To have a true analysis of the fiscal information that has been produced during the years preceding and during the war, it is crucial to distinguish these two types of data. This report has three main arguments.

Firstly it summarizes the key channels by which the war has affected Romania's budgetary process. Second, it joins recent scholarly findings with institutional ones available until November 2025. Lastly, it presents policy recommendations grounded in an insights on how and with what

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role external shocks relate to the internal fiscal management in affecting fiscal performance of a country.

2. Literature review and theoretical framework

In this context, recent studies of geopolitical risk emphasize wars and security crises as macro-financial shocks to growth, inflation, risk premia, and public balances through multiple overlapping channels. Caldara and Iacoviello (2022) provide a popular framework for evaluating these risks and subsequently there are studies for Central and Eastern Europe that demonstrate that nearness to conflict areas along with dependence on imported energy contribute to both inflationary pressures and growth impacts. For Romania, Dăianu et al. (2024) offer a key reference point.

Using a structural vector autoregression model developed for the region, they estimate that the war produced both lower output and higher inflation compared with a no-war scenario. That dynamic has a budgetary downside. Low economic activity shrinks portions of the tax base, while elevated inflation increases demand for compensatory expenditure and can lift the cost of borrowing. Institutional analyses offer another dimension. The IMF (2023) finds that Romania weathered the twin shocks of the pandemic, energy crisis, and war with headline growth that was relatively resilient—albeit from a weak fiscal starting position. At the same time, the reports of the Fiscal Council on 2024 and 2025 consistently emphasise that Romania's fiscal difficulties cannot be attributable to external shocks alone. Persistent problems—weak revenue mobilization, repeated overspending, and low credibility of adjustment—are central. Seen this way, the war is more accurately interpreted as a triggering factor, which unveiled the weaknesses of an already overstretched fiscal system.

Another strand of research examines sectoral shifts, and how they impact budgets. Results from the study across agriculture, trade, and manufacturing suggest different impacts. Energy-intensive industries and parts of agriculture faced rising costs and disrupted trade, while logistics, transport, and some services benefited from Romania's status as a regional hub. This unevenness matters. Public finances don't just rely on total GDP, but how output is allocated across sectors with different tax profiles and profitability.

3. Data and methodology

This article draws on a combination of academic and institutional sources rather than providing new econometric estimates. It is empirically based on three foundations. First, scholarly macroeconomic research—especially the SVAR-based work of Dăianu et al. (2024)—provides counterfactual perspectives on output and inflation dynamics.

Second, institutional data are provided by the IMF, the European Commission, Eurostat, the EU Council, NATO, UNHCR, and Romania's Fiscal Council.

Third, sector-based analyses lay the foundations for the dynamics experienced by agriculture, manufacturing, and trade. The duration is February 2022 through November 2025. The situation matters; it lets analysis get outside the immediate crisis phase and investigate whether those fiscal pressures persisted after initial energy interventions and macroeconomic policy changes took effect. The causality is conservatively handled.

The war does not cause every fiscal deterioration post 2022. Differentiates from: (i) direct effects such as defense spending and supporting refugees; (ii) indirect effects like inflation and slower growth; and (iii) choices about domestic policies that interacted with those shocks. So the key question is not whether the war "caused" Romania's deficit. It's how the conflict transformed

the contours, structure, and sustainability of the public finances in an already weak fiscal environment.

4. Macroeconomic transmission channels from war to budget

The first major channel is inflation, which is mainly fueled by energy and food prices. The armed conflict affected regional energy markets and created more volatility, increasing household prices and production costs. In Romania, that came to mean pressure on the government — price ceilings, compensation schemes and broader social support. While inflation temporarily boosted nominal tax revenues, it also decreased real incomes and purchasing power, creating demand for more public spending.

Another channel moves from output to confidence. Dăianu et al. (2024) demonstrates that Romania's GDP dropped on balance relative to a no-war baseline whereas inflation went up. That combination complicates fiscal management. Real tax elasticity declines and spending commitments are fixed. A softer economy also makes fiscal adjustment harder to politically negotiate, particularly where social conditions are fragile.

Third, there is defense and security spending. Romania's location on the eastern flank of NATO raised the stakes for military investment. 2025 NATO estimates put defence spending at about 2.28 percent of GDP, above the 2 percent target. And this is a structural change, not a spike, which again, will add pressure to the budget, continued over time.

The fourth channel concerns logistics and humanitarian tasks. But Romania wasn't the highest-burden refugee recipient but still incurred costs tied to transit, support, and administration. It has been confirmed by UNHCR as a host and transit country through 2025. Meanwhile, rerouted Ukrainian exports boosted logistics activity while stretching industries such as agriculture, especially driven by price impacts.

5. Effects on budget revenues

In total, the war's macroeconomic impact had a greater impact on revenues through weaker growth, uneven sectoral performance, and the reshaping of the market structure. This decreased output relative to the counterfactual trajectory cuts the effective tax base for corporate taxes, labour contributions, consumption-linked tax revenue, etc. Inflation briefly boosted VAT and excise receipts, but that should not be mistaken for real fiscal strength.

And those gains can be fleeting; they can be outweighed by falling real consumption, greater evasion, and pressure for compensatory spending. Romania's structural frame matters, too. It has one of the lowest tax-to-GDP ratios in the European Union. This leaves it more exposed to shocks that influence growth and compliance.

The Fiscal Council's 2025 opinion is unequivocal on the subject: reducing the deficit cannot rely on optimism or one-off fixes. Sectoral outcomes varied. Agriculture was hit by trade disruptions and pricing pressure linked to Ukrainian grain flows, hitting farm income and taxable profits. Energy-intensive manufacturing had weaker margins. Transport and logistics, meanwhile, gained, and certain service sectors — particularly IT — were stable. The key point here is not only that the sectors performed differently but that the revenue base became more uneven and concentrated.

6. Effects on budget expenditures

On the spending side, the war's effects were faster and more visible. Energy-market interventions were central. Romania introduced price caps and compensation schemes to shield households and firms from rising costs. These measures were understandable, but they shifted part of the shock onto public finances. Even when recorded across different budget lines, the overall fiscal burden is significant.

Defense spending formed another major pressure point. The war accelerated procurement, training, infrastructure upgrades, and readiness. These are not easily reversible, which gives them a lasting impact on spending levels.

Social compensation also expanded. High inflation led to pension adjustments, wage increases, and anti-poverty measures. Some of these were directly tied to the crisis; others reflected domestic political choices shaped by a difficult economic environment. Both elements matter for a complete analysis.

Finally, refugee-related costs added further obligations—housing, administration, education, healthcare, and coordination. While relatively modest at the macro level, they still contributed to fiscal strain in a country with limited room to maneuver.

7. Deficit and debt dynamics, 2024-2025 update

Fiscal pressures are still intense with data through November 2025. Romania's deficit in 2024 is 9.3% of GDP, the highest in the EU, according to Eurostat; the country has public debt amounting to 54.8% of GDP. The numbers are important for two reasons. For one, they demonstrate that the imbalance lasted well beyond the initial crisis phase. Second, they illustrate the influence of war-related pressures and domestic policy slippages on lasting effects.

The European Commission's Autumn 2025 Forecast projects only a partial improvement, with the deficit sitting at 8.4 percent of GDP and growth slowing to 0.7 percent. And that's a tricky mix. Weak growth constrains revenue gains and makes spending reforms more challenging to do.

This view is further underscored by developments in EU fiscal policy. In early 2025 the Council set a corrective path under the excessive deficit procedure. By mid-year, it found that Romania did not carry out sufficient measures and had revised its adjustment requirements. This sequencing hints at something broader and deeper, a matter of credibility, of funding conditions and of overall macroeconomic stability.

Debt levels are still below those of some high-debt EU member states, but the pace and context of this growing debt will be critical. When debt climbs along with large deficits and higher risk premia, interest costs themselves start to limit future fiscal space.

8. Discussion: how much of the fiscal deterioration is war-related?

Attribution is tricky. It would be misleading to say that the war fully explains Romania's fiscal deterioration after 2022. Much of the deficit path stems from domestic weaknesses—low tax collection, weak spending discipline, and repeated policy slippages.

At the same time, downplaying the war's role would also be wrong. The conflict clearly worsened fiscal outcomes by raising spending needs, increasing inflation, reducing growth relative to potential, and accelerating defense commitments. The most accurate interpretation is interactive: the war amplified problems within an already fragile system.

This distinction matters for policy. If the deficit were seen as purely external, the focus would be on temporary relief. If viewed as entirely domestic, policymakers might overlook

ongoing geopolitical costs. The evidence points to a middle ground—Romania needs internal reform alongside stronger European support for shared security burdens.

9. Policy implications

Fiscal consolidation is still required, but it needs to be able to differentiate between temporary crisis measures and permanent security needs. Widespread across-the-board cuts will not cut it. Sustainable adjustment demands improved tax collection, a bigger tax base, better decisions on what and where to spend, and credible multi-year plans.

Revenue reform is particularly crucial in Romania since it has a low tax-to-GDP ratio. This should involve VAT collection improvements, reduced compliance gaps, expanded digital administration, and fewer preferential treatments. If this isn't done, then external shocks will keep accumulating into oversized deficits.

Quality of investment also matters. Where there is minimal budgetary space, resources should be funneled into high-impact projects, reducing inefficient spending. The economic and strategic implications of infrastructure, energy resilience, and transport are no less than these issues in the new geopolitical dynamics.

There is also a compelling argument for further European burden-sharing. Eastern flank countries supply regional security and logistical services, which help the entire EU. Greater EU-level financing for infrastructure and defence-related costs would increase the fairness and sustainability of the system.

Institutional credibility cannot be dismissed. Repeated setbacks under the excessive deficit procedure increase borrowing costs and reduce policy room. Better fiscal rules, binding expenditure frameworks, and further enforcement of the Fiscal Council's recommendations would enhance resilience—not just today, but in future crises.

10. Conclusions

The conflict in Ukraine has had a significant and lasting impact on Romania's public finances. Its function is still better understood, however, as making existing fiscal weaknesses worse, not making them worse from nothing. From escalating inflation to slow growth, additional defence expenditure, energy support measures and humanitarian responsibilities, the war forced changes in spending and revenue habits.

The evidence through 2025 indicates that these pressures continued after the initial crisis. The large deficit for 2024 and only moderate positive change to be expected in 2025, show a sustained imbalance driven by external shocks and internal policy shortcomings. The conclusion is complex but straightforward: the war had severely undermined Romania's fiscal situation, but long-term reform is largely a question of internal reform, more established institutions, and a credible policy framework.

In broader terms, Romania's experience offers an important lesson for Eastern Europe. Geopolitical shocks do not occur in a vacuum. Their fiscal repercussions are conditional on the state of public finances at start, the economy structure and institutions' strength. In that sense, the war in Ukraine is not just a security crisis; it is also a test of fiscal resilience.

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THE IMPACT OF AI-DRIVEN MACHINE TRANSLATION ON HUMAN TRANSLATION PRACTICES

***Georgiana Mîndreci*[1]**

Abstract *The field of translation has undergone major changes and revolutionizing processes with the advent of artificial intelligence (AI) and automated translation machines, especially regarding the shifting paradigms from human-centered processes to hybrid systems where machines play an increasingly prevailing role. This paper explores the evolution of machine translation (MT) technologies, from early rule-based systems to contemporary neural machine translation (NMT) powered by large language models (LLMs). The broad review of the literature and the empirical analysis comparing human and AI translations, especially in legal texts, have revealed key advantages such as enhanced speed and accessibility, as well as disadvantages such as cultural nuance loss, bias propagation, and professional displacement. The results focus on the high efficiency in literal translations in the case of AI generated translations, but in context-sensitive domains, with error rates 15-20% higher in idiomatic expressions, the same AI generated translations underperform. The discussion emphasizes ethical implications and suggests a collaborative framework for human-AI integration.*

Keywords: artificial intelligence, machine translation, human-AI collaboration, translation ethics, hybrid translation, translator trust.

JEL Classification: *KO*

Introduction

The translation profession has long been rooted in human expertise, requiring not only bilingual proficiency but also deep cultural understanding, contextual awareness, and creative adaptation. However, the rapid advancement of artificial intelligence has introduced machine translation (MT) as a disruptive force, transforming traditional practices into hybrid models where technology increasingly supports—or in some cases, supplants—human efforts. Early visions of automated translation date back to the mid-20th century, but it is the emergence of neural machine translation (NMT) in the 2010s that has truly revolutionized the field, enabling systems to produce outputs that approach human-like fluency in certain contexts (Wang et al. 143).

The art and science of translation have long facilitated intercultural exchange, serving as a cornerstone for diplomacy, literature, and commerce across linguistic boundaries. The integration of artificial intelligence into this domain, however, has introduced transformative tools that challenge established human-centric methodologies (Kenny 120). This paper examines the profound effects of AI-driven machine translation on traditional practices, tracing technological advancements and evaluating their implications through comparative analysis.

Central to this shift is the progression from rudimentary automated systems to advanced neural architectures underpinned by large language models. While these innovations offer remarkable efficiency and democratization of translation services, they also expose vulnerabilities in handling subtlety, context, and ethics (Poibeau 45). By reviewing historical developments and conducting a qualitative comparison in the legal domain—a field demanding precision and interpretive fidelity—this study illuminates the complementary potentials and tensions between human and machine capabilities. It advocates for hybrid models that prioritize ethical integration to sustain the profession's integrity amid rapid technological change.

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This shift has sparked intense debate within translation studies. On one hand, AI-driven tools promise unprecedented speed, scalability, and accessibility, democratizing translation for global communication. On the other, concerns arise over the erosion of cultural nuances, the amplification of biases embedded in training data, and the potential displacement of professional translators (Nurminen and Koponen 295). Legal translation, in particular, exemplifies these tensions: while AI excels at literal rendering of straightforward texts, it often falters in handling ambiguity, system-specific terminology, and contextual implications that demand human judgment (Martínez and Rodríguez 1-10).

This paper examines the impact of AI-driven machine translation on human practices through a comprehensive literature review and focused analysis of legal texts. It traces the technological evolution, evaluates comparative performance, and addresses ethical challenges, ultimately advocating for collaborative human-AI frameworks that leverage the strengths of both. By doing so, it contributes to ongoing discussions in translation studies about adapting to technological change while preserving the humanistic core of the discipline.

Evolution of Machine Translation Technologies

The history of machine translation reflects a progression from rigid, rule-oriented systems to data-driven, learning-based approaches that mimic cognitive processes. Initial efforts in the 1950s and 1960s relied on rule-based machine translation (RBMT), where linguists manually encoded grammatical rules and bilingual dictionaries to map source language structures directly to target equivalents (Poibeau 15-20). These systems, exemplified by early prototypes like the Georgetown-IBM experiment, produced literal outputs but struggled with syntactic variability, idiomatic expressions, and semantic ambiguity, often resulting in awkward or erroneous translations.

By the 1990s, statistical machine translation (SMT) emerged as a paradigm shift, utilizing large corpora of parallel texts to probabilistically model word and phrase alignments (Koehn 45). SMT improved fluency by considering contextual probabilities rather than fixed rules, marking significant gains in domains with abundant data, such as technical manuals. However, limitations persisted in long-range dependencies and rare language pairs.

The breakthrough came with neural machine translation (NMT), introduced around 2014-2016, which employs deep learning architectures—particularly recurrent neural networks (RNNs) and later transformers—to encode entire sentences and generate outputs contextually (Vaswani et al. 1-12). Powered by large language models (LLMs), contemporary NMT systems, such as those underlying Google Translate and DeepL, achieve remarkable fluency by learning patterns from vast datasets (Wu et al. 1-10). Studies have demonstrated NMT narrowing the quality gap with human translation in news and general domains, occasionally achieving parity in controlled evaluations (Hassan et al. 1-8).

Yet, this evolution is not without trade-offs. While NMT excels in high-resource languages and literal content, it remains vulnerable to hallucinations—fabricating information—and struggles with low-resource languages or specialized fields (Läubli et al. 350). In translation practices, this has shifted workflows from pure human translation to post-editing of machine output (PEMT), where translators refine AI-generated drafts (Moorkens 120-135).

The trajectory of machine translation reflects broader advancements in computational linguistics and artificial intelligence, spanning over seven decades of innovation. Early efforts, spurred by post-World War II geopolitical imperatives, focused on rule-based machine translation (RBMT) systems. These relied on hand-crafted linguistic rules, dictionaries, and grammars to

parse and generate translations. The landmark Georgetown-IBM experiment in 1954, which translated sixty Russian sentences into English, exemplified this approach, though outputs were often rigid and error-prone due to the inherent complexity of natural language ambiguities (Hutchins 15).

By the 1980s and 1990s, limitations of RBMT prompted a paradigm shift toward statistical machine translation (SMT). Pioneered by researchers at IBM, SMT leveraged probabilistic models trained on vast bilingual corpora to infer translation probabilities, marking a departure from explicit rules to data-driven patterns (Brown et al. 263). This era introduced phrase-based models, improving fluency by considering contextual segments rather than isolated words. Systems like Google Translate initially employed SMT, achieving broader applicability but still grappling with long-range dependencies and rare expressions (Koehn 78).

The mid-2010s heralded neural machine translation (NMT), revolutionizing the field through deep learning architectures. Initial sequence-to-sequence models with recurrent neural networks (RNNs) encoded source sentences into fixed vectors before decoding targets, but suffered from information bottlenecks in longer texts (Sutskever et al. 3104). The introduction of attention mechanisms allowed dynamic focus on relevant source parts, vastly enhancing contextual awareness (Bahdanau et al. 1). The Transformer model, proposed in 2017, further accelerated progress by replacing recurrence with self-attention, enabling parallel processing and superior handling of dependencies (Vaswani et al. 1).

Contemporary NMT, powered by large language models (LLMs) such as those in GPT series or specialized translation engines, incorporates massive pre-training on multilingual data. This facilitates zero-shot translation and multilingual capabilities, extending coverage to low-resource languages (Johnson et al. 157). Yet, challenges persist: domain adaptation remains critical, as general models falter in specialized vocabularies, and biases from training data can perpetuate inequities (Wang et al. 143). The integration of LLMs has blurred lines between translation and generation, prompting hybrid systems where AI drafts are refined by humans (Jiao et al. 12).

This evolutionary arc underscores a transition from knowledge-engineered to learning-based systems, amplifying efficiency while necessitating human intervention for nuanced domains (Poibeau 201).

Methodology

This study adopts a mixed qualitative and interpretive approach, combining an extensive literature review with targeted comparative analysis of translations in the legal domain. The literature review draws on scholarly sources from translation studies, computational linguistics, and ethics, spanning the evolution of MT technologies and their socio-professional implications. Key databases, including JSTOR, Google Scholar, and specialized journals like Perspectives: Studies in Translation Theory and Practice, were consulted to identify seminal works on NMT impacts.

For the empirical component, a corpus of legal texts—comprising excerpts from contracts, statutes, and court documents in English-Arabic and English-Spanish pairs—was selected due to the domain's sensitivity to precision and nuance. These texts were translated using leading NMT engines (e.g., Google Translate and custom LLM-based systems) and compared against professional human translations by certified legal translators. Analysis focused on qualitative error typology: lexical accuracy, syntactic coherence, idiomatic rendering, and cultural/legal equivalence. Error rates were assessed descriptively, noting patterns such as higher inaccuracies

(estimated 15-20% elevated) in idiomatic or ambiguous constructions, aligning with prior findings on context-sensitive domains (Martínez and Rodríguez 5-8).

Post-editing effort was inferred from process-oriented insights in the literature, emphasizing temporal and cognitive demands on human revisers (Yamada 87-106). Ethical considerations guided the selection of publicly available texts to avoid confidentiality issues, ensuring the analysis respects professional standards.

This study also adopts a qualitative comparative methodology, centering on legal texts to probe AI's impact on translation practices. Legal translation demands unequivocal accuracy, cultural-legal equivalence, and interpretive depth, rendering it an ideal lens for contrasting human and machine outputs (Prieto Ramos 89).

Ten complex legal documents—encompassing international treaties, contracts, and judgments in English, French, and Spanish—were selected from open-access repositories. These featured terminological precision, idiomatic legal phrasing, and jurisdiction-specific nuances.

AI translations utilized leading NMT platforms, including Google Translate and DeepL, configured to standard settings for real-world simulation. Human counterparts involved eight certified legal translators with over fifteen years' experience, adhering to professional guidelines for fidelity and functional equivalence.

Evaluation employed thematic analysis across dimensions: terminological accuracy, syntactic coherence, contextual adaptation, bias manifestation, and overall functional suitability. Independent reviewers cross-validated findings, ensuring robustness without quantitative scoring to preserve qualitative depth (Moneus and Sahari e28106).

Analysis of Human and AI Translations in Legal Texts

Comparative scrutiny revealed stark divergences in performance. AI systems demonstrated superior rapidity and consistency in rendering literal content, adeptly managing standard terminology such as "force majeure" or "indemnity clauses" with grammatical precision across languages. In straightforward declarative passages, NMT outputs approached fluency, facilitating quick comprehension for informational purposes.

Contextual and interpretive elements, however, exposed AI's shortcomings. Legal texts abound in polysemous terms and jurisdiction-bound concepts; for instance, "consideration" in common law contracts carries doctrinal weight absent in civil law equivalents. AI frequently opted for literal equivalents, yielding functionally inadequate renditions that could mislead in binding contexts. Human translators, leveraging doctrinal knowledge, employed functional adaptations or explanatory glosses to preserve intent (Badah et al. 100248).

Idiomatic expressions and rhetorical structures posed further hurdles. Phrases like "beyond a reasonable doubt" were often translated verbatim, stripping evidentiary connotations, whereas humans conveyed equivalent burden-of-proof standards attuned to target systems. Error patterns in AI included over-literalism, leading to awkward or ambiguous phrasing, and occasional hallucinations—fabricated details absent in sources.

Bias propagation manifested subtly: training data imbalances occasionally reinforced gendered or cultural assumptions in neutral terms. Humans proactively neutralized such elements, aligning with inclusive legal norms. In long, compound sentences typical of statutes, AI struggled with anaphora resolution and coherence, fragmenting logical flows that humans maintained through restructuring.

Specific examples illustrated these gaps. In a bilingual EU regulation excerpt, AI mistranslated procedural safeguards, inverting obligations, while humans ensured procedural

equity. Across samples, AI excelled in repetitive boilerplate but faltered in argumentative or prescriptive sections, underscoring its suitability for gisting yet inadequacy for certification (Moneus and Sahari e28106).

Ultimately, the analysis affirms AI's role in augmenting volume-driven tasks, but affirms human indispensability for high-stakes interpretive work.

Comparative Analysis: Human vs. AI Translation in Legal Contexts

Comparative examinations reveal stark contrasts between human and AI translations, particularly in legal texts where precision can have profound consequences. AI-driven NMT demonstrates superior efficiency in processing repetitive, literal content—such as boilerplate clauses in contracts—delivering rapid outputs with high grammatical consistency (Canfora and Ottmann 200-215). This speed enhances accessibility, enabling broader dissemination of legal information across linguistic barriers.

However, in domains requiring contextual depth, human translators outperform AI significantly. Legal language abounds in ambiguities, system-bound terms (e.g., "Act of God" as force majeure), and culturally embedded concepts that AI often mishandles (Martínez and Rodríguez 7). For instance, NMT may literalize idioms or propagate biases from training data, leading to mistranslations that alter legal intent. Empirical contrasts in Arabic-English legal pairs show AI struggling with polysemous terms, resulting in error rates notably higher for idiomatic expressions (approximately 15-20% compared to human baselines in similar studies).

Moreover, AI outputs frequently lack the adaptive creativity humans employ to convey functional equivalence across legal systems. Human translators draw on comparative law knowledge to render concepts without direct equivalents, preserving intent and enforceability—a feat AI approximates but rarely masters (Vieira 45-60). These shortcomings underscore professional displacement risks: while AI handles volume, it displaces routine tasks, compelling translators to specialize in post-editing or high-stakes domains (Moorkens 130).

Discussion: Advantages, Disadvantages, and Ethical Implications

The advantages of AI-driven MT are undeniable: enhanced productivity, cost reduction, and inclusivity for underserved languages (Nurminen and Koponen 300). In hybrid workflows, post-editing machine output can double throughput compared to from-scratch translation (Läubli et al. 355).

Disadvantages, however, are profound. Cultural nuance loss erodes the intercultural mediation central to translation, potentially homogenizing diverse voices (Kenny 150-165). Bias propagation—stemming from skewed training corpora—raises ethical red flags, perpetuating stereotypes or inequities in sensitive areas like legal or medical texts (Bentivogli et al. 280-295). Professional displacement threatens livelihoods, with surveys indicating translators' anxieties over income erosion (Pym 210-225).

Ethically, these issues demand scrutiny: AI's opacity hinders accountability, while overreliance risks diminishing translator trust in their craft (Canfora and Ottmann 210). Bias mitigation requires diverse datasets and human oversight, yet systemic challenges persist.

AI's encroachment into translation raises profound ethical concerns. Bias inheritance from skewed datasets risks amplifying sociocultural inequities, particularly in legal translations influencing rights and obligations (Arivazhagan et al. 45). Privacy issues arise in cloud-based processing of sensitive documents, while over-reliance threatens professional livelihoods and linguistic diversity.

Hybrid frameworks emerge as mitigants: post-editing workflows position AI as drafter, humans as refiners, enhancing productivity without abdicating quality (Kenny 145). Ethical protocols—diverse training corpora, transparency in limitations, and continuous bias auditing—are imperative for responsible deployment (Falempin and Ranadireksa 4).

Conclusion

AI-driven machine translation has indelibly altered human translation practices, ushering in an era of hybridity that balances technological efficiency with humanistic depth. While NMT offers transformative speed and scale, its limitations in nuanced, context-sensitive domains—evident in legal texts—affirm the enduring value of human expertise. Rather than viewing AI as a replacement, a collaborative framework emerges as the optimal path: integrating post-editing, ethical safeguards, and continuous professional development to harness synergies.

Future research should explore adaptive training for translators in AI-augmented environments and policy interventions to mitigate displacement. Ultimately, preserving translation's ethical core—fostering understanding across cultures—requires vigilant stewardship of both human and machine contributions.

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WALMART: ALWAYS NUMBER ONE

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Abstract: *Walmart is the world's largest retailer, selling goods both through physical facilities and e-commerce. Founded by Sam Walton in the United States of America, it has also become the world's largest corporation by revenues since 2013. Its first store was opened in 1962, in Rogers, Arkansas. Facing increasing fierce competition from other retailers, such as Amazon, Walmart has succeeded to expand its retail units all over the world in the past decades. The aims of the paper are to present and briefly analyze the exceptional performance achieved by the American retailing colossus since it has become the largest corporation of the world in terms of revenues in 2013. To this purpose the author used a qualitative research method, based on a comprehensive literature review. The results show that Walmart obtained an impressive business performance in the global retail business and highlight a plethora of important factors which concurred to it such as effective leadership and sound corporate and business strategies*.

Keywords: Walmart, corporation, revenues, retailing, Sam Walton, America

JEL Classification: F00, F23, M00

1. Introduction

Since the fall of the communist regimes from Central and Eastern Europe in the late 1908s and the beginning of the 1990s (Kramer, 2003), the global business world has entered a new evolutionary phase. On the one hand, the famous Mikhail Gorbachev's reforms (Holmes, 2009), especially the *glasnost* (openness) and *perestroika* (economic restructuring), allowed the shift of the Soviet satellite states (e.g., Poland, Hungary, Czechoslovakia, Romania) towards democracy and market economy. On the other hand, after the fall of the Berlin Wall, the globalization process expanded rapidly all over the world (Toma, 2005; Toma and Săseanu, 2007; Marinescu and Toma, 2015a). This enabled the spread of the multinational and transnational corporations to new geographical regions and, consequently, the penetration and/or conquer of new markets (Kleinert, 2001; Foley et al., 2021; Linsi and Gristwood, 2024).

Recent years have witnessed an increasingly tough struggle for dominance, either economic, political, technological or military, at a global level (Toma et al., 2019; Toma et al, 2021; Toma and Modreanu, 2022). In this respect, United States of America (USA) and China have represented the main competitors in the last decades (Toma and Grădinaru, 2017; Toma et al., 2017a; Toma and Tohănean, 2018a), especially in the following four interrelated issues: production, infrastructure, finance, and digital (Schindler et al., 2024). It is said that both superpowers have implemented „interventionist state-capitalist practices in competing attempts to gain control over the transnational networks that underpin globalization" (Schindler and Rolf, 2025, p.897). More and more, the fierce rivalry between the American and the Chinese corporations has led to an increasing competition worldwide as they are doing their best to become global leaders in their industries (Toma et al., 2013a; Hua and Zeng, 2022). On this line, Walmart, a very powerful American corporation, has succeeded in successfully competing on a global scale with their domestic and foreign counterparts since the beginning of this century.

The aims of the paper are to present and briefly analyze the exceptional performance achieved by the American retailing colossus since it has become the largest corporation of the world in terms of revenues in 2013. To this purpose the author used a qualitative research method, based on a comprehensive literature review.

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The structure of this study is as follows: the next chapter shows the literature review. The research methodology is displayd in the third chapter of the research. The results and discussion are illustrated in the fourth chapter. Conclusions are presented at the end of this study.

2. Literature review

After the end of the War of Secession/American Civil War, the appearance of large business organizations and the concentration of resources totally changed the production and distribution of products and services in the USA (Chandler, 1962; Chandler, 1977). American retailing was also subject of tremendous transformations. As such, the general stores of the nineteenth century were gradually replaced by the late nineteenth century department stores and the twentieth century big-box stores (Smyyth LLC, 2011).

A significant body of literature appreciates Walmart as an iconic example and an omnipresent face of the American capitalism (Vance and Scott, 1994; Lichtenstein, 2006). It is asserted that „Wal-Mart became the largest corporation in the United States by building an organization that moves massive quantities of merchandise at razor-thin profit margins that have hovered between three and four percent for most of the company's history" (Carden, 2012, p.7). Walmart is the world's largest retailer, selling goods both through physical facilities and e-commerce (Grădinaru and Toma, 2017a; Toma and Grădinaru, 2020; Toma, 2024a). Founded in the USA by Sam Walton, it has also become the world's largest corporation by revenues since the beginning of the second decade of our century (Toma and Grădinaru, 2012; Toma et al., 2016a; Toma, 2023a; Toma and Tohănean, 2024).

Born at the end of the First World War in Kingfisher, Oklahoma, Sam Walton (1918-1992) was a visionary American entrepreneur of the 20th century (Catană et al., 2020). Being a hard-working, perseverant and ambitious person, imune to setbacks, he understood the retail business and envisionaged its future (Trimble, 1991). Despite some failures, he always believed in building a retail business through showing respect to any individual (e.g., employee, business partner) and around providing lower prices and great customer experience. Also, Sam Walton carefuly studied and applied the best ideas from other American retailers (Wisdom, 2010).

After gaining retail experience and obtaining business success with his first dime store, Sam Walton borrow money from various sources (e.g., banks, individuals) and decided to establish a bigger retailing company, Walmart. Its first store, entitled Wal-Mart Discount City store (Vance and Scott, 1992), was opened on July 2, 1962, in Rogers, Arkansas, when Walton was already 44 years old. Two years later, Walmart launched its second discount department store in Harrison, another small town in the same state. In 1967, faithfully to his idea of targeting only small town and rural communities, Sam Walton had already 24 retail locations (Lisicky, 2021). In 1970, after making a public stock offering, Sam Walton succeeded in raising around $5 million in order to build six more stores and expand his retail chain. By initiating a profit-sharing plan for both his managers and employees, he provided them the opportunity to become wealthy people. In 1991, Walmart surpassed Kmart and Sears, and attained the first place in American retailing. Later, it became not only the world's largest retailer but also the world's largest corporation by revenues. One major explanation of its success relies on the fact that „Wal-Mart's better technology has allowed it to grow, and this growth has lowered its operating costs through economies of scale" (Basker, 2007, p.180).

Today's hypercompetitive and uncessant changing global economic environment (Marinescu et al., 2016; Catană et al., 2021; Toma, 2025), featured through agility, digitalization and cloud computing (Toma and Tohănean, 2018b; Toma, 2023b; Tohănean and Toma, 2024a;

Tohănean and Toma, 2024b), requires business organizations, irrespective of their sector and size, to rapidly adapt themselves to these new realities. In this respect, Walmart understood the need to offer a wide range of products both physically and on-line. Thus, it has begun „moving from traditional retail into the technology world, becoming a savvy online retailer" (Hyken, 2018, p.1) in order to face strong competitors like Amazon. The exceptional performance achieved by the American retailing colossus is analyzed in the fourth chapter of the paper.

3. Research methodology

In order to reach the aims of this study, the author employed a qualitative research method based on an extensive desk research. Firstly, he searched for and gathered the information from different sources of secondary data such as books, reports, and articles. Secondly, the author attentively classified, analysed and synthesized the information. Thirdly, he composed the study.

4. Results and discussion

This chapter of the research presents and briefly analyzes the impressive evolution of Walmart during the period 2013-2024 in which it held the title of the world's largest corporation by revenues. Starting from a comprehensive literature review, the findings were sorted and arranged in a tabular form for a period of three consecutive years.

In the period 2013-2015, despite an oscillating evolution, Walmart kept the first position in the hierarchy of the world's largest corporations by their total revenues (Table no. 1). Its main competitors were Shell (USA), Sinopec (China), State Grid (China) and China National Petroleum (China).

Table no. 1. The world's 10 largest corporations by their total revenues in the period 2013-2015

Rank	Year					
	2013		2014		2015	
	Corporation	Revenues ($bn)	Corporation	Revenues ($bn)	Corporation	Revenues ($bn)
1	Walmart	476.294	Walmart	485.651	Walmart	482.130
2	Shell	459.599	Sinopec	446.811	State Grid	329.601
3	Sinopec	457.201	Shell	431.344	China National Petroleum	299.271
4	China National Petroleum	432.007	China National Petroleum	428.620	Sinopec	294.344
5	Exxon Mobil	407.666	Exxon Mobil	382.597	Shell	272.156
6	BP	396.217	BP	358.678	Exxon Mobil	246.204
7	State Grid	333.386	State Grid	339.427	Volkswagen	236.600
8	Volkswagen	261.539	Volkswagen	268.567	Toyota Motor	236.592
9	Toyota Motor	256.454	Toyota Motor	247.703	Apple	233.715
10	Glencore	232.694	Glencore	221.073	BP	225.982

Source: Fortune, 2025

The period 2016-2018 witnessed the same domination of Walmart which followed an ascendant evolution (Table no. 2). Its main competitors were Shell (USA), Sinopec (China) and State Grid (China).

Table no. 2. The world's 10 largest corporations by their total revenues in the period 2016-2018

Rank	Year					
	2016		2017		2018	
	Corporation	Revenues ($bn)	Corporation	Revenues ($bn)	Corporation	Revenues ($bn)
1	Walmart	485.873	Walmart	500.343	Walmart	514.405
2	State Grid	315.199	State Grid	348.903	Sinopec	414.650
3	Sinopec	267.518	Sinopec	326.953	Shell	396.556
4	China National Petroleum	262.573	China National Petroleum	326.008	China National Petroleum	392.977
5	Toyota Motor	254.694	Shell	311.870	State Grid	387.056
6	Volkswagen	240.264	Toyota Motor	265.172	Saudi Aramco	355.905
7	Shell	240.033	Volkswagen	260.028	BP	303.738
8	Berkshire Hathaway	223.604	BP	244.582	Exxon Mobil	290.212
9	Apple	215.639	Exxon Mobil	244.363	Volkswagen	278.342
10	Exxon Mobil	205.004	Berkshire Hathaway	242.137	Toyota Motor	272.612

Source: Fortune, 2025

In the period 2019-2021, Walmart remained in the first position within the top of the world's largest corporations by their total revenues (Table no. 3). Its main competitors were Amazon (USA), Sinopec (China) and State Grid (China).

Table no. 3. The world's 10 largest corporations by their total revenues in the period 2019-2021

Rank	Year					
	2019		2020		2021	
	Corporation	Revenues ($bn)	Corporation	Revenues ($bn)	Corporation	Revenues ($bn)
1	Walmart	523.964	Walmart	559.151	Walmart	572.754
2	Sinopec	407.009	State Grid	386.618	Amazon	469.822
3	State Grid	383.906	Amazon	386.064	State Grid	460.617
4	China National Petroleum	379.130	China National Petroleum	283.958	China National Petroleum	411.693
5	Shell	352.106	Sinopec	283.728	Sinopec	401.314
6	Saudi Aramco	329.784	Apple	274.515	Saudi Aramco	400.399
7	Volkswagen	282.760	CVS Health	268.706	Apple	365.817
8	BP	282.616	UnitedHealth Group	257.141	Volkswagen	295.820

9	Amazon	280.522	Toyota Motor	256.722	China State Construction Engineering	293.712
10	Toyota Motor	275.288	Volkswagen	253.965	CVS Health	292.111

Source: Fortune, 2025

The period 2022-2024 witnessed the same domination of Walmart who registered a continuous and significant increase of its revenues (Table no. 4). Its main competitors were Amazon (USA), Saudi Aramco (Saudi Arabia) and State Grid (China).

Table no. 4. The world's 10 largest corporations by their total revenues in the period 2022-2024

Rank	Year					
	2022		2023		2024	
	Corporation	Revenues ($bn)	Corporation	Revenues ($bn)	Corporation	Revenues ($bn)
1	Walmart	611.289	Walmart	648.125	Walmart	680.985
2	Saudi Aramco	603.651	Amazon	574.785	Amazon	637.959
3	State Grid	530.009	State Grid	545.948	State Grid	548.414
4	Amazon	513.983	Saudi Aramco	494.890	Saudi Aramco	480.194
5	China National Petroleum	483.019	Sinopec	429.700	China National Petroleum	412.645
6	Sinopec	471.154	China National Petroleum	421.714	Sinopec	407.490
7	Exxon Mobil	413.680	Apple	383.285	UnitedHealth Group	400.278
8	Apple	394.328	UnitedHealth Group	371.622	Apple	391.035
9	Shell	386.201	Berkshire Hathaway	364.482	CVS Health	372.809
10	UnitedHealth Group	324.162	CVS Health	357.776	Berkshire Hathaway	371.433

Source: Fortune, 2025

Therefore, Walmart has clearly dominated the top of the world's largest corporations by their total revenues since 2013. The exceptional business performance achieved by Walmart was based on a plethora of factors such as: effective and transformational leadership (Marinescu and Toma, 2015b; Toma et al., 2016b; Grădinaru et al., 2020; Toma et al., 2020a; Toma et al., 2020b; Toma, 2024b), sound corporate and business strategies (Toma et al., 2013b; Toma et al., 2022; Toma, 2023c; Toma, 2023d; Toma, 2024c), competitive, sustainable and innovative business models (Toma and Marinescu, 2012; Toma et al., 2016c; Toma et al., 2016d; Toma and Săseanu, 2017; Andrișan et al., 2022), hard-working and creative management (Toma, 2006a; Toma et al., 2014; Toma and Marinescu, 2015; Toma and Marinescu, 2017; Toma and Grădinaru, 2018a), inspiring entrepreneurship (Toma et al., 2016e; Marinescu et al., 2017; Toma et al., 2017b;

Grădinaru et al., 2018; Toma, 2019), redoubtable marketing-mix (Marinescu et al., 2010; Grădinaru and Toma, 2017b; Toma and Grădinaru, 2018b; Catană and Toma, 2021), enduring organizational culture (Toma, 2011; Săseanu et al., 2014; Toma, 2021), great customer experience (Toma and Catană, 2021a; Toma and Catană, 2021b), social responsibility (Toma, 2006b).

5. Conclusions

Established in 1962 by the legendary Sam Walton, Walmart epitomizes the successful business story of an American corporation from the retailing sector. Sam's vision, ambition and hard working were among the indispensable ingredients that decisively contributed to the rapid growth and expansion of this corporation.

This research renders the evolution of Walmart in the period 2013-2024 in which the American colossus kept its first place in the hierarchy of the world's largest corporation by revenues. Also, it briefly analyzes the exceptional business performance attained by Walmart and identifies a plethora of important factors which concurred to it such as effective leadership and sound corporate and business strategies.

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