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# УПРАВЛІННЯ РОЗВИТКОМ

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# ESPEG model and corporate governance system for ensuring sustainable development of enterprises

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**Abstract.** In 2023, there is a pressing requirement to promote enterprise growth and guarantee enduring sustainability, therefore, it is timely to craft an effective model for sustainable progress and establish a corporate governance framework. The aim of the research was to develop innovative approaches to ensure the sustainable development of enterprises through the development of a sustainable development model and corporate governance system. The essence of the concepts of "corporate governance" and "corporate management" is also defined in the article using the categorical method of two-level triadic decoding. The research is based on the principles of sustainable development, systemic and holistic approaches. The article proposes a four-component model of the enterprise sustainable development concept (ESPEG model), which reflects the hierarchical arrangement of the environmental (E), socio-political (SP), economic (E), and governance (G) spheres of the enterprise. This model identifies the directions for the application of management tools to influence specific interacting spheres. The result of the work is an improved model of enterprise sustainable development that enables the structuring of the key components of the concept to ensure effective management of the enterprise based on the balance of its key elements. The model of corporate governance system has been improved, incorporating

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the paradigm of sustainable development and considering the necessity of integrating various management subsystems within the company. The proposed corporate governance system identifies the control loop of corporate management and defines the governing and controlled subsystems along with their components. It has been established that a corporate governance system built on the principles of sustainable development will contribute to achieving positive results in the company's development, ensuring the sustainability of its social, environmental, and economic aspects. The implementation of the proposed corporate governance system will facilitate further research into its essence and application specifics in modern companies

**Keywords:** management; connections; stakeholders; personnel; two-level triadic decoding; holistic approach

## INTRODUCTION

Achieving lasting impact on society and environment through sustainable development is a vital business goal. Amid challenges such as the COVID-19 pandemic and the Ukraine crisis, fostering resilient enterprises demands innovative models and adaptable systems. As of January 1, 2022, approximately 6 million Ukrainians had left the country, accounting for 14-15% of the permanent population (Ukraine: A quick assessment…, 2022). In Ukraine, military operations resulted in substantial losses, damaging transportation infrastructure, industrial and transportation enterprises, and more. The estimated direct infrastructure damages reached $114.5 billion as of September 5, 2022 (The total amount of infrastructure…., 2022). These disruptions have reverberated through global logistics, compelling businesses to re-evaluate their management strategies for survival and holistic prosperity. This entails not only navigating immediate obstacles but also contributing to the economy, society, and environmental conservation through job creation, responsible taxation, local collaborations, and eco-conscious efforts. In this context, building long-term enterprise viability becomes crucial. Enterprises must rethink their management approaches to address present challenges and threats, and sustainable development becomes more important than ever before.

In the modern scholarly environment, numerous Ukrainian scientists including Z. Atamanchuk & Z. Makohin (2022) along with global researchers such as G. Dicuonzo *et al.* (2022) and P. Ludwig & R. Sassen (2022) demonstrate interest in corporate governance issues based on the paradigm of sustainable development. Many of them have investigated the relationship between corporate governance and sustainable development. However, most of them have not devoted sufficient attention to the formation of a corporate governance system based on a systemic approach. The International Labour Organization has long been working towards supporting viable enterprises and ensuring sustainable development: it has developed the "Decent Work for Sustainable Development" (DW4SD) platform and "The 2030 Agenda for Sustainable Development", with one of the important objectives being the promotion of viable enterprises (Decent work for…, n.d.). Authors such as S. Barile *et al.* (2018) emphasize that the concept of "viable enterprises" is interrelated with the three components of sustainable development: economic, social, and environmental. The International Labour Organization promotes the development not of any enterprises but only those that are economically viable, socially responsible, and environmentally conscious (Decent work for…, n.d.). The works of the authors lack sufficient attention to the study of the interaction among various elements of enterprise management systems and the impact of such systems on all aspects of sustainable development. Moreover, they inadequately address the role and importance of involving all stakeholders in the development and implementation of corporate management systems, as well as the insufficient focus on the development of mechanisms and tools to ensure and support this interaction. Ukrainian scientist N. Voloshko (2021) provides a detailed analysis of the foundations of international corporate governance, examines key models, and evaluates the alignment of corporate governance in Ukrainian companies with international practices and standards. The findings underscore the need to enhance the company's management system for sustainable development in the market and establish a global standard of corporate governance rules and principles. It can be concluded that the literature offers insufficient coverage of the issue of forming a corporate governance system in terms of ensuring sustainable development of enterprises.

The concept of sustainable development management has emerged as a widely adopted approach in business practice, drawing upon theoretical foundations that prioritize holistic and responsible approaches. This approach, supported by scholarly works by S. E-Vahdati *et al.* (2019), N.E. Kalicheva *et al.* (2019) and V. Naciti *et al.* (2022), has evolved to become an integral component of successful corporate policies. These scholars primarily focus on studying the mechanisms of corporate governance in sustainability, exploring the rights and responsibilities of internal corporate actors and examining their impact on sustainability outcomes. They investigate how corporate governance practices and processes contribute to enhancing sustainable performance. One limitation of the existing literature is the lack of a unified approach to identifying components in the concept of sustainable development and constructing a model for sustainable enterprise development. There is a need for clarification regarding the role of corporate governance within the framework of sustainable development, as well as the systematic and comprehensive formation of corporate management, which is why this research was necessary to conduct. The study aimed to develop the model of sustainable development and the corporate governance system as innovative approaches to ensuring the sustainable development of enterprises. It focused on three main research objectives: developing a model of sustainable development concept for an enterprise; differentiating and clarifying the concepts of "corporate governance" and "corporate management"; forming a corporate governance and corporate management system to ensure sustainable development.

## LITERATURE REVIEW

The analysis of scientific literature on sustainable development-oriented enterprise management reveals a lack of consensus among researchers regarding the components of sustainable development and the development of a model for sustainable development within enterprises. Various approaches and models have been proposed, including the triple bottom line perspective proposed by J. Elkington (1997), which emphasizes the economic, environmental, and social responsibilities of enterprises, and the normative approach by R.E. Freeman *et al.* (2006), which highlights moral responsibility towards stakeholders. Models of sustainable development, such as the "Mickey Mouse" and "bull's eye" by L. Zaitseva (2019), have evolved over time, with the I. Morandín-Ahuerma *et al.* (2019) sphere balance model being the most widely adopted. According to most scholars, this model of sustainable development is based on a methodological approach in which the ecological, social and economic components are presented as equal parts of a cohesive system (Khan *et al.*, 2021; Peng, 2023).

While most researchers agree on a three-component enterprise sustainable development model, they often overlook enterprise-stakeholder interactions (Cochran & Rauch, 2020; Alkaraan *et al.*, 2023; Cano *et al.*, 2023). However, these models lack considering enterprise-environmental interactions. Although authors commonly understand the three sustainable development components, they often neglect the enterprise-stakeholder relationship while crafting a model. These relationships are vital for effective sustainable strategy implementation. Exploring these interactions is crucial to form comprehensive models encompassing economic, environmental, and social aspects. The ESG (Environmental, Social, and Governance) model and its variations hold promise for enterprise sustainable development (Pedersen *et al.*, 2020). It encompasses environmental responsibility, social obligations and corporate governance indicators, aligned with the UN's 17 Sustainable Development Goals. While the ESG model offers a hopeful framework, it overlooks stakeholder-enterprise relationships, limiting effective implementation.

The analysis of scientific literature on sustainable development-oriented corporate governance reveals a lack of consensus among different authors such as S. E-Vahdati *et al*. (2019), V. Naciti *et al*. (2022), and G. Dicuonzo *et al*. (2022), not only regarding the specific content and formation of sustainable development-oriented management within enterprises but also the absence of a systemic approach to the formation of a corporate governance system. Authors have often examined individual elements of the corporate governance system or corporate management separately, resulting in some confusion between these concepts. Despite the significant volume of scholarly work in the field of sustainable development-oriented corporate governance (Ludwig & Sassen, 2022; Rahman *et al.*, 2022) and the implementation of corporate social responsibility in corporations (Tandoh *et al.*, 2022; Zaman *et al.*, 2022), researchers have primarily focused on defining models and key directions and stages of implementing corporate management systems. Little attention has been given to the formation of a corporate governance system from a systemic and cybernetic perspective.

Literature underscores the necessity of a holistic, integrated approach to sustainable development-focused corporate governance. Grasping interrelationships between corporate governance and management is vital. Existing definitions lack clear insights into main shared and distinct traits and their interplay. This gap hampers corporate governance theory, impeding well-functioning corporate management systems for companies.

## MATERIALS AND METHODS

The study uses the methods of theoretical synthesis and logical analysis. These methods were used for comparing and synthesizing scientific publications and approaches related to sustainable development and corporate governance. They allowed for a comprehensive analysis of existing knowledge and theories in the field. Dialectical method of cognition was applied to establish the theoretical foundations of the sustainable development model for enterprises and the corporate governance system. It helped in understanding the interrelationships and contradictions within the concepts and principles of sustainable development and corporate governance. Historical approach was employed to study the evolution of sustainable development models and to define the concepts of corporate governance and corporate management. By examining the historical context, the researchers gained insights into the development and transformation of these concepts over time. Holistic and systemic approaches were utilized in developing the model of sustainable development for enterprises and the corresponding corporate management system. They allowed for a comprehensive and integrated perspective, taking into account the various dimensions and interdependencies within the system. Theory of dynamic information systems and the method of two-level triadic decoding were employed to shape and refine the concepts of corporate governance and corporate management. By decoding and analysing the key characteristics of these concepts, a clearer understanding and definition of their essential components were achieved.

The categorical two-level triadic decipherment method (Fedotova & Sanjay, 2020) revealed the sought category through three concepts at the first decipherment level, reflecting the natural essence of the represented phenomenon. This process was repeated at the second level for deciphered concepts. An advantage of using this method was the broader definition of the research object, encompassing socio-economic systems within the systemic economics framework. This approach facilitated a comprehensive understanding of corporate governance and management concepts. The abstract-logical method and the method of generalization were used for forming theoretical generalizations, structuring the sustainable development model, the corporate management system, and formulating research conclusions. It facilitated the logical organization and presentation of the research findings. Graphic visualization techniques were employed to visually present the proposed sustainable development models, the essence of concepts, and the corporate management system. This visual representation enhanced the clarity and understanding of complex ideas and relationships. The work drew on the postulates of the sustainable development concept and relevant scientific models of corporate governance. These

provided the conceptual framework and theoretical basis for the research, guiding the selection of appropriate methods and approaches.

## RESULTS AND DISCUSSION

### The model of sustainable development concept for an enterprise

The holistic approach in managing socio-economic systems emphasizes the priority consideration of the system as a whole in terms of the emergence of new qualities or holistic properties in the system's elements, absent in the components that constitute the system. The viability of enterprises is formed under the influence of external and internal factors, with the interaction of elements within the general system serving as its foundation. To determine the main directions of enterprise activities within the framework of the sustainable development paradigm, it is necessary to develop a model of the sustainable development concept for the enterprise and identify its system-forming components based on systemic and holistic approaches (Moldavska & Welo, 2019).

Viewing any enterprise through its similarity to a living organism is inherent in the holistic approach. R. Charef (2022) emphasize that it is crucial "to have a holistic approach, to identify all the stakeholders involved in the asset lifecycle and to work collaboratively". This approach pays great attention to the relationships and interactions between the parts of the whole in the form of a system. E. Schwarz (2002) examined the system from the perspective of the holistic approach and identified three inseparable primary categories present in all systems: objects, relationships, and the whole. These three types of initial ingredients exist on equal terms – relationships are just as "real" as objects. The author argues that a minimal system consists of a triad, which represents two interacting components and one privileged whole with an ontological status. When considering the model of sustainable development for a viable enterprise as a system, attention should be given not only to the constituent elements of the system but also to the interactions between them.

The advantage of modern business lies in its social orientation and efforts to improve conditions in the areas where the enterprise operates, including sustainable development. Companies must care about the environment and develop ecological projects. The company should take responsibility for continuous improvement and increased performance of its environmental management system by ensuring the environmental safety of its activities. Environmental safety is extremely important as it guarantees living in an environmentally clean environment. It contributes to the overall functioning of the environment and provides rational satisfaction of individual ecological needs, as well as the needs of any enterprise and society as a whole. The implementation of an environmental safety system within the enterprise affects the economic, social and ecological spheres, as it involves the implementation of production norms, labour, emissions, waste, resource-saving standards and more (Cherchyk, 2019). Additionally, if a company wishes to remain viable for an extended period of time, it must pay attention to ensuring the preservation of the environment, resource conservation and the health of society, including its employees.

The paradigm of sustainable development, which involves a dynamic process of sequential positive changes that ensure the balance of economic, social, and ecological aspects of societal life, should form the basis for approaches to solving the viability problems of enterprises. The enterprise, as a socio-economic system, meets the criteria of a complex open system, in which orderliness is achieved through regularity of relationships between the elements of the structure. Orderliness between the subsystems of the enterprise can ensure the maintenance of the system's stability through management oriented towards achieving sustainable development. The stability of enterprises as open dynamic systems serves as a reliable foundation for the functioning of regional and national economies. Conversely, a decrease in their stability leads to a crisis in the entire economic system of the country. In her scientific work, I.V. Fedotova (2020) proposed a model for maintaining the viability of an enterprise based on sustainable development. The proposed model for maintaining the viability of an enterprise incorporates a hierarchical arrangement of the economic, social and environmental spheres of the enterprise's external environment. The suggested directions for implementing management tools are focused on preserving stability, viability and sustainable development of the enterprise. These are the ways to address the adaptation challenge that the enterprise faces within each sphere.

Modern economic and political realities demand the reinforcement of the three-component model of sustainable development. By enhancing the developed model for maintaining enterprise viability, the addition of a political component to the social component of sustainable development is proposed. This political component reflects the political will of the governing representatives to implement the concept of sustainable development. In order to be realistic and effective, the concept of sustainable development must establish mechanisms for making efficient and legitimate decisions that consider the interests of the majority of nations in the context of escalating international political conflicts. At the global level, new institutions and rules of conduct need to be formed and defined, specifying and refining the goals of sustainable development. At the national level, relevant legislative and regulatory acts need to be adopted to support the concept of sustainable development, while monitoring the activities of enterprises. At the enterprise level, the implementation of sustainable development principles and specific goals should be ensured.

Thus, as an open system, the enterprise interacts with the external environment, which is represented by three spheres: ecological, socio-political and economic. However, the three-dimensional concept of sustainable development reflects the interaction of the enterprise with the external environment, and an additional subsystem needs to be added to this model. This subsystem corresponds to the governance component of the enterprise, as depicted in the ESG concept. This component is focused on establishing relationships with stakeholders in the other three spheres of sustainable development (economic, socio-political, and ecological). In the context of the enterprise's pursuit of sustainability and viability, an idealized structure of interconnected subsystems can be outlined. These subsystems, in their interrelation, form the model of the enterprise's sustainable development concept, as illustrated in Figure 1.

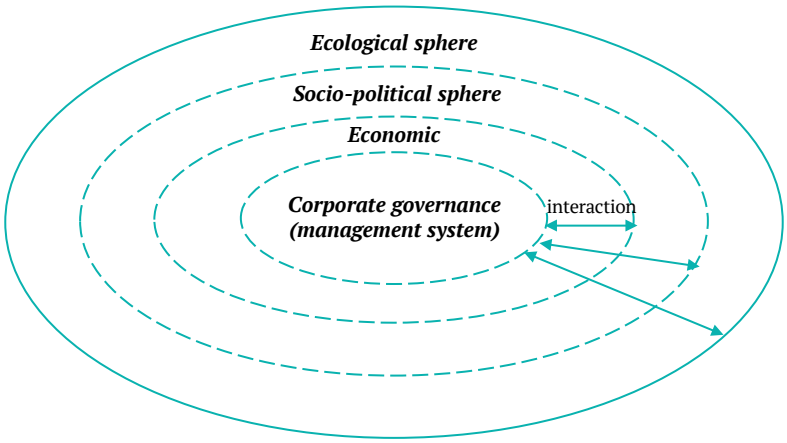


**Figure 1.** The model of sustainable development concept for a viable enterprise (ESPEG model)
**Source:** developed by the authors

The proposed model enables the achievement of long-term balance among the key spheres of sustainable development for an enterprise, including the economic, socio-political, environmental, and governance dimensions, with corresponding directions for implementing management tools to ensure the viability of the enterprise. According to the research, the concept of sustainable development is closely intertwined with the concept of viability. The concept of sustainable development is based on an approach where the economic, social, environmental and governance components are considered equal and integral parts of a comprehensive system. Balancing these components, while meeting the needs of society and safeguarding the interests of future generations, is a prerequisite for sustainable development and the key elements of viability.

At the core of the model lies the sphere of corporate governance as a subsystem responsible for aligning the enterprise's activities with the goals of sustainable development and establishing relationships with other subsystems within the model. Expanding on existing approaches to the concept of sustainable development, this model is referred to as ESPEG, incorporating four components: environmental (E), socio-political (SP), economic (E), and governance (G). Additionally, the model depicts the need for establishing relationships with specific stakeholders within the realm of corporate governance for each sphere (economic, socio-political, and environmental). The model reflects the directions for implementing corporate governance tools, through which they influence the respective component and address contemporary societal demands for a safe environment.

The proposed model of the sustainable development concept for a viable enterprise illustrates the fundamental components of a management system based on sustainable development principles and the scope of applying management tools to establish a viable enterprise. The research on the ESPEG model aimed to enhance the understanding and improvement of corporate structures in the modern world.

**The differentiation and clarification of the concepts of "corporate governance" and "corporate management"**

In order to develop a sustainable model of a viable enterprise from the perspective of corporate management, it is necessary to first establish the distinction between the concepts of "corporate governance" and "corporate management". The relationship between the concepts of corporate governance and corporate management needs to be explored, highlighting their key features. It is proposed to examine the relationship between the concepts of corporate governance and corporate management based on the following aspects: essence, management, responsibility, effectiveness, foundation, etc. (Table 1).

**Table 1.** The correlation between the concepts of "corporate governance" and "corporate management"

| Main aspects | Corporate governance | Corporate management |
|---|---|---|
| Essence | It is a system that focuses on the management and control of organizational activities. | It primarily involves organizing and ensuring the effective functioning of the management system. |
| Governance | It is a system that encompasses management and control over the activities of the organization. The existing management structure and mechanisms of interaction between departments that ensure the protection of the rights and interests of shareholders and investors. | Its primary purpose is to organize and ensure the smooth functioning of the management system. Strategic planning of the company's activities, taking into account the interests of its owners and other relevant parties. |
| Decision-making | Responsible for strategic decision-making, implementing mechanisms and monitoring actions. | Emphasizes operational decision-making and execution of management decisions. |
| Scope of responsibility | Corporate governance is responsible for the development of strategies, decision-making, implementation mechanisms and monitoring of managers' actions. | Management is responsible for executing the strategies, organizing the implementation of management decisions. |

Table 1, Continued

| Main aspects | Corporate governance | Corporate management |
|---|---|---|
| Key actors | Shareholders, members of the board of directors, top management and other stakeholders. | Top managers, middle managers, workers, and employees. |
| Effectiveness | Effective corporate governance entails proper control over the implementation of the organization's development strategy, ensuring the interests of all stakeholders. | Effective management involves proficient management of operational processes within the organization, irrespective of stakeholders' interests. |
| Goal orientation | Long-term strategic planning to achieve organizational objectives. | Short-term planning and execution of specific management objectives. |
| Foundation | Based on established principles, codes, "best practices" and legal frameworks. | Guided by recommendations and instructions of the general meeting of shareholders and the board of directors. |

**Source:** supplemented by the authors based on the research of D.M. Vasylkivskyi (2018), V. Tsaruk (2020), N. Bocharova (2021)

In the realm of contemporary academic discourse on corporate governance, diverse perspectives exist concerning the definitions of corporate governance and corporate management. Some scholars, such as V. Tsaruk (2020), perceive corporate governance and corporate management as synonymous concepts. They employ the term "corporate governance" interchangeably with "corporate management" and do not consistently differentiate their respective definitions. P. Iliev *et al*. (2021) posits a definition of corporate governance as "the set of firm practices that seek to minimize frictions and mitigate agency costs". Nevertheless, this perspective overlooks the nuanced characteristics inherent in each concept under scrutiny, potentially leading to inaccuracies in corporate decision-making.

An alternative approach involves examining the closely related, albeit not interchangeable, terms "corporate management" and "corporate governance". The latter term pertains to the network of relationships among company owners (shareholders), management personnel (executives), and other stakeholders (governing bodies, creditors, etc.). R. Zaman *et al.* (2022) conceptualize corporate governance as "the structures specifying the rights and responsibilities among the parties with a stake in the firm, as well as the configurations of organizational processes impacting both financial and nonfinancial outcomes at the firm level". However, this perspective fails to account for the peculiarities of the Ukraine's economic system, warranting caution in solely relying on this viewpoint.

A third cohort of scholars, including M.N. Muxtorovich (2023), defines "corporate management" as a set of mechanisms by which the company operates and the process of development and adoption of decisions by stakeholders to perform their functions, change and update existing ones, as well as to form new interests. Corporate management centres on the mechanisms governing business operations. A. Sharma (2022) asserts that "governance aims at balancing the 4Ms (money, manpower, machine, and management) to harmonize the interests of various stakeholders and the company". Corporate governance encompasses a broader spectrum of issues pertaining to corporate functioning, entailing the coordination of interactions among numerous individuals and organizations associated with various aspects of corporate operations.

Widely regarded by most researchers, corporate governance is conceived as a comprehensive concept encompassing diverse dimensions, such as legal frameworks, organizational structures, personnel management, information systems and cultural values. It also encompasses conventional management functions and the regulation of relationships between business owners and top-level managers. The concepts of corporate governance and corporate management are intricately intertwined, and their interdependencies merit careful consideration. Emphasizing the establishment of corporate management as an integral component of corporate governance within a company assumes paramount importance. Consequently, the varying perspectives on the definitions of corporate governance and corporate management underscore the imperative for a comprehensive understanding of their interrelationships.

V. Tsaruk (2018) proposes various models of corporate governance (insider and outsider) that accentuate the profound interaction between corporate governance and corporate management. Consequently, concurring with V. Tsaruk (2018) viewpoint on elucidating the interrelation and subordination of corporate management to corporate governance, while delineating its purpose entailing decision-making, control, analysis, and the application of management tools, proves appropriate to this research. However, an inclusive examination should encompass characteristics like system input and output, managerial influence and management subsystems. When evaluating systemic impact, M. Arslan & A. Alqatan (2020) recognize the role played by formal and informal institutional determinants, including auditing, politics, law, boards, shareholder awareness, voting, culture and values, in the domain of corporate governance. M.A. Garzón Castrillón (2021) advocate for a systemic approach, defining corporate governance as the system that directs and controls business corporations. Therefore, the expanding research on corporate governance necessitates prioritizing the concepts of corporate governance and management, discerning their shared characteristics and distinctive features. Of particular significance is comprehending the essence and exploring the definition of corporate governance itself, as constructing a corporate governance system requires determining the composition and interrelationships of its key elements, which is unattainable without establishing the essence of the corporate governance system.

To determine the essence of the definitions of "corporate management" and "corporate governance", the application of the Theory of Dynamic Information Systems (TDIS) is proposed. Analyse the possibilities of solving this

methodological task using the example of applying the triadic decipherment of the basic concept to such a large research object as "corporate governance". The ontological foundations of corporate governance can be presented in the form of a triadic scheme of interconnected basic categories: 0 – elements ("what"), 1 – processes (abilities) ("how"), 2 – results ("why"). In this case, the logic of the relationship between these categories can be interpreted as follows: the application of the company's abilities ("how") on interacting elements ("what") should be directed towards achieving qualitative and quantitative results of activities and development ("why"). The triadic principle provides the necessary and sufficient categorical basis that allows unfolding an adequate TDIS work in full, highlights the following primary categorical triad and substantiates the composition of its elements.

Complex relationships: corporate governance encompasses relationships between the company's management, the board of directors (supervisory board), controlling shareholders, minority shareholders and other stakeholders. The main interacting elements include the company's owners (shareholders), its management (administration, board), and other stakeholders (investors, creditors, suppliers, customers, government and local authorities, local population and other interested parties). Complex activities: management represents conscious purposeful activity of the management subject, which exerts systematic, consistent and planned influences on the object of management in accordance with norms and rules. Complex results: these represent the outcomes of the company's functioning. A key condition for sustainable development is a positive dynamic of the company's efficiency. In the market, more efficient organizations survive and thrive. Therefore, it is important to formulate the company's goals correctly, reflecting its efficiency and effectiveness while adhering to the principles of sustainable development and rational resource utilization.

Each of the first-level concepts, in turn, is elaborated by three second-level concepts: [0] successful complex interactions are formed by the elements: [0,0] enterprise management (administration), [0,1] enterprise owners, [0,2] other stakeholders. [1] Strategic complex activities are revealed through characteristics such as: [1,0] systematicity and balance, [1,1] strategic planning, [1,2] compliance with norms and rules. [2] The complex result includes: [2,0] sustainable development, [2,1] goal achievement, [2,2] rational resource utilization. Each of the first-level concepts, in turn, is elaborated by three second-level concepts. Furthermore, to form the second-level decoding, it is necessary to identify another set of categories that facilitate the decoding of first-level categories (Fig. 2).

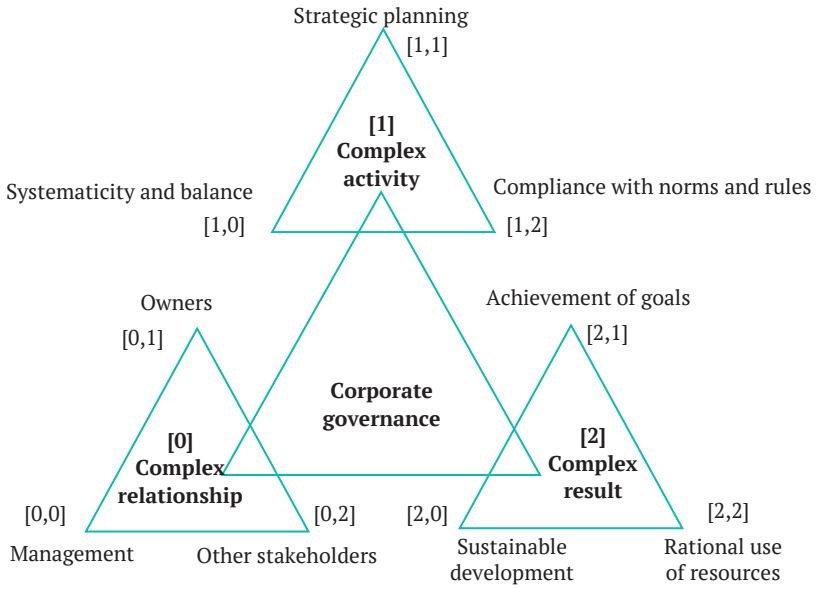


**Figure 2.** Two-level triadic decoding of the concept of "corporate governance"

**Source:** developed by the authors

The generalization of three hierarchically structured concepts allows formulating the following definition: Corporate governance is understood as a systematic and planned activity for managing an organization (corporation) to establish a balance in the relationships of all participants in corporate governance (owners (shareholders), founders, directors, managers and other stakeholders), while complying with legal norms and rules of conducting business, it aims to attract and rationalize resource utilization in strategic management to achieve the goals of the organization's functioning (corporate enterprise) while adhering to the principles of sustainable development.

Corporate governance encompasses all aspects of management, organization, and control within a company to ensure efficiency, stability, and alignment with the interests of various stakeholders. On the other hand, corporate management focuses on specific aspects of managing a company, such as planning, organization, leadership, and control. It emphasizes team leadership and task execution, achieving strategic objectives, and resource management.

Therefore, corporate governance is a broader concept that includes corporate management as well as other aspects such as managing relationships with stakeholders, their protection and more. To formulate the concept of "corporate management", the following primary categorical triad should be identified and its elements should be substantiated.

Complex system: management is considered as a system of rules, methods and processes through which a company carries out its management and control. In the management system of a company, the subject influences the object, and the means of influence are management methods. Management is implemented through management functions (analysis, evaluation, planning, control, accounting, coordination, regulation, etc.) and management technologies, which represent processes and methods for implementing these functions.

Complex leadership: the management system of a company incorporates various aspects of corporate leadership into a unified and integrated system. This requires interaction and coordination among different functional areas of the company and considers the interests and needs of various stakeholders of the company.

Complex result: these represent the results of a company's functioning. The criterion of efficiency is the ratio of the result to the resources invested to achieve it. Being more efficient means obtaining greater results with the same resources or achieving the same result with fewer resources. The key condition is achieving the goals of the company based on adherence to the principles of sustainable development. The categories of the 1st level should be defined. Thus, for the 1st level decoding, the basic categories will be: complex system, complex leadership and complex result (Table 2).

**Table 2.** Two-level decryption of the basic category "corporate management"

| Categories of the 1st level | Categories of the 2nd level |
|---|---|
| [0] Complex system | [0,0] – Rules |
| | [0,1] – Methods and functions |
| | [0,2] – Processes |
| [1] Complex leadership | [1,0] – Systematicity |
| | [1,1] – Integration |
| | [1,2] – Stakeholder orientation |
| [2] Complex result | [2,0] – Goal achievement |
| | [2,1] – Efficiency |
| | [2,2] – Sustainable development |

**Source:** developed by the authors

The conducted description allows formulating the following definition of corporate management: corporate management is a systematic integrated leadership of corporate organization's activities, based on balancing the interests of all stakeholders, it operates through a system of rules, methods, functions and processes that enable the enterprise to achieve its goals and enhance operational efficiency while adhering to the principles of sustainable development through rational resource utilization.

**Formation of a corporate governance and corporate management system to ensure sustainable development of an enterprise**

The ESPEG model places the corporate governance system at its core. This system utilizes principles from the ecological, socio-political, economic and corporate management domains to achieve innovative solutions, efficient resource utilization and ensure the organization's sustainable development. Implementing the corporate governance system within the ESPEG model requires a deep understanding and analysis of the organization's current state, its external environment, and the interconnections among various aspects. Key elements of such a system include defining strategic goals, developing policies and procedures, establishing effective communication networks and fostering the development of highly competent personnel. The adoption of a systemic approach is advisable for the formation of a corporate governance system.

When applying a systemic approach, any management system or its individual components are regarded as a holistic, independent phenomenon characterized by activity or development goals, resources, structure, processes and interrelationships with other systems. The systemic approach enables the examination of the management system as a whole, analysing both its static and dynamic aspects. According to S. Suwanda & B.Y. Nugroho (2022), it does not rely on a strictly defined methodology or logical concept. Elements recommended for the formation of a management system include the seven factors according to the McKinsey 7S model. Elements are classified as soft elements (staff, skills, style, shared values) and hard elements (structure, systems, strategies) (Suwanda & Nugroho, 2022). However, as mentioned earlier, it is essential to determine the essence of the subject and object of governance. The administrative personnel of the enterprise, including top management, managers at various levels and employees, are considered the subjects of management. The subsystems of corporate governance are proposed as the objects of management (Fig. 3).

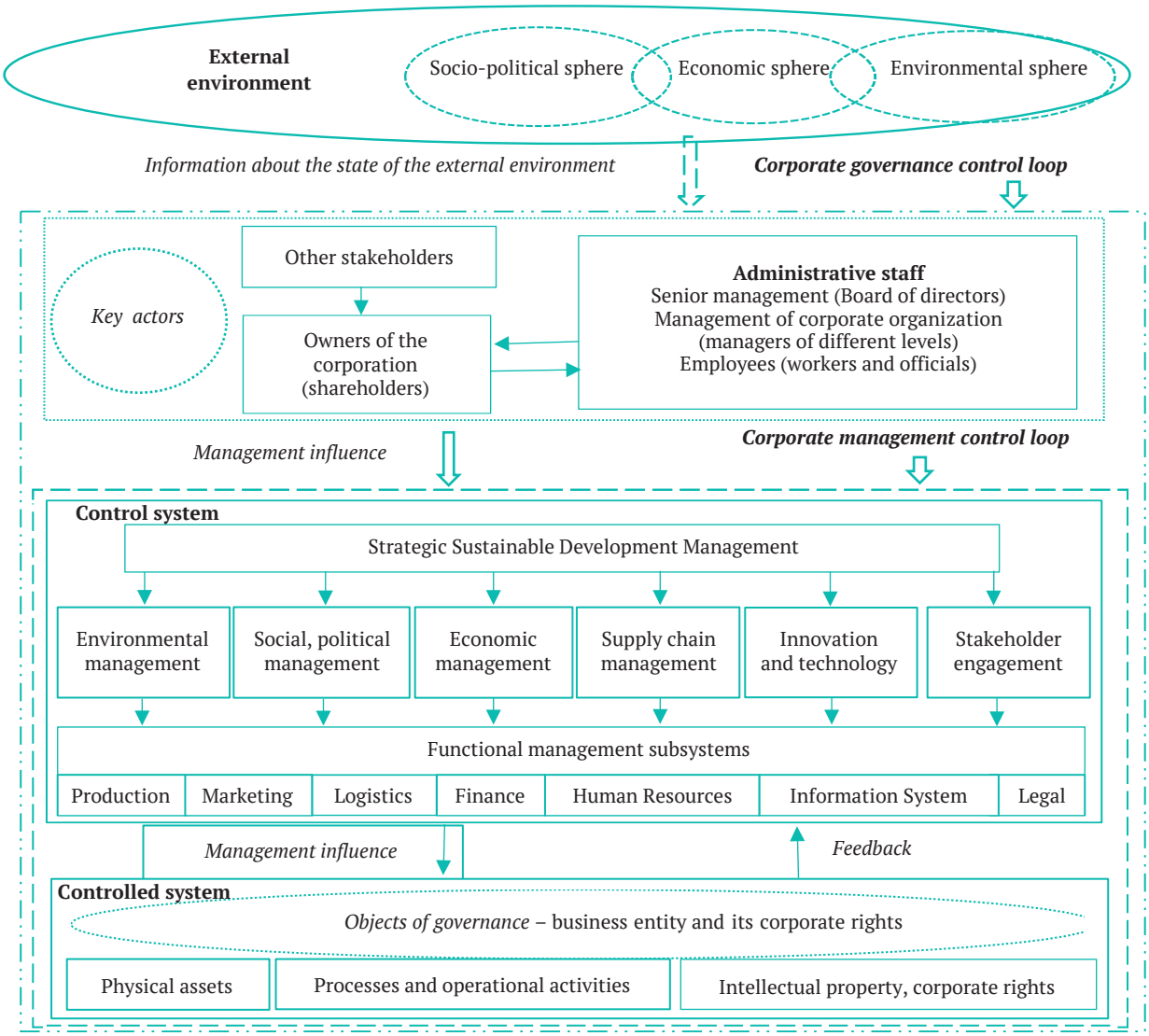


**Figure 3.** Corporate governance system based on the sustainable development paradigm

**Source:** developed by the authors

The study of any system requires identifying external influences and establishing methods and directions for information provision. Equally important is the internal environment and the information obtained through the functioning of the system. The PEST model (P – Political, E – Economic, S – Social, T – Technological), for example, can be used as a basis for classifying such information (Kenton, 2020). Monitoring the external environment forms the basis for positioning companies within their surrounding environment and developing various strategies and forecasts. Based on the obtained information, corporate plans and budgets are formulated to ensure that the company's current activities align with its strategy. This is illustrated in Figure 3.

The proposed model of corporate governance, based on the paradigm of sustainable development, incorporates the need for integrating strategic planning, decision-making, work coordination, management efficiency and development of the company. However, to enhance understanding and successfully implement this model, it is necessary to add a vision regarding the formation of a corporate governance system based on the principles of sustainable development. In the proposed system of corporate governance based on a systemic approach, the corporate management control loop has been identified, consisting of the following main subsystems: strategic management for sustainable development, environmental management, social and political management, economic management, innovation and technology, supply chain management, stakeholder engagement, functional subsystems. Functional management encompasses the administration of various functional areas within the organization, including finance, marketing, production, human resources and more. It involves the development of strategies, policies and processes specific to each area to effectively meet the enterprise's objectives. These subsystems constitute the governing subsystem within the corporate management system, enabling effective functioning and development of the enterprise.

Considering that the object of corporate governance is often either the business entity itself, its corporate rights

or its corporate property and other components, the following blocks of the controlled subsystem in the corporate management system are proposed: physical assets, intellectual property and corporate rights, processes and operational activities. Physical assets encompass corporate property, means and objects of labour, real estate, equipment, transportation vehicles, materials, and other tangible resources used by the enterprise in its operations. Intellectual property includes patents, copyrights, trademarks, trade secrets and other intellectual assets owned by the enterprise. Corporate rights refer to the legal status of the company, defining its organizational structure, internal regulations, management principles, rights and obligations of shareholders as stipulated by legislation and the company's bylaws. They regulate the relationships among shareholders, management bodies, and other stakeholders. Processes and operational activities encompass business processes, operational processes, supply processes, production, sales, customer service and other operational processes that ensure the fulfilment of the enterprise's core functions. The paradigm of sustainable development and the proposed ESPEG model require considering economic, socio-political and environmental aspects in enterprise management. The main idea is to ensure the satisfaction of current needs without compromising the ability of future generations to meet their own needs. Applying the paradigm of sustainable development in corporate governance system demands a shift in approaches to strategic planning, decision-making and coordination of work.

In the subsystem of strategic sustainable development management, the Strategic planning block should take into account not only economic aspects but also social and environmental factors. It is crucial to actively involve stakeholders, including consumers, employees, suppliers and public organizations, in the process of formulating strategic goals and alternatives. Integrating sustainable development into the company's strategy is necessary to strike a balance between economic achievements, social responsibility, and environmental protection. Within the context of an enterprise's commitment to sustainable development principles, the strategic planning block places great emphasis on gathering and processing information to identify potential company development scenarios, formulate acceptable strategic alternatives, evaluate them and make choices. This process of strategic analysis is based on collecting information about the current and projected state of the external environment (external analysis) and the company itself (internal analysis). Based on this information, common development goals are determined, which are positioned at the top level of the strategic goals hierarchy, and strategic alternatives are formulated, which then undergo evaluation and implementation. Forecasts are also created as a result of this process, serving as the basis for creating non-financial corporate reporting.

The Decision-making block also requires re-evaluation from the perspective of the sustainable development paradigm, as it plays a crucial role in translating the chosen strategy at the enterprise into specific target indicators. Various methodologies, such as the Balanced Scorecard can be utilized to achieve these goals (Agarwal *et al.*, 2022). When selecting target indicators and indicators of strategic development, it is necessary to consider not only financial results but also social and environmental impacts. Taking these principles into account, the top-level goals and strategic alternatives are decomposed, allowing for the creation of a detailed system of strategic corporate goals and indicators aimed at achieving sustainable development.

The Coordination block plays a crucial role in ensuring the connection between strategic objectives and key performance indicators defined for the company as a whole, taking into account the principles of sustainable development. These indicators should be aligned with the financial and operational plans of individual business units and departments. This will enable harmony between strategic goals, the performance of individual departments, and the requirements of sustainable development.

The Management efficiency and sustainable development block should include an analysis not only of financial reporting but also of the findings derived from analysing the social and environmental aspects of the company's activities. Involving stakeholders such as consumers, employees and public organizations in assessing the company's performance in the context of sustainable development will contribute to forming a comprehensive picture of the results. Furthermore, the analysis and reporting should consider important aspects of sustainable development, such as social responsibility, environmental sustainability and other factors influencing the long-term success of the enterprise.

A corporate governance system built on the foundation of sustainable development paradigm entails integrating economic, socio-political and environmental aspects into enterprise management. This requires revisiting approaches to strategic planning, decision-making, coordination, and performance evaluation. Such a model will foster positive outcomes in company development while ensuring the sustainability of social, environmental, and economic aspects of its activities. Therefore, the corporate governance system consists of the subject and object of management, interconnected through managerial influence from one side and feedback from the other, both acting under the influence of the external environment and receiving informational support and resources for their functioning, necessary for achieving the overall goal of the company's activities.

The proposed model of corporate governance can be further developed, taking into account the principles of sustainable development. Within each block, specific functions can be identified, and information flows and interconnections aimed at ensuring effective management and achieving sustainable development of the enterprise can be established. The ESPEG model of sustainable enterprise development, with its name reflecting the consideration of environmental, socio-political, economic, and corporate governance aspects, opens up new opportunities for the development of corporate structures. The corporate governance system, which occupies a central place in this model, contributes to achieving sustainable development, innovation and competitiveness of organizations in the modern dynamic world.

## CONCLUSIONS

This article specifically focused on refining and developing the corporate governance (management) system, which occupies a central position within the ESPEG model.

A four-component model of the sustainable development concept for a viable enterprise (ESPEG model) is proposed, which represents the hierarchical arrangement of economic, socio-political, environmental and governance spheres of the enterprise, as well as the directions for applying management tools through which it influences a specific interacting sphere. The justified model of sustainable development for a viable enterprise is based on the principles of the sustainable development paradigm, systemic and holistic approaches. The enhanced conceptual model of sustainable development for a viable enterprise allows for structuring the main components of the concept in order to ensure effective management of the viable enterprise based on the balance of its key constituents.

The theoretical basis of defining the essence of "corporate governance" and "corporate management" has been refined in this study. Unlike existing approaches, the proposed conceptualization is formed based on a categorical method of two-level triadic deciphering, prioritizing the systemic property and acknowledging their complex characteristics. Existing factors were systematically categorized, and objective foundations for defining the concept of "corporate governance" were identified as relationships, activities and results. The development of the triad of fundamental components of the "corporate governance" concept allowed the formulation of this definition and a comparison with the triad of the "corporate management" concept, which was defined as a system, leadership and results. The definitions encompassed a distinctive characteristic – systematization – enabling the analysis and differentiation of the content of these notions, thus aiding in identifying directions for enhancing enterprise management based on sustainable development. The proposed model of the corporate governance system takes into account the need for integrating different management subsystems of the company. In the proposed system of corporate governance, the control loop of corporate management is identified, along with the designated governing and controlled subsystems and their constituents. Within the context of this model, it is important to consider the economic, socio-political and environmental aspects in enterprise management. The application of the sustainable development paradigm requires changes in approaches to strategic planning, decision-making and coordination. Further research could analyse diverse corporate governance models' effects on sustainability in enterprises over time, guiding better integration of sustainable practices. Also, studying regulatory impacts on adopting such governance in different countries and industries can aid governments and organizations in promoting socially responsible and stable corporate practices.

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## CONFLICT OF INTEREST

None.

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# ESPEG-модель та система корпоративного управління для забезпечення сталого розвитку підприємств

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**Анотація.** В 2023 році існує нагальна потреба сприяти зростанню підприємств та забезпечувати їх довготривалу сталість, тому створення ефективної моделі для сталих досягнень та встановлення корпоративної системи управління є на часі. Метою дослідження була розробка моделі сталого розвитку та системи корпоративного управління як інноваційних підходів до забезпечення сталого розвитку підприємств. На основі категоріального методу дворівневого тріадичного дешифрування визначено сутність понять «корпоративне управління» та «корпоративний менеджмент», що дозволило доповнити етимологічно-семантичну складову теоретичних та методологічних основ корпоративного управління та корпоративного менеджменту в підприємствах на основі принципів сталого розвитку. Дослідження базується на принципах сталого розвитку, системного та холістичного підходів. Запропоновано чотирикомпонентну модель концепції сталого розвитку підприємства (модель ESPEG), яка відображає ієрархічне розташування екологічної (E), соціально-політичної (SP), економічної (E) та управлінської (G) сфер підприємства. В цій моделі визначено напрямки застосування інструментів управління для впливу на конкретні взаємодіючі сфери. Результатом роботи є удосконалена модель сталого розвитку підприємства, яка дозволяє структурувати основні складові концепції для забезпечення ефективного управління підприємством на основі балансу його ключових складових. Удосконалено модель системи корпоративного управління, що базується на парадигмі сталого розвитку, та враховує необхідність інтеграції різних підсистем управління компанії. В запропонованій системі корпоративного управління виокремлено контур корпоративного менеджменту, визначені керуюча та керована підсистеми та їх складові. Встановлено, що система корпоративного управління, побудована на основі парадигми сталого розвитку, сприятиме досягненню позитивних результатів у розвитку компанії, забезпеченню сталості соціальних, екологічних та економічних аспектів її діяльності. Впровадження запропонованої системи корпоративного управління полегшить подальше дослідження її сутності та особливостей застосування в сучасних компаніях

**Ключові слова:** менеджмент; відносини; стейкхолдери; персонал; дворівневе тріадичне дешифрування; холістичний підхід

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# Assessment of the influence of factors on the formation of the management structure of a competent organization

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**Abstract.** An important task of Ukrainian organizations in the context of the intensification of European integration processes is to ensure competence on the European market and the ability to compete with organizations of the European Union countries, which directs the efforts of managers to find ways to optimize management structures as part of a set of measures to increase the level of organizational competence. The purpose of the article was to justify the factors of external and internal influence that should be taken into account when building the management structure of the organization in the context of acquiring competence on the European market. To achieve the goal, the methods of content analysis, logical analysis and generalization, analysis of hierarchies, pairwise comparisons, dialectical and expert methods have been used. It is substantiated that in the conditions of Ukraine's accession to the European economic space, it is important to shift the perspective of attention from external circumstances to internal organizational properties, to their competence, which is evidence of knowledge, experience, and skills to perform effective activities, a prerequisite for successful competition of organizations with European producers. The determination of the management structure of organizations as the basis of activity, the guarantee of adaptive properties, have allowed to consider it as a factor of organizational competence and effective functioning in the European environment. The dynamism of the requirements of the European market has been given the status of a priority task of analyzing the factors influencing the formation of the management structure of the organization as a prerequisite for ensuring its competence. An online survey of heads of Ukrainian organizations has made it possible to choose the most significant factors of influence based on the criteria of the strength of influence, cost and duration of prevention of a negative influence. The necessity of priority consideration of the selected factors during the construction of the management structure of the organization for its timely adjustment and improvement of adaptive properties has been proven. Formulated conclusions and recommendations will be useful to managers who strive to form a rational management structure in accordance with the goals and objectives of the organization, which will ensure the coordination of the efforts of employees, a quick reaction to the influence of internal and external factors, increasing the level of organizational competence

**Keywords:** competitiveness; internal environment; external environment; European integration; organizational development

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## INTRODUCTION

The intensification of European integration processes, expanding the possibilities of successful activity of Ukrainian organizations on the European market, causes the emergence of new problems of their functioning. High quality standards and significant competitive advantages of European goods, due to the experience of the functioning of product manufacturers, their knowledge of the specifics and features of the European market space, require the ability of organizations to navigate in the flows of various information, apply progressive tools to optimize business processes, respond flexibly and quickly adapt to dynamic conditions of activity. In an effort to solve the mentioned problem, there is a change in the perspective of attention from external circumstances to the internal properties of organizations in ensuring successful integration into the European economic space. The concept that describes the internal properties of organizations, their knowledge, experience, skills in carrying out activities in combination with available resources, production and management technologies, is the competence of the organization. Its high level promotes organizational development in response to changing market conditions and the unpredictability of market processes.

The need to ensure the successful functioning of Ukrainian organizations on the domestic and foreign markets made it necessary to consider the structure of their management. There is a well-founded opinion that it is the basis of rational activity, a guarantee of high adaptive capabilities of the organization, a prerequisite for acquiring competence and competitive advantages, in particular, on the European market, as I. Gruzina (2023) writes. Questions of forming an effective organizational structure have always been at the center of discussions among representatives of the scientific community. L. Dolhova (2021) studied the possibilities of the organizational structure, in particular, its adaptive properties in ensuring the effective activity of business entities in the conditions of a changing external environment. A. Zaverbnyi & V. Ilnytskyi (2020) focused on assessing the impact of organizational structures on the effectiveness of project management, limiting themselves to the sphere of production of technological products, which significantly narrowed the degree of universality of the developed recommendations. The conclusions of O. Svatiuk *et al.* (2018), who analyzed the trajectories of change in organizational management structures under the influence of situational factors are valuable. However, scientists focused more attention on the construction of effective management structures without determining their impact on the organization's activities as a whole.

T. Omelianenko & K. Korotkova (2020), trying to systematize the traditional and identify the latest factors influencing the development of Ukrainian small entrepreneurship and small business, singled out the ineffectiveness of management decisions as one of the most significant factors. The impact of this factor, both negative and positive, is directly related to the degree of optimality of the management structure, which can be significantly increased by establishing the minimum necessary number of management levels, observing the norms of management in the organization, building an effective communication platform between managers and employees, acquiring them necessary knowledge and skills for the formation of awareness in the system of market relations. Interesting are the conclusions of V.V. Lapteva (2020), which quite clearly define the importance of the correct distribution of powers within the organization, responsibility for the implementation of all necessary functions, tasks between employees, which significantly depends on the applied management structure. The system of indicators for evaluating the effectiveness of the organizational structure developed by the author can be useful in the process of its construction (improvement) with an emphasis on ensuring a high level of organizational competence.

Without diminishing the value of scientific developments, it should be noted that previous studies did not reveal developments devoted to the analysis of directions for the construction and development of organizational management structures in the context of ensuring a high level of organizational competence in the market. There are almost no attempts by scientists to investigate and analyze the direction and strength of the influence of external and internal factors on the management structure in the conditions of the dynamic environment of the functioning of modern organizations, its deep transformational tendencies. The urgent need to adapt modern Ukrainian organizations to the conditions of an unstable political and economic situation, the peculiarities and requirements of the European market directed the research to the analysis of factors influencing the formation of the organizational structure of management in the context of increasing the competence of the organization and the efficiency of its activities. In view of this, the purpose of the study was to identify the external and internal factors that have the most significant impact on the management structure of a competent organization.

## MATERIALS AND METHODS

The working hypothesis of the research is as follows: taking into account the influence of factors of the internal and external environment of the organization contributes to the creation of a rational management structure as a prerequisite for acquiring a level of organizational competence sufficient for successful activity on the European market. The methods of content analysis, logical analysis and generalization have made it possible to form a set of key factors of the internal and external environment of the organization. The generalization of approaches to the analysis of factors, the justification of their influence on the organizational structure of management has been carried out by using the dialectical method. The method of analyzing hierarchies has become useful in determining the factors of the most significant influence on the management structure in the context of ensuring an increase in the level of organizational competence. With the help of the analysis of literary sources and the existing practice of the activities of Ukrainian organizations, the selection of evaluation criteria of factors has been carried out, among which: the strength of the influence of the factor on the formation of the management structure of the organization, the cost and duration of prevention of their negative impact.

Direct assessment of factors according to the selected criteria has been carried out by using the method of

pairwise comparisons with the help of an expert method. The research has been based on the group work of experts. Heads of Ukrainian organizations in the field of small business were chosen as representatives of the expert group. Such organizations are more flexible and adaptive, therefore, more often inclined to change the management structure in response to changes in the conditions of the market situation. The results have been obtained through an anonymous online survey of managers of organizations operating in similar fields of activity, having similar organizational properties, sizes, and positions in the market segment. The main focus has been on clarifying the opinions of experts regarding the feasibility of taking into account certain factors of external and internal influence during construction management structure of the organization in view of the selected assessment criteria. During the survey, heads of organizations have compared different alternatives in pairs according to each criterion. Ethical norms have been followed when working with people (American psychological..., 2017). All participants have been informed about anonymity, the purpose of the study, and how their data will be used. For ease of presentation of the results, the following designations have been chosen: HO 1 – head of organization 1; HO 2 – head of organization 2; HO 3 – head of organization 3; HO 4 – head of organization 4; HO 5 – head of organization 5. Experts have been asked to evaluate the importance of factors according to the selected criteria using points.

The calculation of the most significant factors of external and internal influence on the management structure of the organization in view of the selected evaluation criteria was carried out by filling in the matrices of pairwise comparisons, calculating the components of the eigenvector of the matrices (1), the normalized vector of the matrices (2), the consistency index (4) and the consistency coefficient (5) (Tavana *et al.*, 2021):

$$W_i = (a_{i1} \times a_{i2} \times a_{i3} \dots a_{in})^{\frac{1}{n}}; \quad (1)$$

$$W_n = \frac{W_i}{\sum_{i=1}^{n} W_i}; \quad (2)$$

$$\lambda_{max} = \sum_{j=1}^{n} a_{ij} \times W_{n\,j}\,\lambda_{max} = \sum_{i=1}^{n}\left(\sum_{i=1}^{n} E_{ij} \times W_i\right); \quad (3)$$

$$CI = \frac{(\lambda_{max} - n)}{n-1} \leq 0.2; \quad (4)$$

$$CR = \frac{CI}{RC}, \quad (5)$$

where W is the component of the eigenvector of the matrix; $W_n$ is the normalized vector of the matrix of pairwise comparisons; $\lambda_{max}$ is the maximum eigenvalue of the matrix; CI is the consistency index; *RC* is the average value of the consistency indicator; CR is the consistency coefficient.

The method of analysis of hierarchies has been used to reconcile inconsistent and consistent data. The value of the consistency index at a level lower than 0.2 and the relative consistency (inconsistency) index at the level not exceeding 0.1 makes it possible to assert the consistency of expert opinions. Failure to comply with these requirements necessitates revision of expert assessments. The level of significance of expert assessments and the degree of their suitability for the purpose of further research are significantly increased if the experts' opinions are consistent. The most common is the method of assessing the agreement of the opinions of a group of experts, which involves calculating of the concordance coefficient. The calculation of the concordance coefficient has been carried out by converting the score matrix into the rank matrix of the degree of agreement of the experts' opinions regarding the criteria for evaluating the factors of the external and internal environment. Since evaluations of influencing factors are characterized by repeatability and standardized ranks are present, the concordance coefficient was calculated using formulas (6-8) (Hrabovetskyj, 2010).

$$W = \frac{12\sum_{j=1}^{m} d_j^2}{n^2(m^2-m)}; \quad (6)$$

$$d_j = S_j - \frac{\sum_{j=1}^{m} S_j}{m}; \quad (7)$$

$$S_j = \sum_{i=1}^{n} R_{ij}, \quad (8)$$

where *W* the concordance coefficient; *n* is number of experts, persons; *m* is number of criteria, units; $d_j$ is deviation of the sum of ranks according to the *j* criterion from the average sum of ranks for the sample; $S_j$ is sum of ranks according to the *j* criterion; $R_{ij}$ is matrix of ranks.

Compliance with the algorithm of calculations based on the method of analysis of hierarchies has made it possible to determine indicators of average integral advantages for various factors and the global priority of alternatives. This provided an opportunity to substantiate the choice of the most significant factors of influence, the consideration of which is a primary task when building the management structure of the organization, which will contribute to the achievement of the necessary level of its competence in the European market. Data processing and necessary calculations have been carried out using Microsoft Excel (Microsoft, USA). Visualization of the research results to simplify the perception of the obtained results have taken place with the help of graphic and tabular data presentation methods.

## RESULTS AND DISCUSSION

The determination of the organization's management structure as an element of ensuring its viability, development and gradual achievement of the level of competence corresponding to the current market situation necessitated the consideration of factors of the external and internal environment in the process of its creation or transformation. The selection of factors and their assessment was carried out according to the following algorithm (Fig. 1).

Previous studies (Gruzina, 2022) systematized external and internal factors for the purpose of their further analysis, evaluation and consideration of the impact. This makes it possible to make timely decisions about the need to adjust or reorganize the management structure in the context of ensuring organizational competence in accordance with market requirements (Bobrovnyk, 2009; Vilhutska, 2013; Pinchuk, 2015). The factors of external influence include the complexity and dynamism of the external environment, unregulated by the organization, the level of competition in the industry, the state of the market situation, legislation regulating economic activity; partially regulated peculiarities of national culture, state institutions

and geographical location of the organization; regulated human factor of the external environment, which included business partners, suppliers of materials, consumers of products and the public. As for the factors of the internal environment that are regulated, it is advisable to include the organizational form, the type of economic activity, the scale (size) of the organization, the organization of work (the level of its automation), goals, tasks, mission and organizational standards, the degree of integration into the production economic structures, applied technologies and the human factor of the internal environment, which includes the level of personnel qualifications, their value and work experience, the interests of owners, professionalism, vision, beliefs and ambitions of managers, relationships in the organization, the behavior of employees and their competencies (Gruzina, 2022).

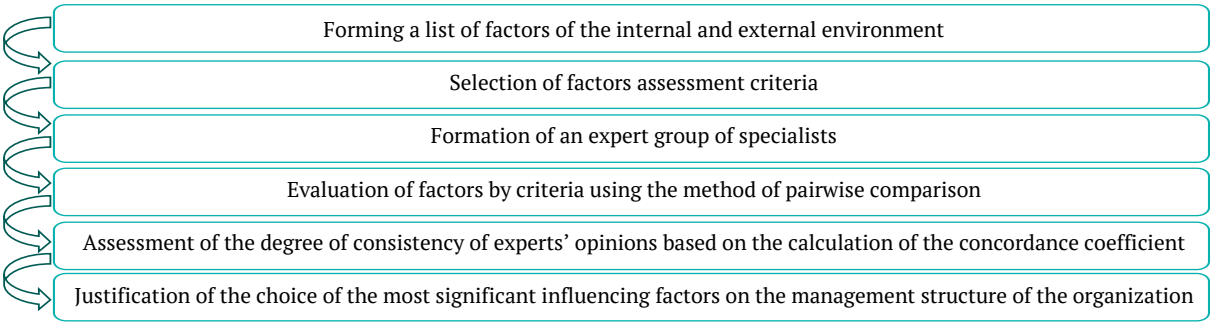


**Figure 1.** Algorithm for selecting factors influencing the organizational management structure
**Source:** made by the authors

Establishing a list of factors is not a particularly difficult task, because it is supported by a meaningful theoretical and practical basis (Vilhutska, 2013; Pinchuk, 2015; Svatiuk *et al.*, 2018). This cannot be said about determining the degree of influence of each factor on the organizational management structure, which determines the priority of their consideration in the process of building or adjusting the organizational management structure. Issues related to determining the expediency of preventing the negative impact of factors, which requires determining the cost and duration of this process in comparison with the likely positive effect for the level of the organization's competence, and, therefore, the effectiveness of its activities, are insufficiently researched. The specified list of factors is not exhaustive and is quite dynamic, because it changes according to the needs of the organization at a specific stage of its development, desired goals and priority tasks, which, in turn, determine the necessary level of organizational competence. Each factor is important, because it has a direct or indirect influence on the organization's management structure, requiring its improvement in the context of ensuring a certain level of competence. However, the desire to take into account as many factors as possible often leads to the formation of a too broad list of them. This objectively complicates their further evaluation, slows down the implementation of this process, its implementation in organizational practice, provokes additional financial and time costs. It is expedient to select alternative variants of factors using the analytical-hierarchical process. The algorithm for selecting the factors influencing the external and internal environment on the management structure of the organization, depending on the selected criteria, is presented in Table 1.

**Table 1.** Hierarchy of the decomposition of the selection of factors influencing the external and internal environment on the management structure of the organization

| Purpose | Criteria | Alternatives |
|---|---|---|
| Selection of factors influencing the external environment on the management structure of the organization | The influence of the factor | Complexity and dynamism of the external environment |
| | | Level of industry competition |
| | | The state of the market |
| | | Geographical location of the organization |
| | | Legislation regulating economic activity |
| | | State institutes |
| | | Peculiarities of national culture |
| | | The human factor of the external environment |
| | The cost of preventing the negative impact of the factor | Complexity and dynamism of the external environment |
| | | Level of industry competition |
| | | The state of the market |
| | | Geographical location of the organization |
| | | Legislation regulating economic activity |
| | | State institutes |
| | | Peculiarities of national culture |
| | | The human factor of the external environment |

Table 1, Continued

| Purpose | Criteria | Alternatives |
|---|---|---|
| Selection of factors influencing the external environment on the management structure of the organization | The duration of the prevention of the negative impact of the factor | Complexity and dynamism of the external environment |
| | | Level of industry competition |
| | | The state of the market |
| | | Geographical location of the organization |
| | | Legislation regulating economic activity |
| | | State institutes |
| | | Peculiarities of national culture |
| | | The human factor of the external environment |
| Selection of factors influencing the internal environment on the management structure of the organization | The influence of the factor | Organizational form |
| | | Kind of economic activity |
| | | Scales (sizes) of the organization |
| | | Organization of work (level of its automation) |
| | | Goals, tasks, mission and organizational standards |
| | | The degree of integration into production and economic structures |
| | | Applied technologies |
| | | The human factor of the internal environment |
| | The cost of preventing the negative impact of the factor | Organizational form |
| | | Kind of economic activity |
| | | Scales (sizes) of the organization |
| | | Organization of work (level of its automation) |
| | | Goals, tasks, mission and organizational standards |
| | | The degree of integration into production and economic structures |
| | | Applied technologies |
| | | The human factor of the internal environment |
| | The duration of the prevention of the negative impact of the factor | Organizational form |
| | | Kind of economic activity |
| | | Scales (sizes) of the organization |
| | | Organization of work (level of its automation) |
| | | Goals, tasks, mission and organizational standards |
| | | The degree of integration into production and economic structures |
| | | Applied technologies |
| | | The human factor of the internal environment |

**Source:** developed by the authors

Assessments of the importance of factors were obtained based on the criteria of influence, cost and duration of prevention of the negative direction of their influence, which made it possible to establish the priority of their consideration when building the organization's management structure. Checking the obtained estimates, considering the degree of consistency of experts' opinions, is a mandatory stage, because only agreed opinions can be used for further research. The calculation of the concordance coefficient made it possible to assert the possibility of using the hierarchy of factors in the construction of the management structure of an organization striving to acquire a high level of competence in the European market. To increase the accuracy and objectivity of the research, it is advisable to carry out calculations separately based on the totality of factors of the external and internal environment (Table 2).

**Table 2.** Assessment of the degree of consistency of experts' opinions regarding the criteria for assessing the factors of the external and internal environment

| Criteria | Expert | | | | | Sum of ranks *Sj* | Deviation of the sum of ranks from the average sum of ranks by sample (*di = rj-dcp*) | The square of the deviation of the sum of ranks from the average sum of ranks for the sample ($d^2$) |
|---|---|---|---|---|---|---|---|---|
| | HO 1 | HO 2 | HO 3 | HO 4 | HO 5 | | | |
| The influence of the factor | 1 | 1 | 1 | 1 | 1 | 5 | -5 | 25 |
| The cost of preventing the negative impact of the factor | 3 | 3 | 3 | 3 | 3 | 15 | 5 | 25 |

Table 2, Continued

| Criteria | Expert | | | | | Sum of ranks Sj | Deviation of the sum of ranks from the average sum of ranks by sample ($di = rj - dcp$) | The square of the deviation of the sum of ranks from the average sum of ranks for the sample ($d^2$) |
|---|---|---|---|---|---|---|---|---|
| | HO 1 | HO 2 | HO 3 | HO 4 | HO 5 | | | |
| The duration of the prevention of the negative impact of the factor | 2 | 2 | 2 | 2 | 2 | 10 | 0 | 0 |
| The variance of the sum of ranks ($S = \Sigma d^2$) | 50 | | | | | | | |
| Concordance factor ($W = 12*S/(N^2*(m^3-m))$) | 1 | | | | | | | |
| Parameter $x^2$ ($x_p^2 = N*(m-1)*W$) | 35 | | | | | | | |

**Source:** developed by the authors

Scientists have established (Hrabovetskyj, 2010) that the value of the concordance coefficient can vary from 0 to 1. The lower value of the coefficient indicates a lower degree of consistency of experts' opinions. When , the absolute lack of agreement among experts can be established. When the value of the concordance coefficient is at the level of one, there is a complete agreement of expert opinions. According to the results of the expert evaluation of the criteria (Table 3), the concordance coefficient is equal to 1, which indicates the complete agreement of the experts' opinions. The calculated value of the Pearson test ($x_p^2$) exceeds the table value (6) and is evidence of high consistency of experts' opinions. On the basis of the received expert evaluations, a matrix of average integral advantages was constructed for alternative factors of external and internal influence (Table 3-4).

**Table 3.** Assessment of the degree of average integral advantages of alternative factors of external influence

| Alternatives | The influence of the factor | The cost of preventing the negative impact of the factor | The duration of preventing the negative impact of the factor | Integral benefits |
|---|---|---|---|---|
| Complexity and dynamism of the external environment | 0.27 | 0.34 | 0.20 | 0.26 |
| Level of industry competition | 0.25 | 0.08 | 0.07 | 0.20 |
| The state of the market | 0.16 | 0.05 | 0.06 | 0.13 |
| Geographical location of the organization | 0.10 | 0.18 | 0.11 | 0.11 |
| Legislation regulating economic activity | 0.09 | 0.18 | 0.32 | 0.15 |
| State institutes | 0.05 | 0.11 | 0.17 | 0.08 |
| Peculiarities of national culture | 0.04 | 0.03 | 0.03 | 0.03 |
| The human factor of the external environment | 0.04 | 0.03 | 0.04 | 0.04 |
| Importance of the criterion | 0.67 | 0.11 | 0.22 | 1.00 |

**Source:** developed by the authors

**Table 4.** Evaluation of the degree of average integral advantages of alternative factors of internal influence

| Alternatives | The influence of the factor | The cost of preventing the negative impact of the factor | The duration of preventing the negative impact of the factor | Integral benefits |
|---|---|---|---|---|
| Organizational form | 0.03 | 0.06 | 0.04 | 0.03 |
| Kind of economic activity | 0.05 | 0.07 | 0.12 | 0.07 |
| Scales (sizes) of the organization | 0.15 | 0.11 | 0.24 | 0.17 |
| Organization of work (level of its automation) | 0.03 | 0.03 | 0.05 | 0.04 |
| Goals, tasks, mission and organizational standards | 0.29 | 0.32 | 0.25 | 0.28 |
| The degree of integration into production and economic structures | 0.11 | 0.15 | 0.08 | 0.11 |
| Applied technologies | 0.07 | 0.03 | 0.03 | 0.06 |
| The human factor of the internal environment | 0.26 | 0.24 | 0.19 | 0.24 |
| Importance of the criterion | 0.67 | 0.11 | 0.22 | 1.00 |

**Source:** calculated by the authors

According to the results of the calculations, the most significant factors of the external environment, which must be taken into account when building the organization's management structure in view of ensuring the necessary level of its competence, are the complexity and dynamism of the external environment (integral advantage 0.26), the level of industry competition (integral advantage 0.20), legislation regulating economic activity (integral advantage 0.15) and the state of the market situation (0.13) (Fig. 2).

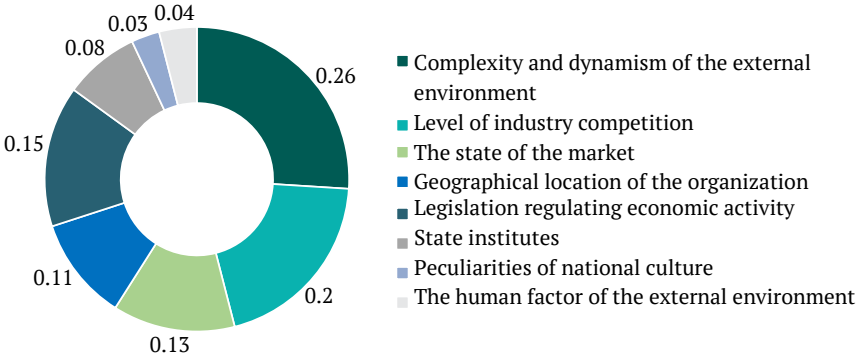


**Figure 2.** The importance of assessing the global priority of alternative factors of the external environment
**Source:** developed by the authors

This is explained by the fact that all factors are unregulated by the organization, their impact is significant and rapidly changing, which can both harm the organization and provide it with additional opportunities, contributing to an increase in the level of its own competence and, accordingly, the acquisition of additional competitive advantages in the market. The external environment directly determines the feasibility of using different types of organizations. Practice has proven that relative stability or minor changes in the environment determine the success of mechanistic organizations that are characterized by rationality, hierarchy, a certain rigidity and stability. This also determines the applied type of organizational management structure (Chorna, 2014). If it is about a more dynamic environment with a certain level of uncertainty, which is a characteristic of the current state of the Ukrainian economy, organic-type organizations will be more effective. Such structures, distinguished by a high level of decentralization of the structure and active delegation of large volumes of decision-making rights to structural units, due to flexibility and adaptability, are able to change shape relatively easily, adapt to new conditions, and quickly respond to external changes.

As for the level of competition and the state of market conditions, forcing organizations to adapt to them, they also force them to implement organizational changes and reorganize existing management structures. The management's ability to accurately determine the nature of changing trends in the economic situation and its ability to make adequate management decisions to strengthen the organization's market position become critically important. Often this involves the opening of new branches of the organization with a mandatory reorganization of the existing management structure; regarding the provisions of the legislation, the current normative acts directly determine the organizational structure of economic entities, influencing the structure of their management at various stages of formation (Vilhutska, 2013; Pinchuk, 2015). The lack of regulation of the factor on the part of the organization and the dynamics of its change in modern economic conditions explain the importance of taking it into account when building an organizational management structure and planning future activities. Among the factors of the internal organizational environment, the most significant in the construction of the management structure of the organization are goals, tasks, mission and organizational standards (integral advantage 0.28), human factor (integral advantage 0.24), scale (dimensions) of the organization (integral advantage 0.17) (Fig. 3).

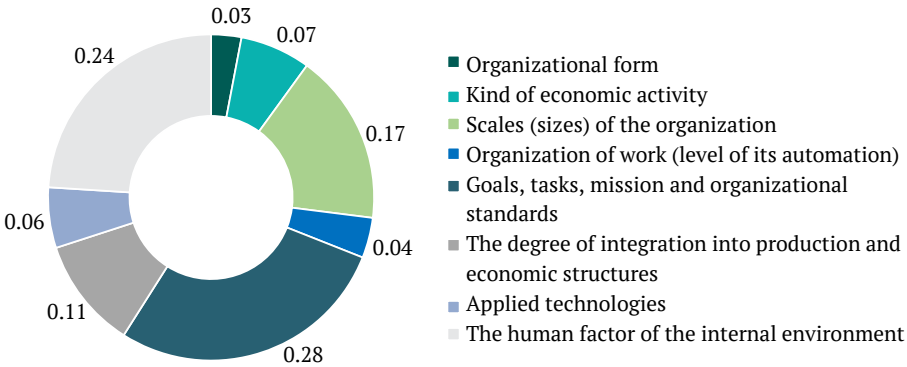


**Figure 3.** The importance of assessing the global priority of alternative factors of the internal environment
**Source:** developed by the authors

The priority of the first factor coincides with the opinion of the vast majority of scientists, who consider the goals and objectives of the organization, its mission and standards to be the determining internal factors influencing the formation of management structure (Vilhutska, 2013; Pinchuk, 2015). The structure is built in such a way that achievement of goals becomes possible thanks to the performance of tasks by structural units. Sometimes this requires a redesign of the organization's management structure, the main purpose of which is to create conditions for successful achievement of goals and realization of its mission (Bobrovnyk, 2009; Pinchuk, 2015). The role of the human factor is key for organizations seeking to acquire competence in domestic and foreign markets. The insufficient level of qualification of employees or the absence of experienced management personnel can inhibit the construction (reorganization) of the management structure, create additional difficulties for the distribution of functions and tasks between units and performers (Gruzina, 2022).

Approaches to building management structures in large, medium and small organizations are radically different, which emphasizes the importance of taking into account the scale (dimensions) of the organization when building a management structure (Bobrovnyk, 2009). This factor affects the number of levels of the management hierarchy, the number and geographical location of structural divisions, the number of linear and functional connections, the number of management employees and the total number of employees in the organization (Gruzina, 2023). The size of the organization, which directly affects the number of captured markets (market segments) with varying degrees of similarity and peculiarities of the operating conditions in different territories, determines the formation of a certain organizational management structure. The specified factors must be under constant control, it is important to study the relationships between them and other factors in order to ensure timely corrective measures aimed at ensuring an increase in the level of organizational competence and, accordingly, indicators of the economic development of the organization (Vilhutska, 2013).

Representatives of the scientific community of different countries at different times tried to identify directions for building an effective organizational management structure, systematize the factors influencing the organization's management structure, determine the direction and strength of their influence, justify the need to take into account when building and revising strategies for future activities. The achievements of T. Hörbe *et al*. (2021) are valuable in view of the purpose of research, because the goal of the scientists was to analyze the influence of the dimensions of the organization's structure on its ability to learn, which is one of the most important components of organizational competence. Limiting themselves to only one factor – size, and choosing a representative of a specific field of activity as a basis for analysis – a transport company, the scientists somewhat reduced the degree of universality of the developed recommendations. However, the used research methodology, in particular, the case method, quantitative and qualitative data collection and analysis procedures, provided they are consistently adapted, can be no less successfully used to analyze the management structures of organizations in other areas of business. A. Joyce *et al*. (2022) chose a somewhat different direction of research. Based on the analysis of organizations in the social sphere, scientists studied the impact of organizational structures and processes on the health and well-being of employees. Turning to the structure of organizational competence, it should be noted that employees, their physical and psychological state directly affect the quality of work, determining the overall level of organizational competence. The developed recommendations are valuable for the creation and development of competent organizations, despite the specificity of the research evidence base. S. Nowotny *et al*. (2022) studied the causes of differences in the excellence of organizational management, focusing mainly on intra-organizational aspects. Considering the management structure as the main organizational determinant, scientists investigated its influence, in particular, such variables as centralization, formalization and horizontal integration, on the quality of management and the organizational ability to implement innovations. The formulated conclusions are useful, but to a greater extent, for understanding the role and importance of the organizational structure in ensuring the effective operation of the organization, increasing the level of its competence. The issue of choosing factors whose influence is significant and must be taken into account when building the organization's management structure in the context of its acquisition of competence in the modern market remains open.

Researchers X. Dong *et al.* (2023) studied the advantages of flat and flexible organizational structures in a dynamic external environment, in particular, the absence of the need for standardization and specialization, focusing on their facilitation of quick solutions to simple tasks. Formulated conclusions differ in practical value in the conditions of today, which is characterized by an unstable political and economic situation. However, the developed recommendations make it almost impossible to use them in large, developed organizations that differ in the scale of their activities and the complexity of business processes, therefore, they need a clear definition of the duties, rights and benefits of employees, that is, a certain hierarchy with the corresponding strict observance of corporate rules and norms in the direction ensuring overall organizational efficiency. Management structures considered by X. Dong *et al.* (2023) have a positive effect on the level of competence, but in a limited range of organizations. Factors that lead to the need to transform management structures, as well as signs that indicate the expediency of implementing flexible structures, remained outside the attention of scientists.

R. Carucci & J. Shappell (2022) emphasized the importance of building an organizational management structure in maximum compliance with the requirements of the organization's strategy. Scientists considered a major problem to be a misunderstanding of the term "alignment", which, in their opinion, means the configuration of the management structure for the implementation of the declared activity strategy. However, the scientists chose for evaluation only one factor of influence on the management structure – the strategy of organizational activity, the mission and actual goals of the organization, without paying attention to the rest of the equally important factors. K. Henderson & A. Salado (2023) demonstrate the opposite direction of research, considering organizational culture and structure as factors that prevent the rapid

implementation of systems engineering in the activities of industrial organizations. Having selected a significant list of characteristics of the organizational structure, including size, formalization, centralization, specialization, vertical differentiation, flexibility and interconnection, scientists tried to investigate the correlation between them and the prerequisites for the effective implementation of systems engineering. There was a study of the impact of the main characteristics of the management structure on a separate component of organizational competence without a corresponding analysis of those aspects that determine the need to change these characteristics.

The conclusions of representatives of McKinsey & Company deserve attention. Specialists P. Guggenberger *et al*. (2023) studied different directions of change in modern organizations, caused first by the COVID-19 pandemic, and then by economic recession, rapid inflation and geopolitical upheavals. The main focus of the research was on the justification of necessary organizational changes that significantly affect management structures, the processes that take place in them, and people. Useful recommendations for the prediction and response of organizations to external shocks were based on the inverse relationship between the state of the organization and its management structure. The focus was on the trajectory of changes in the organizational structure under the influence of implemented organizational changes. Since the organizational form, the type of economic activity, and the scale (size) of the organization are, according to the evaluation results, factors of significant influence on the organizational structure, according to the authors, the conclusions of scientists are valuable, but need to be supplemented by researching other, equally important factors.

Recommendations of representatives of the scientific community of other countries (Carucci & Shappell, 2022; Henderson & Salado, 2023) allowed analysis of the foreign experience of building effective organizational structures for the management of modern organizations. However, not always the conclusions formed on the basis of the analysis of the local organizations activities are relevant for the specific conditions of organizations' functioning in Ukraine and they cannot always be successfully implemented in their economic practice. Returning to the aim of the research, it should be noted that there are only rare cases of research by scientists into the organization's management structure and factors ensuring its effectiveness in the context of acquiring a high level of organizational competence. It is possible to emphasize the relevance and expediency of the selection and objective assessment of the direction and strength of the influence of internal and external environmental factors on the creation of an effective organization management structure, which has been considered in this article. This will significantly expand the opportunities for the development of organizational competence, in particular, on the European market, and will allow Ukrainian organizations to successfully integrate into the European economic space.

## CONCLUSIONS

The main idea of the article has been to systematize factors of the external and internal environment and justify the need to take them into account when building (restructuring) management structures of modern organizations. This will provide an opportunity to increase the level of organizational competence and to adapt more quickly to the dynamic requirements of the European market. It is noted that the course chosen by Ukraine to join the European economic space creates a number of new problems in their functioning. This is a high level of competition and quality standards of European goods, the competitive advantages of European manufacturers, due to their experience of operation, knowledge of the specifics of the market. The increasing chances of success of Ukrainian organizations depend on the ability to respond flexibly and quickly adapt to changing business conditions, which draws attention to internal organizational properties. This is about competence, which includes knowledge, experience, skills in carrying out activities in combination with resources, production and management technologies.

It has been justified that the management structure of modern organizations should be considered as a prerequisite for acquiring competence in the European market due to the ability to ensure organizational development, rapid adaptation to changes in market conditions and the unpredictability of market processes. The dynamism of the requirements of the European market determines the need for adaptation of Ukrainian organizations, requires an analysis of the factors affecting the formation of their management structure to ensure competence and efficiency of activities. The influence of factors determines the presence in the structures of elements and connections that directly affect its rationality and compliance with the conditions of functioning. An online survey of heads of Ukrainian organizations have helped to assess the factors of internal and external influence based on the criteria of influence, cost and duration of prevention of its negative direction. This made it possible to choose the most significant factors, the consideration of which is a priority in the process of building the management structure. It has been proven that the complexity and dynamism of the external environment, the level of competition in the industry, the legislation regulating economic activity and the state of the market, as well as goals, tasks, missions and organizational standards, the human factor of the internal environment and the scale of the organization have the greatest impact on the organization's management structure. These factors should be primarily taken into account when building the management structure and be under constant control to ensure its timely adjustment and adaptability to the requirements of the market situation. The high degree of concordance of experts' opinions, determined on the basis of calculating the concordance coefficient, has made it possible to establish the factors of significant influence on the formation of the management structure and lead them to a certain system. This will allow, through further research, to develop recommendations for analysis, evaluation and consideration of their impact in the process of creating or transforming the organization's management structure in the context of its acquisition of competence in the modern market.

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## CONFLICT OF INTEREST

None.

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# Оцінка впливу чинників на формування структури управління компетентною організацією

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**Анотація.** Важливим завданням українських організацій в умовах інтенсифікації євроінтеграційних процесів є забезпечення компетентності на європейському ринку та можливості конкурувати з організаціями країн Європейського Союзу, що спрямовує зусилля керівників на пошук шляхів оптимізації структур управління в складі комплексу заходів із підвищення рівня організаційної компетентності. Метою статті було обґрунтування чинників зовнішнього та внутрішнього впливу, що мають враховуватися при побудові структури управління організацією в контексті набуття компетентності на європейському ринку. Для досягнення мети використано методи контент-аналізу, логічного аналізу й узагальнення, аналіз ієрархій, метод попарних порівнянь, діалектичний та експертний методи. Обґрунтовано, що в умовах приєднання України до європейського економічного простору важливим є зміщення ракурсу уваги із зовнішніх обставин на внутрішні організаційні властивості, їх компетентність, що є свідченням знань, досвіду, навичок здійснення ефективної діяльності, передумовою успішної конкуренції організацій з європейськими товаровиробниками. Визначення структури управління організаціями основою діяльності, запорукою адаптаційних властивостей, дозволило розглядати її як чинник організаційної компетентності та ефективного функціонування у європейському середовищі. Динамічність вимог ринку Європи надали статусу першочергового завдання аналізу чинників впливу на формування структури управління організацією як передумови забезпечення її компетентності. Онлайн-опитування керівників українських організацій дозволило обрати найсуттєвіші чинники впливу за критеріями сили впливу, вартості й тривалості попередження негативного впливу. Доведено необхідність першочергового врахування обраних чинників при побудові структури управління організацією для своєчасного її коригування та підвищення адаптивних властивостей. Сформульовані висновки та рекомендації будуть корисними керівникам, які прагнуть до формування раціональної структури управління відповідно до цілей й задач організації, що забезпечить координацію зусиль співробітників, швидку реакцію на вплив внутрішніх та зовнішніх чинників, підвищуючи рівень організаційної компетентності

**Ключові слова:** конкурентоспроможність; внутрішнє середовище; зовнішнє середовище; європейська інтеграція; розвиток організації

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# Exchange rate fluctuations and manufacturing output: Stylized evidence in Nigeria

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**Abstract.** One of the key engines of growth in many countries is the manufacturing sector, whose performance is impacted by the movement of the local currency. The manufacturing sector also offers opportunities like increased commerce, innovation, competitiveness, increasing exports, and productivity, which will only be possible when exchange rate is in the form of currency appreciation. The purpose of this study, therefore, was to investigate the effect of exchange rate fluctuations on Nigerian manufacturing output. The Generalized Autoregressive Conditional Heteroscedasticity technique was used in the study in order to examine the exchange rate oscillations. The result of the model estimation revealed that there is no persistence of shocks in the volatility of the exchange rate in the Nigerian economy. The business cycle stylized facts were also used to examine exchange rate volatility and the result established that exchange rate is highly volatile and has a negative effect on manufacturing output in Nigeria. The Auto Regressive Distributed Lag Bounds test was used to establish the long-run relationship and the result showed that there is a long-run relationship between exchange rate and manufacturing output. The variance decomposition and Impulse Response function were employed and the result

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revealed that exchange rate fluctuation has a negative impact on manufacturing gross domestic product in Nigeria. In practice, based on the results of the study, it can be recommended to the monetary authorities to constantly monitor the exchange rate fluctuations in order to create policies that are well-informed and match the exchange rate to the actual needs of manufacturing sector in order to boost its output

**Keywords:** generalized autoregressive conditional heteroscedasticity; Hodrick-Prescott filter; volatility; business cycle; consumer price index

## INTRODUCTION

One of the major constraints on the overall development of an economy is exchange rate fluctuation because it makes planning more problematic and difficult and investment becomes riskier. Exchange rate is the value of one currency in relation to another. It is the price of the currency of one country in terms of another currency that a country uses in determining its level of economic performance (Onabote *et al.*, 2021). Exchange rate is significant because it bridges the gap between domestic and foreign prices. There is a high demand for foreign exchange in Nigeria, with a high import rate of raw materials and capital goods from the manufacturing sector. Thus, shocks to Nigerian exchange rates will have a wide range of effects on manufacturing sector (Areghan *et al.*, 2018). Exchange rate fluctuations impact the production level of manufacturing firms through trade channel effects and variations in the prices of inputs and outputs. In the words of R.O. Akeem (2019) increasing manufacturing sector performances have a positive impact on a country's economy. That is not the case in Nigeria because the inability to import due to currency depreciation has negative impacts on manufacturing production (Tams-Alasia *et al.*, 2018).

Statistics shows that Nigeria's exchange rate has been depreciating consistently (World Bank data, n.d.). Recently, CBN (Central Bank of Nigeria) recorded Nigeria exchange rate as $1: ₦460.6 (Exchange rate archives, 2023). This gave clear evidence of the country's exchange rate swings, which are observable in the increase in cost of production for manufacturers. Several programs have been adopted to reduce the continuous fluctuating exchange rate. Some of these programs are: exchange rate targeting, independent exchange rate management, Second-tier Foreign Exchange Market, Pro-rata System of foreign exchange allocation, Wholesale Dutch Auction System and New Flexible Exchange Rate Policy. Unfortunately, despite all these, exchange rate fluctuation and naira devaluation are still major problems in Nigeria (Sunday & Olajide, 2018). As a result, these movements have generally hindered the performance of the manufacturing sector (Orji *et al.*, 2018).

The economic effects of exchange rate fluctuation have been a focus of several authors. O. Tams-Alasia *et al*. (2018) investigated the impact of exchange rate deregulation on Nigerian manufacturing output performance. Using the ARDL (Auto-regressive distributed lag) they found out that there is no significant positive long-run effect on manufacturing industry output. Alternatively, A.J. Falaye *et al*. (2019) examined the relationship between Naira depreciation and manufacturing output using Johansen co-integration test. They discover that depreciation of Naira will be detrimental to Nigeria's manufacturing sector's performance. E. Buabeng *et al*. (2019) examined the impact of exchange rate fluctuations on the performance of Ghanaian manufacturing firms. The limits test approach to cointegration was adopted, and they found out that the performance of manufacturing firms is negatively and significantly linked to the exchange rate. Similarly, C. Mlambo (2020) examined how exchange rate affected manufacturing performance in Southern African Customs Union countries. The study used the FMOLS (fully modified ordinary least squares) and PMG (pooled mean group) panel group methods to analyse data. They find out that manufacturing performance was positively correlated with exports and inflation.

The macroeconomic effects of exchange rate fluctuations on Nigeria's manufacturing sector performance was examined by A.N. Amadi *et al*. (2018). Using the vector auto regression estimate method and GARCH (Generalised Autoregressive Conditional Heteroscedasticity) to estimate exchange rate volatility, they found that exchange rate fluctuations limit the performance of Nigeria's manufacturing sector and thus have a significant macroeconomic impact on the industry. Similarly, N.J. Okoye *et al*. (2021) examined the link between exchange rate oscillation and government spending in Nigeria. The study adopted the Mundell-Fleming model and descriptive statistics. They find that both capital and recurrent expenditures have no significant effect on exchange rate in Nigeria. N. Ali (2020) examined the impact of exchange rate fluctuations on manufacturing performance in Nigeria using the ARDL approach. The study's revealed that exchange rate fluctuation has a negative impact on the performance of the Nigerian manufacturing sector. Contrarily, O.T. Ayobami (2019) used an ARDL estimate technique to investigate the impact of exchange rate volatility on the performance of Nigeria's manufacturing sector. The author found that exchange rates have a positive but insignificant effect on manufacturing sector output in the long run, but a negative significant effect in the short run.

Despite several research works carried out on exchange rate fluctuations and their numerous effects on various macroeconomic variables, not much attention is given to its effect on manufacturing output using the GARCH method and the Hodrick-Prescott filtering approach. Thus, this study uses these techniques to investigate the impact of exchange rate fluctuations on manufacturing output in Nigeria.

## MATERIALS AND METHODS

This study adopted Lewis Authur's structural change theory. The theory comprises the traditional- subsistence division and the modern-manufacturing segment. The hypothesis is that the overall improvement of an economy is subject to the development of two segments. This can be stated as:

$$Y = f(A, M), \quad (1)$$

where $Y_t$ is Economic Development; $A_t$ is Agricultural Sector; $M_t$ is the Manufacturing Sector. Equation 1 can be explicitly stated as:

$$Y_t = a_0 + \sum b_i A_i + b_2 M_i + \varepsilon_t, \quad (2)$$

where $Y_t$ is the output at time t, $a_0$ is the intercept, $\varepsilon_t$ is the error term, $b_1$ and $b_2$ are the coefficients of independent variables.

$$MGDP_t = f(EXCH_t, INT_t, CPI_t, MCU_t, MCAP_t). \quad (3)$$

The economic relationship can be specified in a linear form as:

$$MGDP_t = \beta_0 + \beta_1 EXCH_t + \beta_2 INT_t + \beta_3 CPI_t + \\ + \beta_4 MCU_t + \beta_5 MCAP_t + \varepsilon_t. \quad (4)$$

Stating equation 4 in log form:

$$L\_MGDP_t = L\_\beta_0 + \beta_1 L\_EXCH_t + \beta_2 L\_INT_t + \\ + \beta_3 L\_CPI_t + \beta_4 L\_MCU_t + \beta_5 L\_MCAP_t + \varepsilon_t, \quad (5)$$

where $MGDP_t$ is Manufacturing Gross Domestic Product at time t, $EXCH$ is Exchange Rate at time t; $MCU_t$ is Manufacturing Capacity Utilization at time t, $MCAP_t$ is Manufacturing Capital at time t; $INT_t$ is Interest rate at time t, and $CPI_t$ is Consumer Price Index at time $t$; $\mu_t$ is Error term at time $t$, $\beta_0$-$\beta_5$ are coefficient of the independent variables. The data used in this research are secondary time series annual data for the period of 1981-2022, and Eviews 9 (n.d.) was used for analysing the results. Table 1 describes the sources of data used in this study.

**Table 1.** Data sources and descriptions

| Variables | Symbol | Description | Source | Measurement |
|---|---|---|---|---|
| **Manufacturing Output** | MGDP | Manufacturing Gross Domestic Product in Nigeria. | WDI | Manufacturing Output (% of GDP) |
| **Exchange Rate** | EXR | Nigerian Naira Exchange rate to Dollar. | WDI | Local Currency per US$ |
| **Manufacturing Capital** | MCAP | Domestic Credit to the private sector. | WDI | Domestic credit to the private sector (% of GDP) |
| **Manufacturing Capacity Utilization** | MCU | Rate at which a firm employs its installed productive capacity. | CBN Bulletin | Average Manufacturing Capacity Utilisation (%) |
| **Consumer Price Index** | CPI | The yearly percentage change in the cost for an average consumer is measured by the consumer price index. | WDI | Inflation, consumer prices (annual %) |
| **Interest rate** | INT | The lending rate is adjusted for inflation using the GDP deflator to determine the real interest rate. | WDI | Real interest rate (%) |

**Source:** compiled by the authors

Most time series data are typically non-stationary at the level of form, employing such series could produce spurious results. Therefore, it is crucial to verify stationarity before performing analysis on time series variables. In this work, the existence of a unit root (or non-stationarity) existence was investigated using the Augmented Dickey-Fuller (ADF) test. The ADF regression equation is as follows:

$$\Delta Y_t = \sigma_0 + \sigma_t \delta Y_{t-1} + \rho + \sum_{j=1}^{n} \delta_j \Delta Y_{t-k} + \varepsilon_t, \quad (6)$$

where $Y_t$ is the time series, $\Delta$ is the first difference operator, $\rho$ is the linear trend, $\sigma_0$ is a constant, and $\varepsilon_t$ is the error term. If the null hypothesis is not accepted, then the variables are differenced. The series could therefore be integrated of order 1.

This study used the GARCH (1, 1) Model to determine the volatility of the naira exchange rate for the period considered. The GARCH model was selected because it excels at modelling the fluctuation of financial data. In line with B. Almisshal & M. Emir (2021) this study's GARCH (1,1) Model is specified as follow:

$$\varphi_t^2 = \alpha_0 + \beta_1 \gamma_{t-1}^2 + \delta_1 \varphi_{t-1}^2, \quad (7)$$

where $\varphi_t^2$ is the conditional variance. To ensure a positive variance in every situation the following restrictions are put in place: $\alpha_0 > 0$, and $\beta_1, \delta_1 \geq 0$.

As opposed to other cointegration methods like S. Johansen (1991), R.F. Engle & C.W.J. Granger (1987), this study used the ARDL because: (i) it can be used regardless of the regressor's order (ii) models allow different optimal lags for distinct variables, (iii) it uses a single reduced form equation to analyse the long-run and short-run relationships between variables (Lawal *et al.*, 2018; Popoola *et al.*, 2018). The ARDL framework for this study is as follow:

$$\Delta lnMGDP_t = \sigma_0 + \sigma_1 lnMGDP_{t-1} + \sigma_2 lnEXCH + \sigma_3 lnINT_{t-1} + \\ + \sigma_4 lnCPI_{t-1} + \sigma_5 lnMCU_{t-1} + \sigma_6 lnMCAP_{t-1} + \sum_{i=1}^{n1} \beta_{11} \Delta lnMGDP_{t-1} + \\ + \sum_{i=1}^{n2} \beta_{12} \Delta lnEXCH_{t-1} + \sum_{i=1}^{n3} \beta_{13} \Delta lnINT_{t-1} + \sum_{i=1}^{n4} \beta_{14} \Delta lnCPI_{t-1} + \\ + \sum_{i=1}^{n5} \beta_{15} \Delta lnMCU_{t-1} + \sum_{i=1}^{n6} \beta_{16} \Delta lnMCAP_{t-1} + \varepsilon_t, \quad (8)$$

where $\sigma_0$ is the constant terms, $\Delta$ is the first difference operator, $\sigma_1$ to $\sigma_6$ represent the long run coefficients, while the $\beta_{11}$ to $\beta_{16}$ represent the short- run coefficients, $n1$ to $n6$ represent the lag length and $\varepsilon_t$ is the error term. The following criteria are used to determine whether to accept or reject the null hypothesis that there is no co-integration between the variables: (i) $H_0$ is rejected if F- Statistics (Fs) > upper bond, meaning that the variables are co-integrated; (ii) we accept $H_0$ if F statistics is less than the lower bound, this implies that all variables are not co-integrated; (iii) however, if F s ⩾ lower bound and ⩽ upper bound, the result is ambiguous under this circumstance and the decision is inconclusive.

The variance decomposition was used to show the amount of movement in the dependent variables caused by their own shocks versus the shocks of the independent variable. It establishes the amount of the forecast error variance for each variable that exogenous shocks to the other variables can account for. This impulse response function was also adopted to depict how a change in the

dependent variable in a system influences the time course of another. The impulse response study measures the response of each dependent variable in the model to an exogenous shock. The diagnostic checks on the estimated outcomes were performed to determine if the models are properly specified. The residual's series must be normally distributed, not serially correlated, and homoscedastic in order for a model to be adequately defined (Asaleye *et al*., 2018). After the model estimation in the following section, the diagnostic checks are discussed.

## RESULTS AND DISCUSSION

The value of a country's currency determines whether foreigners will invest in such economy or not. In the face of currency depreciation, foreign investment will be low, hence, the monetary authorities will be forced to increase interest rate in order to encourage foreign investors, since the return from their investment will be higher. However, increasing interest rate is a hinderance to Nigeria's manufacturing firms that intend borrowing money for capital to carry out productive activities. The concept of exchange rate fluctuations and manufacturing output in Figure 1 demonstrates the linkage between these two macroeconomic variables as they are very crucial for economic growth and development. Insufficient capital will have adverse effect on the firm's levels of capacity utilization and productivity, as the firms will not be able to cover their costs and expenses.

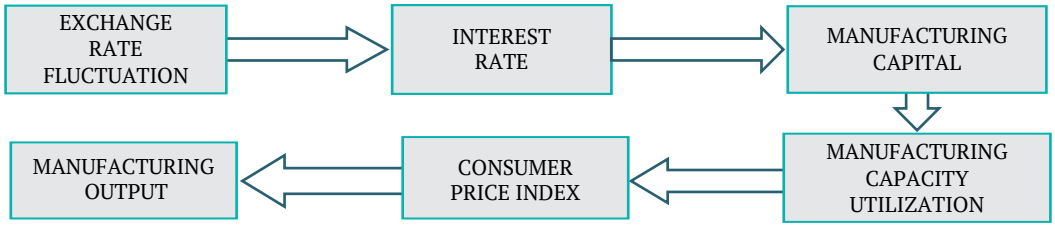


**Figure 1.** A conceptual framework on the relationship and linkages between Exchange Rate Fluctuations and Manufacturing Output

**Source:** made by the authors

The resultant effect of this will be borne by the consumers through the prices of goods and services produced by these firms. Following a fundamental principle of human behaviour, increasing prices of goods and services will make the consumers reduce their demand for the goods produced by these firms, and this is expected to have a negative effect of the firms' output, as they will be discouraged to produce in larger quantities since demand does not match up with their supplies. Hence, it is evident that exchange rate is important in the economy because of its impact on the prices of goods and services, resource allocation and investment decisions (Ehikioya, 2019). The macroeconomic variables discussed in these frameworks makes up the analytical result of this study below. Table 2 below shows the result from the ADF unit root test using trend and intercept for trend specification. The null assumption indicates that at 5% significance level the series is not stationary.

**Table 2.** Unit root test

| Variables | ADF test | | Critical Value | | Interpretation |
|---|---|---|---|---|---|
| | LEVEL | 1st Diff | 1% | 5% | |
| L_EXCH | 1.521013 | 4.665964 | 4.110394 | 3.561159 | I(1) |
| L_MGDP | 0.649622 | 4.578760 | 4.110394 | 3.561159 | I(1) |
| L_CPI | 4.104288 | - | 4.110394 | 3.561159 | I(0) |
| INT | 4.379287 | - | 4.110394 | 3.561159 | I(0) |
| L_MCAP | 4.167780 | - | 4.110394 | 3.561159 | I(0) |
| L_MCU | 3.226890 | 5.241237 | 4.110394 | 3.561159 | I(1) |

**Source:** author's computation using Eviews 9 (n.d.)

It can be concluded from the table that *L_CPI*, *INT* and *L_MCAP* were stationary at a 5% level of significance in the level form while *L_EXCH*, *L_MGDP* and *L_MCU* became stationary at the first differentiation. The "Obs*R-squared" statistics (that is, the Auto-Regressive Conditional Heteroskedasticity (*ARCH*) test of autocorrelation in the squared residuals) has a probability value of 0.0000 and is displayed in Table 3 below, with a value of 0.78815.

**Table 3.** ARCH effects tests result

| Heteroskedasticity Test: ARCH | | | |
|---|---|---|---|
| F-statistic | 20.79431 | Prob. F (1,148) | 0.0000 |
| Obs*R-squared | 0.78815 | Prob. Chi-Square | 0.0000 |

**Source:** author's computation using Eviews 9 (n.d.)

This blatantly implies that either ARCH effect exists or that the null hypothesis of homoscedasticity has been rejected. As the F-statistic probability value is statistically significant at the 5% level, the table also shows that the residual has the ARCH effect, indicating the rejection of the null hypothesis that there is no ARCH effect and accept the alternative hypothesis that there is ARCH effect. Given that the p-value is below the necessary threshold of 5%, this suggests the existence of an ARCH effect in the variables. This finding implies that the present exchange rate volatility relative to US dollars is influenced by the volatility of the prior period's exchange rates. This is in line with the findings of C.E. Onwuka (2021) who examined the impact of exchange rate volatility on manufacturing sector in Nigeria. The author adopted the ARCH/GARCH model to establish the extent of exchange rate volatility in Nigeria and find that exchange rates in Nigeria is highly volatile and persistent, which was validated by their coefficients, which were positive and statistically significant at 1% level. The author therefore affirmed that exchange rate volatility, if not checked, would worsen the performance of the manufacturing sector in the country. This demonstrates that the GARCH model, which was used for the current study to explain exchange rate volatility, is appropriate (Table 4).

**Table 4.** GARCH effect test results

| Variable | Coefficient | Std. Error | z-statistics | Prob. |
|---|---|---|---|---|
| C | 0.106637 | 0.000776 | 131.7912 | 0.0000 |
| L_EXCH(-1) | 0.972264 | 0.000115 | 4148.991 | 0.0000 |
| Variance Equation | | | | |
| C | -0.095561 | 7.03E-06 | -1.449310 | 0.1662 |
| RESID(-1)^2 | 0.011517 | 0.101500 | 25.62961 | 0.0000 |
| GARCH(-1) | -0.510442 | 0.006294 | -0.044232 | 0.8557 |

**Source:** author's computation using Eviews 9 (n.d.)

Due to the probability of the value of the ARCH term being less than 0.05 (P<0.05), it is revealed that the coefficient is positive and statistically significant at the 5% level of significance, providing more proof of the volatility of the exchange rate in Nigeria. As their probability value is bigger than 0.05, the GARCH term, on the other hand, is negative and not statistically significant at the 5% level of significance. The GARCH (1,1) test result indicates that there are persistent shocks in the exchange rate volatility in the Nigerian economy. This is similar to the findings of the study by E. Adjei (2019) on exchange rate volatility and economic growth in Ghana, in which the author revealed that the coefficients of both the ARCH and GARCH are positive and close to one, implying that the volatility shocks are persistent.

A closer look at the results shows that the ARCH term's coefficient is higher than the GARCH term's, indicating that the periods under review are likely to have more extreme exchange rate volatility. The business cycle and the cyclical behaviour of the Nigerian economy in relation to exchange rate volatility and manufacturing output are reported in Table 5.

**Table 5.** Cyclical behaviour of MGDP and exchange rate volatility, Nigeria (1981-2022)

| MGDP VOLATILITY | 5.2297 |
|---|---|
| **MCU** | **Countercyclical** |
| Volatility (%)<br>Relative Volatility<br>Contemporaneous Correlation<br>Phase Shift | 10.2241<br>1.80523<br>-0.3778<br>Lagging |
| **EXCH** | **Countercyclical** |
| Volatility (%)<br>Relative Volatility<br>Contemporaneous Correlation<br>Phase Shift | 94.8339<br>19.6749<br>-0.8557<br>Lagging |
| **MCAP** | **Countercyclical** |
| Volatility (%)<br>Relative Volatility<br>Contemporaneous Correlation<br>Phase Shift | 3.5231<br>0.5812<br>-0.8873<br>Lagging |
| **INT** | **Countercyclical** |
| Volatility (%)<br>Relative Volatility<br>Contemporaneous Correlation<br>Phase Shift | 15.8871<br>2.11710<br>-0.4331<br>Lagging |
| **CPI** | **Procyclical** |
| Volatility (%)<br>Relative Volatility<br>Contemporaneous Correlation<br>Phase Shift | 18.6654<br>3.11662<br>0.5531<br>Leading |

**Source:** author's computation using Eviews 9 (n.d.)

Noting the variables measured by the percentage of standard deviation, it was observed that the volatility of manufacturing output, exchange rate, consumer price index, interest rate, manufacturing capacity utilization and market capitalization is about 5.2297%, 94.8339%, 18.6654%, 15.8871%, 10.2241% and 3.5231, respectively. This implies that exchange rate is the most volatile. According to the result of relative volatility that measures amplitude of fluctuations, market capitalization has a value less than one, implying that it is less vulnerable to macroeconomic fluctuations in comparison with other variables having their relative volatility above one. Also, among all the variables, exchange rate has the highest relative volatility (19.6749). This argument supports the findings of H. Kamalyan & V. Davtyan (2022) that high exchange rate volatility is a key driver of economic fluctuations in emerging countries. They investigated the influence of exchange rate uncertainty in business cycle fluctuations and found that while an elevated and persistent exchange rate uncertainty depresses economic activity, inflates prices and causes exchange rates to depreciate; no other known disruptions in economic literature can create these co-movement patterns amid macro variables. One economic implication of these findings is that an unstable exchange rate will worsen the performance of macroeconomic variables and exposes nations to unanticipated movements in exchange rate.

Examining the degree of contemporaneous correlation with Manufacturing output (MGDP), exchange rate has a countercyclical relationship (-0.8557) indicating that manufacturing output tends to fall during the period of negative change in exchange rate. This explains that exchange rate is highly volatile and subject to manufacturing output fluctuations in Nigeria. This finding corroborates that of C.G. Uruakpa *et al*. (2021) who examined the effects of exchange rate volatility and exchange rate movement on the performance of manufacturing firms in Nigeria, and found that appreciation of Nigeria's local currency has a positive impact on manufacturing firm's performance, whereas the effect of exchange rate volatility on manufactured output is negative and significant. This result conforms with D.H. Vo *et al*. (2019) who focused on the nexus between exchange rate volatility, exchange rate devaluation and Vietnam's manufactured export flows to her twenty-six trading partners and reveals that while Vietnam's currency depreciation enhance manufactured exports in the short run, exchange rate volatility could negate this positive effect in the long run.

Consumer price index has a procyclical relationship with manufacturing output in Nigeria. This implies that manufacturing output tends to rise as price rises. They are strongly correlated and the explanation for this could be due to a strong relationship that exists between price and output in Nigeria. This indicates that inflation contributes to the growth of manufacturing output in the country. Nevertheless, this is contrary to the study of J.W. Oduor *et al*. (2021) who verifies the implication of rising rate of inflation on Kenya's manufacturing sector growth and revealed a harmful effect of inflation on the growth of manufacturing sector in Kenya. In line with I. Bawa *et al*. (2020), J.W. Oduor *et al*. (2021) also found that increasing price level has adverse effect on manufacturing output in Nigeria. This was observed while investigating the effects of macroeconomic variables on output from the manufacturing sector. Focusing on the results of the phase shift, consumer price index is the only variable that leads the cycle of manufacturing output in Nigeria while the other macroeconomic variables are lagging the indicators over time, I. Bawa *et al*. (2020) argued.

Figure 2 depicts the actual trend and cyclical movement of Exchange Rate Fluctuation over a period of time. In the figure below, the red, green, and blue lines denote the trend, cyclical and actual series of Exchange Rate Fluctuation in Nigeria, respectively. The figure shows that there was fluctuation in Nigeria's Exchange Rate around its trend from 1994 until recently. These fluctuations led to contractions but eventually led to an expansion from 2016 upwards. Figure 3 reveals the actual trend and cyclical movement of Manufacturing Capital over a period of time. The figure below shows that there was fluctuation in Nigeria's Manufacturing Capital around its trend from 1981 until recently. These fluctuations led to the contraction in 2018.

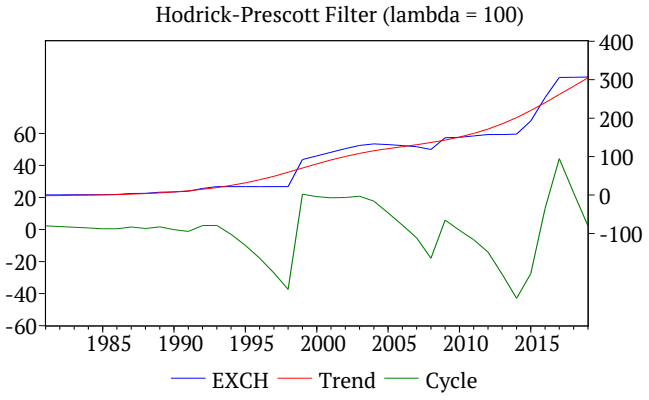


**Figure 2.** Exchange rate fluctuation

**Source:** author's computation using Eviews 9 (n.d.)

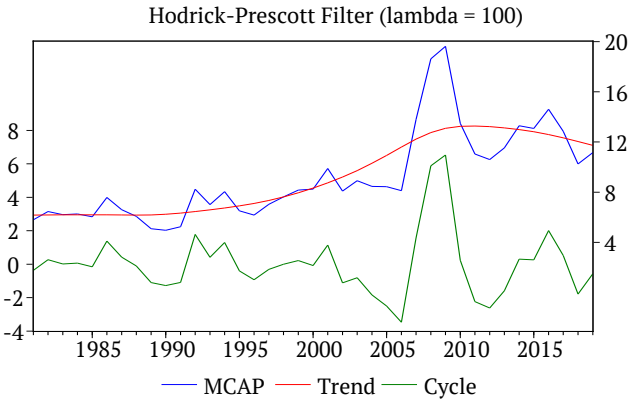


**Figure 3.** Manufacturing capitalization

**Source:** author's computation using Eviews 9 (n.d.)

Figure 4 depicts the actual trend and cyclical movement of Manufacturing Capacity Utilization over a period of time. It shows that there was fluctuation in Nigeria's Manufacturing Capacity Utilization around its trend from 1981 until recently. These fluctuations led to the contraction in 2012. Figure 5 reveals the actual trend and cyclical movement of Manufacturing Gross Domestic Product over a period of time. It shows that

there was fluctuation in Nigeria's Manufacturing Gross Domestic Product around its trend from 1983 until recently. These fluctuations led to the expansion in 2016. These findings support the study of H. Kamalyan & V. Davtyan (2022). They examine the effect of exchange rate uncertainty on business cycle fluctuations and observe that a high and persistent exchange rate uncertainty depresses economic activity, increases price level and generates exchange rate depreciation. In this view, the implication of volatile exchange rates is more severe than any other economic disruptions, H. Kamalyan & V. Davtyan (2022) argued.

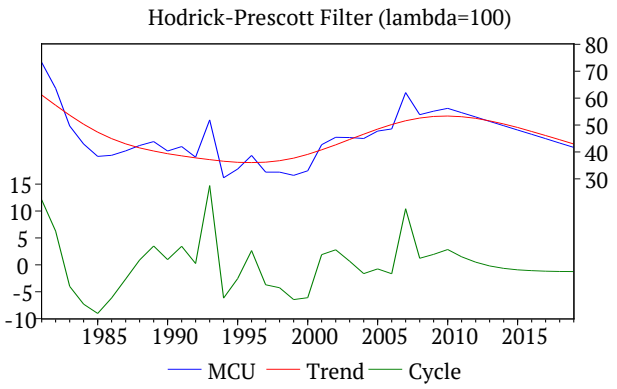


**Figure 4.** Manufacturing capacity utilization
**Source:** author's computation using Eviews 9 (n.d.)

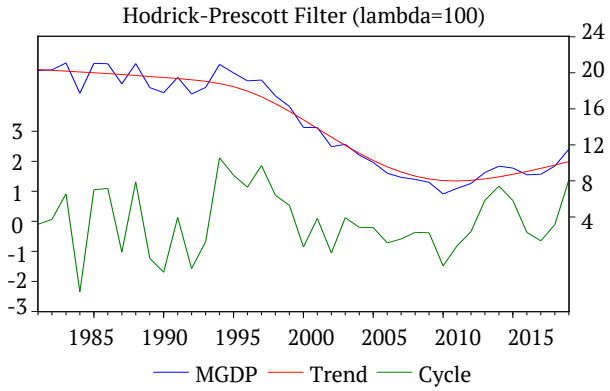


**Figure 5.** Manufacturing gross domestic product
**Source:** author's computation using Eviews 9 (n.d.)

The ARDL Bounds Test is appropriate to check for cointegration since variables are stationary at both level form and first difference, that is, variables consist of a combination of I(0) and I(1) (Table 6).

**Table 6.** ARDL bounds test results

| SIGNIFICANCE LEVEL | CRITICAL BOUNDS | | F STAT VALUE | KMAX | HYPOTHESIS TESTING |
|---|---|---|---|---|---|
| | I(0) | I(1) | | | |
| AT 10 % | 2.21 | 3.41 | 3.62475 | 5 | Cointegration exist |
| AT 5 % | 2.21 | 3.88 | 3.62475 | 5 | Cointegration exist |
| AT 2.5 % | 2.88 | 4.11 | 3.62475 | 5 | Cointegration exist |
| AT 1 % | 2.99 | 4.77 | 3.62475 | 5 | Cointegration exist |

**Source:** author's computation using Eviews 9 (n.d.)

Table 6 displays the ARDL bounds test result, using *L_MGDP* as the dependent variable, with 6 lags for *L_MGDP* and 6, 6, 6, 6, and 6 lags for *INT*, *L_CPI*, *L_EXCH*, *L_MCAP*, and *L_MCU*. The result of the F-stat (3.62475) is above the lower bounds 2.21, 2.61, 2.88, and 2.99 at 10, 5, 2.5, and 1%, respectively; establishing the existence of long-run relationship between the variables and cointegration exists at all levels of significance. This is consistent with C.E. Onwuka (2021) who found a long run relationship between exchange rate volatility and the performance of manufacturing sector in Nigeria and confirmed that volatile exchange rates disrupt manufacturing sector's performance. A similar study by S. Jyoti & K.N. Bhatt (2022) also discovers a log run relationship between Indian manufacturing exports and exchange rate volatility, although the study found mixed effects of exchange rate volatility on manufactured exports, both in the short and long run. Using the coefficient in the VAR result in Table, it is evident that 7, the first lag of *MGDP*, has a positive relationship with *L_MCAP* and *L_CPI* while a negative relationship exists between *L_EXCH*, *L_MCU* & *INT* and *MGDP*.

Table 8 presents the variance decomposition of the exchange rate: emphasis of the result is on manufacturing output.

**Table 7.** Unrestricted vector autoregressive model result

| | *L_MGDP* | *L_EXCH* | *L_MCU* | *L_MCAP* | *L_CPI* | *L_INT* |
|---|---|---|---|---|---|---|
| *L_MGDP*(-1) | | | | | | |
| Coefficient | 1.751446 | -0.16165 | -0.05522 | 0.023214 | 1.426101 | -3.225114 |
| Standard errors | (0.08011) | (0.45560) | (0.11236) | (0.16220) | (0.86441) | (9.44361) |
| t-statistics | [20.7113] | [-0.4290] | [0.3411] | [0.2715] | [1.5513] | [0.4288] |

**Source:** author's computation using Eviews 9 (n.d.)

**Table 8.** Variance decomposition of EXCH

| PERIOD | S.E. | L_MCAP | L_MCU | L_MGDP | L_EXCH | INT | L_CPI |
|---|---|---|---|---|---|---|---|
| 1 | 0.053115 | 0.228613 | 0.037141 | 0.629910 | 99.31991 | 0.000000 | 0.000000 |
| 2 | 0.086110 | 0.384490 | 0.073710 | 0.399342 | 98.71226 | 0.128861 | 0.026192 |
| 3 | 0.137315 | 0.392285 | 0.062891 | 0.719191 | 98.50101 | 0.419066 | 0.031044 |
| 4 | 0.158821 | 0.324891 | 0.116288 | 0.872281 | 97.58133 | 0.856722 | 0.114522 |
| 5 | 0.189901 | 0.388901 | 0.091185 | 1.887211 | 96.37886 | 1.023113 | 1.087143 |
| 6 | 0.197731 | 0.520851 | 0.093328 | 2.879522 | 95.29732 | 1.345991 | 1.578817 |
| 7 | 0.210091 | 0.651952 | 0.161129 | 3.878809 | 92.76443 | 2.819942 | 1.623309 |
| 8 | 0.225561 | 1.233719 | 0.438439 | 5.501162 | 85.72971 | 5.790111 | 1.569901 |
| 9 | 0.236198 | 1.490549 | 1.388913 | 6.227813 | 86.44911 | 8.628440 | 1.487331 |
| 10 | 0.261134 | 1.882691 | 2.379411 | 7.591131 | 80.91330 | 11.88304 | 1.170932 |

**Source:** author's computation using Eviews 9 (n.d.)

It can be seen from the result that the forecast error shock of exchange rate affect manufacturing output more in period 5,6,7,8,9,10 compared to other periods. This implies that the forecast error shock of exchange rate shows more variations in manufacturing output than other macroeconomic variables. This finding is in line with the study of N. Ali (2020) who examined the effect of exchange rate fluctuations on the performance of Nigeria's manufacturing sector and established that fluctuations in exchange rates had a negative and significant impact on manufacturing output in Nigeria, indicating that a flexible exchange rate was riskier and more harmful than the fixed exchange rate. Figure 6 presents the impulse responses of manufacturing output (MGDP), and consumer price index (CPI) to exchange rate.

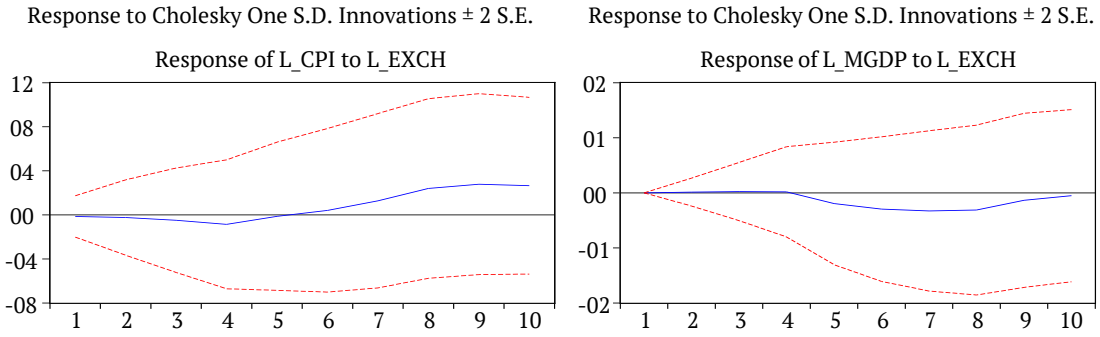


**Figure 6.** Impulse response function exchange rate

**Source:** author's computation using Eviews 9 (n.d.)

A one SD shock (innovation) to exchange rate initially has no noticeable impact on manufacturing output between periods one to four which indicates the short run while from periods four to eight, there was a fall in manufacturing output. Beyond the eighth period, manufacturing output begins to rise but remains in the negative region. This means that shocks to exchange rate will have a negative impact on manufacturing in Nigeria, indicating that an increase in exchange rate shocks aggravate the poor performance of the manufacturing sector in the country. However, a contrary study by J.C. Ukwunna *et al*. (2022), on the nexus between exchange rate fluctuations and industrial productivity growth in Nigeria uncovered that shocks to exchange rate would always have a positive effect of industrial productivity.

Also, a one SD shock (innovation) to exchange rate initially declines consumer price index between periods one to four which indicates the short-run period. Consumer price index then increases sharply from period four to six in the negative region and continues to increase beyond period six above the zero line. According to J.A. Asaleye *et al*. (2018) the specification of the model(s) should be examined for normality, autoregressive conditional heteroscedasticity, stability, and serial correlation. Shocks to exchange rate will have asymmetric impacts on manufacturing output in the long run and short run in Nigeria (Table 9).

**Table 9.** Diagnostic analysis

| DIAGNOSTICS CHECK | PROBABILITY | HYPOTHESES TESTING |
|---|---|---|
| Histogram-Normality Test | 0.6211 | Do not Reject |
| Serial Correlation LM Test | 0.4914 | Do not Reject |
| Heteroskedasticity Test | 0.5334 | Do not Reject |

**Source:** author's computation using Eviews 9 (n.d.)

In conclusion, the null hypothesis is accepted, which states that the variables are normally distributed, homoscedastic, and devoid of serial correlation because the probability of the three tests indicated above is greater than 0.05. In summary, the ARCH term's coefficient demonstrated the evidence of exchange rate volatility in Nigeria. In contrast, the GARCH term indicated that there is no persistent shock in the volatility of the exchange rate in the Nigerian economy. The result of the business cycle revealed that Nigeria's exchange rate is the highly volatile and has a negative effect on manufacturing output. On the other hand, the conclusion arrived at, based on the Variance Decomposition and Impulse Response Function Tests was that shocks to exchange rate will have negative impact on manufacturing output. Based on these findings, exchange rate fluctuations have negative impact on manufacturing gross domestic product in Nigeria which indicates that exchange rate fluctuations are harmful to the manufacturing sector. This result is in line with the findings of N. Ali (2020), C. Mlambo (2020) and C.G. Uruakpa *et al*. (2021). This implies that a shock to exchange rate will reduce the level of manufacturing output in Nigeria because the country depends largely on the external sector for the importation of inputs, hence, production cost increases leading to a corresponding decline in output.

## CONCLUSIONS

This study examined the impact of exchange rate fluctuation on manufacturing output in Nigeria. While conducting this research, statistical tools such as GARCH effect test, business cycle stylized results, ARDL bounds test, variance decomposition, and impulse response were employed to examine the relationship between various variables. The result of the GARCH (1,1) shows evidence of exchange rate volatility in Nigeria, although the outcome of the GARCH (1,1) test indicates that there aren't any persistent shocks in the exchange rate volatility in Nigeria.

The business cycle result revealed that exchange rate is highly volatile and has a countercyclical relationship with manufacturing output, implying a negative relationship between them. The relationship between the consumer price index and manufacturing output is procyclical, meaning that there increase in price causes increase in manufacturing output. This is attributed to the positive relationship that exists between prices and supply under normal economic condition.

The Variance Decomposition and Impulse Response Function Tests show that shocks to exchange rate have a negative impact on manufacturing output. This implies that a depreciation of exchange rate will reduce manufacturing output while its appreciation will increase manufacturing output in Nigeria since the country depends largely on the external sector for import of inputs. These results made it evident that the stabilization of exchange rates will go a long way in maintaining a reasonably high level of Manufacturing Output in Nigeria. Monetary authorities therefore, need to continuously scrutinize the exchange rate in order to create informed policies, and match the exchange rate to the actual needs of manufacturing sectors to increase its output. Further studies can examine the effect of anticipated and unanticipated exchange rate shocks on manufacturing output. Invariably, this will help the monetary authorities to make adequate policies to cushion the economic effect of exchange rate fluctuations.

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## CONFLICT OF INTEREST

None.

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# Коливання обмінного курсу та випуск промислової продукції: стилізовані факти з Нігерії

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**Анотація.** Одним з ключових рушіїв зростання в багатьох країнах є виробничий сектор, на показники якого впливає рух місцевої валюти. Виробничий сектор також надає такі можливості, як зростання торгівлі, інновацій, конкурентоспроможності, збільшення експорту та продуктивності, які стають можливими лише за умови зміцнення валютного курсу. Тому метою цього дослідження було вивчення впливу коливань обмінного курсу на обсяги виробництва в Нігерії. У дослідженні використано метод узагальненої авторегресії з умовною гетероскедастичністю для вивчення коливань обмінного курсу. Результат оцінки моделі показав, що в економіці Нігерії немає стійких шоків у волатильності обмінного курсу. Стилізовані факти економічного циклу теж були використані для дослідження волатильності обмінного курсу, і результат показав, що обмінний курс має високу волатильність та негативний вплив на обсяг виробництва в Нігерії. Крім того, для встановлення довгострокового зв'язку було застосовано авторегресійний розподілений лаговий тест, який показав, що між обмінним курсом та обсягом виробництва існує довгостроковий зв'язок. Використано декомпозицію дисперсії та функцію імпульсного відгуку, і результат показав, що коливання обмінного курсу має негативний вплив на валовий внутрішній продукт промисловості Нігерії. На практиці, виходячи з результатів дослідження, можна рекомендувати монетарним органам постійно відслідковувати коливання обмінного курсу, щоб розробляти проінформовану політику, яка б відповідала реальним потребам виробничого сектора з метою збільшення його обсягів виробництва

**Ключові слова:** узагальнена авторегресивна умовна гетероскедастичність; фільтр Ходріка-Прескота; волатильність; економічний цикл; індекс споживчих цін

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# Government expenditure on education in the light of the paradigm of sustainable development: Econometric spatial models and models of dynamics

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**Abstract.** The knowledge economy is a paradigm of the post-industrial stage of the development of society, therefore research on the relationship between the level of the main economic indicators and state spending on education is relevant. The purpose of this article was to assess the impact of the main economic indicators on the state spending on education both in total and per capita. Econometric models based on spatial data as well as dynamics models were constructed, and the Goldfeld-Quandt test was performed. The study was conducted on the example of the most influential countries of the world and the member states of the European Union. It is shown that the growth of the total volume of gross domestic product and purchasing power parity is accompanied by the growth of the total volume of state education deductions and education deductions per capita. For countries with relatively low purchasing power parity, the correlation between these indicators is tight, and the dispersion of empirical data relative to theoretical data derived from the econometric model is not statistically significant. On the contrary, for countries with high purchasing power parity, the dependence between these indicators does exist, but there is a significant dispersion of empirical data relative to theoretical data. The Goldfeld-Quandt test showed that the countries that were selected for the study should be classified according to this feature to different sample populations. It was found that the volume of deductions for education per capita has little effect on the effectiveness of the educational process. Studies of the dynamics of education expenditures have shown that although Ukraine belongs to countries with a relatively low purchasing power parity and during 2015-2022 the growth rate of education expenditures significantly lagged behind the growth rate of economic indicators, the effectiveness of education remains relatively high. The obtained research results should be taken into account in practice in order to optimize the costs of financing the educational sector

**Keywords:** knowledge economy; gross domestic product; purchasing power parity; effectiveness of learning; multivariate regression; conditions of the Gauss-Markov theorem

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## INTRODUCTION

The integration of Ukraine into the European economic space involves the implementation of a number of reforms aimed at economic growth in all spheres of activity. At the current stage of economic development, which is defined as the knowledge economy, the main factor contributing to the development of science and technology of any country and strengthening its international competitiveness is the level of education of the population. The growth of human potential due to the increase in public spending on education in developed countries allows to create conditions for the long-term economic and social development of these countries, to ensure the implementation of the paradigm of sustainable development, which involves not only meeting the current needs of humanity, but also protecting the interests of future generations. Sustainable Development Strategy for Ukraine by 2030 (2017) is based on the adaptation of sustainable development goals to Ukrainian realities. One of the most important tasks in this direction is the improvement of the educational sector. At the UN Summit on Sustainable Development, 17 global goals were defined, and among them Sustainable Development Goal 4 is quality education and promote lifelong learning opportunities for all (Ensure inclusive..., n.d.).

In the world community of scientists, many studies have been conducted, which testify to the impact of public spending on education on the level of national income of the country. A. Suwandaru *et al*. (2021) when studying the relationship between government allocations to the education sector and economic growth in Indonesia for the period 1986-2018 showed that an increase in budget allocations for education has a positive effect on the development of the country's economy if the government follows a policy aimed at economic growth. K. Efthalitsidou *et al*. (2021) presented research on the empirical assessment of the relationship between public spending (on education, health care, and defence) and national income in Greece for the period 1995-2019. It is established that it is investments in education and health care that are considered productive, therefore, their expansion in the long term contributes to the economic growth of the country. The work of E. Appiah (2017) shows that an increase in education spending has a positive effect on GDP (gross domestic product) per capita and there is no significant difference between developing and Sub-Saharan African countries. However, the magnitude of the effect is higher in developing countries, suggesting that annual export growth in Sub-Saharan Africa is relatively higher than in other developing countries. N.M. Salleh *et al*. (2022) investigating the relationship between the accumulation of human potential (health care and education) and the economic growth of Malaysia in 1982-2019 noted that intellectual development as a component of human potential is important for determining the country's key investments capable of ensuring its economic growth. This is especially important in a fast-paced business environment. Investments in people become a decisive factor in maintaining a country's competitive advantage. G.M. Emeru (2023) explains, based on data from 1980 to 2018, how different types of public spending have affected economic growth and proves that public spending on the education sector creates conditions that will help to achieve a higher level of qualification of the workforce, therefore ensuring and higher rates of economic growth, as they have both short-term and long-term effects. V.D. Chekina & O.A. Vorhach (2020) carried out an analysis of the dependence of the increase in the professional level of the population on the volume of expenditures on higher education in Ukraine and in other countries, and also substantiated the impact of the quality of higher education on economic growth. However, with a direct positive relationship between the increase in state deductions for education and the economic growth of the country, this issue is not so clear-cut. R. Villela & J.J. Paredes (2022) using the example of Honduras for the period from 1990 to 2020 showed that such a relationship can be significant only if the accumulation of human potential in the country occurs in full, which is especially important for poor countries.

Thus, increasing the financing of education in general contributes to the strengthening of the country's economy. But there is both a direct and an inverse relationship between government spending on education and the level of economic development of the country. In accordance, the country's economic growth is able to ensure a further increase in investment in education. However, in most scientific works, only one of the directions of this connection is considered, namely the impact of the amount of public spending on education on the economic growth of the country. The feedback, which reflects the impact of the level of economic development of the country on the state spending on education, is not yet sufficiently worked out. This determines the need to analyse such a connection and the relevance of this study. The purpose of the article was to assess the relationship between macroeconomic indicators and education government expenditure for Ukraine, the countries of the European Union and the most developed countries of the world. The tasks of this study were: analysis of the impact of the total volume of GDP and purchasing power parity (PPP) on the total amount of government expenditure on education and expenditure on education per capita for 63 countries of the world in 2020 using econometric models, based on spatial data; building a dynamic model describing the correlation between education government expenditure and GDP in Ukraine for 2001-2022.

## LITERATURE REVIEW

The study of the factors influencing the government expenditure on education is considered by scientists from different points of view: optimizing the management of educational resources, determining the impact of spending on education on the development of the country's economy, and the effectiveness of education itself. In September 2022, the Summit "Transformation of Education" was held, where reports from 48 countries were presented (Report on the 2022 transforming..., 2023). The leading idea of this Summit is formulated as the need to rethink the purpose and content of education in the 21st century. Development of education, improvement of educational technologies should become priority tasks and determine government policy in the field of education. The transformation of education can ensure quality education for all and the possibility of lifelong learning. It is necessary

to develop scientific approaches to the distribution of educational resources, improve the level of management of educational resources, and expand the scope of technological and innovative education. Education financing is a critically important issue for ensuring the functioning of the country's education system. The list of issues that require constant attention from the government and non-governmental organizations, not only at the local level, but also at the international level, includes issues related to funding sources, the amount of funds and the structure of their distribution, and ensuring the effectiveness of the use of these funds. One of such international organizations is the US Agency for International Development, which provides non-military assistance to other countries, particularly in the field of education. Its activities in this field are aimed at maintaining the stability of the education system functioning (Hurley *et al.*, 2019).

G. Sart *et al*. (2022) emphasize the importance of identifying factors that influence the level of education. Their article investigated the impact of the use of information and communication technologies on the level of education in individual EU member states during 2000-2018 according to the index of information and communication technologies and the index of globalization. G. Patel & M.S. Annapoorna (2019) attempted to draw attention to and stimulate debate on the role of government in human potential development in India by analysing the relationship between public expenditure on education and levels of human resource development. According to data from 1990-2020 by S. Kousar *et al*. (2023) noted the positive impact of current expenditure on health care, social protection, public expenditure on education and foreign direct investment on human potential formation in Pakistan. N. Mehmetaj & X. Nevila (2022) based on the analysis of the impact of education expenditures found that the causal relationship between the real rates of economic growth and the unemployment rate among the youth of Albania is short-term, namely, if the total state expenditure on education increases by 1%, then the unemployment rate among young people decreases by 10.81%. Similarly, but to a lesser extent, is the long-run causality found between government spending on education and the unemployment rate among young graduates. M.M.A. Mohamed *et al*. (2022) considered the costs of education as one of the components of the knowledge economy and investigated their impact on economic growth in 20 developed countries for the period 1996-2020. M. De Ridder *et al*. (2020) examined how expenditure on Federal Pell Grants for education affects local income levels for various US cities. N. Rambeli *et al*. (2021) showed that there was a long-run equilibrium relationship between government spending on education and economic growth during the post-crisis recovery regime in Malaysia. D.J. Deming (2022) identified that issues of education and its financing are attracting increasing attention from researchers in part because people around the world are spending much more money and time on education than they did half a century ago. Between 1950 and 2010, the share of the world's adult population with at least some secondary education increased from 13% to 51%, and the share of people with tertiary education increased from 2.2% to 14.6%, nearly sevenfold. During this time, spending on education in the United States rose from 3.1% of GDP in 1950 to 7.1% in 2018, with most of the increase coming from the public sector.

The analysis of scientific works in which the relationship between education government expenditure and indicators of economic growth of different countries is studied, showed that the least researched is the following question: how does the volume of the country's GDP and PPP affect not only the general level of government spending on education, but also the level of expenditure per capita. Studying this issue on the example of the experience of the most developed countries would make it possible to develop recommendations for optimizing the ways of Ukraine's development.

## MATERIALS AND METHODS

When constructing econometric models based on spatial data, statistical data reflecting the main economic indicators of the studied countries for 2020 were used. This is due to the fact that although the World Bank provides information on GDP and PPP of countries for 2022 as well, data on public spending on education for almost all countries is given only as of 2020. Statistical data for Ukraine, which were used in the construction of dynamics models, are presented from 2001 to 2022 inclusive.

The study was conducted on the example of 63 countries. Among them are 57 countries that, according to the rating of the U.S. News, are classified as the most influential countries in the world (Ranked: World's most influential countries, 2021). The ranking is based on the results of a global survey of more than 280,600 experts, including politicians and business leaders. Ukraine is also included in the ranking of the most influential countries in the world, which took 42$^{nd}$ place. In this study, the list of countries was supplemented by EU member states. According to the World Bank, in the countries under study, government expenditure on education ranges from 2.4% (Pakistan, 56$^{th}$ place in the rating) to 7.8% (Saudi Arabia, 12$^{th}$ place in the rating) (Government expenditure..., 2020a). On average, this is 4.86% of GDP. Although in terms of percentages, such dispersion looks insignificant, but the GDP of the specified countries differ tenfold, therefore, in monetary terms, the difference in government expenditure on education is quite large.

The countries considered in this study differ significantly in terms of population size and quality of life, therefore, in the study of economic factors that affect the amount of government expenditure on education, along with the total GDP, the amount of GDP per capita, taking into account the exchange rate, was taken into account the country's currency in relation to the dollar, i.e., purchasing power parity (PPP). The influence of these macroeconomic factors on the per capita government expenditure on education was considered. There are almost no studies examining the latter indicator in such a context. When calculating this indicator, in this research, it is proposed for each country to use the coefficient resulting as the ratio of its PPP to its GDP. Data on the total volume of GDP and PPP for 2020 for the studied countries are shown in Table 1.

**Table 1.** The total volume of GDP of countries for 2020 (billion USD) and the volume of PPP (thousands of USD)

| No. | Country | GDP | PPP | No. | Country | GDP | PPP | No. | Country | GDP | PPP |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Argentina | 385.54 | 20.76 | 22 | India | 2,667.69 | 6.45 | 43 | Philippines | 361.75 | 8.20 |
| 2 | Australia | 1,326.90 | 53.07 | 23 | Indonesia | 1,058.69 | 12.19 | 44 | Poland | 599.45 | 35.32 |
| 3 | Austria | 435.22 | 57.00 | 24 | Iran | 239.74 | 15.22 | 45 | Portugal | 229.01 | 34.88 |
| 4 | Belarus | 62.37 | 20.28 | 25 | Ireland | 425.85 | 93.95 | 46 | Qatar | 144.41 | 93.89 |
| 5 | Belgium | 525.21 | 54.20 | 26 | Israel | 413.27 | 39.62 | 47 | Romania | 251.36 | 33.34 |
| 6 | Brazil | 1,114.56 | 14.79 | 27 | Italy | 1,896.76 | 43.04 | 48 | Saudi Arabia | 703.32 | 45.24 |
| 7 | Bulgaria | 70.24 | 25.30 | 28 | Japan | 5,040.11 | 41.61 | 49 | Serbia | 53.36 | 19.56 |
| 8 | Canada | 1,645.42 | 47.13 | 29 | Jordan | 44.08 | 9.71 | 50 | Singapore | 345.29 | 99.68 |
| 9 | China | 1,468.67 | 17.19 | 30 | Korea, Rep. | 1,644.31 | 44.69 | 51 | Slovak Republic | 106.70 | 32.44 |
| 10 | Croatia | 57.47 | 29.69 | 31 | Kuwait | 105.96 | 46.33 | 52 | Slovenia | 53.71 | 40.78 |
| 11 | Cyprus | 25.01 | 41.42 | 32 | Latvia | 34.60 | 32.11 | 53 | South Africa | 337.62 | 13.52 |
| 12 | Czechia | 245.97 | 42.72 | 33 | Lithuania | 56.85 | 39.92 | 54 | Spain | 1,276.96 | 38.12 |
| 13 | Denmark | 355.22 | 60.98 | 34 | Luxembourg | 76.99 | 118.97 | 55 | Sweden | 547.05 | 55.57 |
| 14 | Egypt | 365.25 | 12.00 | 35 | Malta | 14.93 | 44.59 | 56 | Switzerland | 739.91 | 72.00 |
| 15 | Estonia | 31.37 | 38.54 | 36 | Malaysia | 337.34 | 27.24 | 57 | Thailand | 499.68 | 17.77 |
| 16 | Finland | 271.89 | 52.29 | 37 | Mexico | 1,090.52 | 18.52 | 58 | Turkey | 720.29 | 27.72 |
| 17 | France | 2,639.01 | 47.98 | 38 | Netherlands | 909.79 | 60.09 | 59 | Ukraine | 156.62 | 13.09 |
| 18 | Germany | 3,889.67 | 55.85 | 39 | New Zealand | 211.73 | 45.38 | 60 | Un. Arab Emirates | 349.47 | 71.37 |
| 19 | Greece | 188.93 | 28.4 | 40 | Norway | 362.20 | 64.17 | 61 | United Kingdom | 2,704.61 | 46.76 |
| 20 | Hong Kong | 344.93 | 58.95 | 41 | Oman | 75.91 | 34.91 | 62 | United States | 21,060.47 | 63.03 |
| 21 | Hungary | 157.18 | 34.06 | 42 | Pakistan | 300.42 | 5.28 | 63 | Vietnam | 346.63 | 11.02 |

**Source:** developed by the authors based on GDP (current US$) (2020), GDP per capita, PPP (current international $) (2020)

Based on the data of Table 1 and the World Bank (Government expenditure..., 2020a), the total amount of government expenditure on education for each country was determined in monetary terms, as well as the amount of government expenditure per capita was calculated (Table 2).

**Table 2.** Total education government expenditure for 2020 (billion USD) and per capita government expenditure for education (thousands of USD)

| No. | Country | General costs | Specific costs | No. | Country | General costs | Specific costs | No. | Country | General costs | Specific costs |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Argentina | 19.28 | 1.04 | 22 | India | 120.05 | 0.29 | 43 | Philippines | 13.38 | 0.30 |
| 2 | Australia | 80.94 | 3.24 | 23 | Indonesia | 37.05 | 0.43 | 44 | Poland | 35.32 | 1.84 |
| 3 | Austria | 22.20 | 2.91 | 24 | Iran | 8.63 | 0.55 | 45 | Portugal | 11.45 | 1.74 |
| 4 | Belarus | 2.88 | 0.95 | 25 | Ireland | 13.20 | 2.91 | 46 | Qatar | 4.62 | 3.00 |
| 5 | Belgium | 35.19 | 3.63 | 26 | Israel | 29.34 | 2.81 | 47 | Romania | 9.30 | 1.23 |
| 6 | Brazil | 86.91 | 0.89 | 27 | Italy | 81.56 | 1.85 | 48 | Saudi Arabia | 54.86 | 3.53 |
| 7 | Bulgaria | 2.81 | 1.01 | 28 | Japan | 171.36 | 1.41 | 49 | Serbia | 1.92 | 0.70 |
| 8 | Canada | 85.56 | 2.45 | 29 | Jordan | 1.41 | 0.31 | 50 | Singapore | 9.67 | 2.76 |
| 9 | China | 528.76 | 0.62 | 30 | Korea, Rep. | 77.28 | 2.10 | 51 | Slovak Republic | 4.91 | 1.49 |
| 10 | Croatia | 3.16 | 1.63 | 31 | Kuwait | 6.99 | 3.06 | 52 | Slovenia | 3.12 | 2.37 |
| 11 | Cyprus | 1.53 | 2.53 | 32 | Latvia | 2.08 | 1.93 | 53 | South Africa | 22.28 | 0.89 |
| 12 | Czechia | 12.54 | 2.18 | 33 | Lithuania | 2.27 | 1.60 | 54 | Spain | 58.74 | 1.75 |
| 13 | Denmark | 23.73 | 3.90 | 34 | Luxembourg | 3.85 | 5.95 | 55 | Sweden | 39.39 | 4.00 |
| 14 | Egypt | 9.13 | 0.30 | 35 | Malta | 0.88 | 2.63 | 56 | Switzerland | 38.48 | 3.74 |
| 15 | Estonia | 2.07 | 2.54 | 36 | Malaysia | 13.16 | 1.06 | 57 | Thailand | 15.49 | 0.55 |
| 16 | Finland | 16.04 | 3.09 | 37 | Mexico | 46.89 | 0.80 | 58 | Turkey | 24.49 | 0.94 |
| 17 | France | 145.15 | 2.64 | 38 | Netherlands | 48.22 | 3.18 | 59 | Ukraine | 8.46 | 0.71 |
| 18 | Germany | 182.81 | 2.62 | 39 | New Zealand | 12.70 | 2.72 | 60 | Un. Arab Emirates | 13.63 | 2.78 |
| 19 | Greece | 8.32 | 1.25 | 40 | Norway | 21.37 | 3.79 | 61 | United Kingdom | 148.75 | 2.57 |
| 20 | Hong Kong | 13.80 | 2.36 | 41 | Oman | 34.91 | 1.89 | 62 | United States | 1,284.69 | 3.84 |
| 21 | Hungary | 7.54 | 1.63 | 42 | Pakistan | 7.21 | 0.13 | 63 | Vietnam | 14.21 | 0.45 |

**Note:** the serial number of the country from Table 1 remains in Table 2
**Source:** developed by the authors based on GDP (current US$) (2020), GDP per capita, PPP (current international $) (2020), Government expenditure on education, total (% of GDP) (2020a)

More detailed studies of the relationship between indicators of the level of economic development of the country and government expenditure for education were carried out on the example of Ukraine. To build an econometric model of dynamics, the time period from 2001 to 2022 was chosen. Data on the total volume of GDP, PPP and population for this period are shown in Table 3.

**Table 3.** Nominal GDP of Ukraine (billion USD), PPP (current international $) and population (million people) for 2001-2022

| No. | Year | GDP | PPP | Population size | No. | Year | GDP | PPP | Population size |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 2001 | 39.31 | 4,789.7 | 48.66 | 12 | 2012 | 182.59 | 9,705.4 | 45.58 |
| 2 | 2002 | 43.96 | 5,173.0 | 48.23 | 13 | 2013 | 190.50 | 11,111.1 | 45.48 |
| 3 | 2003 | 52.01 | 5,824.1 | 47.80 | 14 | 2014 | 133.50 | 10,743.6 | 43.72 |
| 4 | 2004 | 67.22 | 6,736.8 | 47.45 | 15 | 2015 | 91.03 | 10,164.3 | 42.84 |
| 5 | 2005 | 89.24 | 7,214.1 | 47.09 | 16 | 2016 | 93.36 | 11,148.2 | 42.67 |
| 6 | 2006 | 111.88 | 8,054.0 | 46.77 | 17 | 2017 | 112.09 | 11,860.6 | 42.48 |
| 7 | 2007 | 148.73 | 9,004.9 | 46.50 | 18 | 2018 | 130.89 | 12,633.5 | 42.27 |
| 8 | 2008 | 188.11 | 9,434.4 | 46.24 | 19 | 2019 | 153.88 | 13,348.0 | 42.02 |
| 9 | 2009 | 121.55 | 8,093.6 | 46.04 | 20 | 2020 | 156.62 | 13,102.8 | 41.76 |
| 10 | 2010 | 141.21 | 8,559.9 | 45.86 | 21 | 2021 | 199.77 | 14,289.0 | 41.39 |
| 11 | 2011 | 169.33 | 9,246.8 | 45.69 | 22 | 2022 | 160.50 | 12,671.2 | 41.15 |

**Source:** developed by the authors based on Gross domestic product (GDP) in Ukraine (2023); GDP per capita, PPP (current international $) – Ukraine (2022); Population, total – Ukraine (2022)

Data on government expenditure on education as a percentage of GDP and in monetary terms for the period from 2001 to 2022, as well as the results of calculating education deductions per capita are given in Table 4.

**Table 4.** Government expenditure on education in Ukraine for 2001-2022 (% of GDP)

| No. | Year | General costs, % GDP | General costs, billion USD | Specific costs, USD | No. | Year | General costs, % GDP | General costs, billion USD | Specific costs, USD |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 2001 | 4.5 | 1.77 | 170.41 | 12 | 2012 | 6.4 | 11.69 | 621.15 |
| 2 | 2002 | 5.2 | 2.29 | 215.54 | 13 | 2013 | 6.4 | 12.19 | 711.11 |
| 3 | 2003 | 5.4 | 2.81 | 269.00 | 14 | 2014 | 5.9 | 7.88 | 633.87 |
| 4 | 2004 | 5.1 | 3.43 | 314.50 | 15 | 2015 | 5.7 | 5.19 | 579.37 |
| 5 | 2005 | 5.8 | 5.18 | 343.58 | 16 | 2016 | 5.0 | 4.67 | 557.41 |
| 6 | 2006 | 6.0 | 6.71 | 418.42 | 17 | 2017 | 5.4 | 6.05 | 640.47 |
| 7 | 2007 | 5.9 | 8.78 | 483.24 | 18 | 2018 | 5.3 | 6.94 | 669.48 |
| 8 | 2008 | 6.2 | 11.66 | 531.29 | 19 | 2019 | 5.4 | 8.63 | 720.65 |
| 9 | 2009 | 7.1 | 8.63 | 584.93 | 20 | 2020 | 5.4 | 8.46 | 706.71 |
| 10 | 2010 | 7.4 | 10.45 | 574.65 | 21 | 2021 | 5.4 | 10.81 | 767.87 |
| 11 | 2011 | 5.9 | 9.99 | 545.56 | 22 | 2022 | 4.8 | 7.40 | 584.21 |

**Source:** developed by the authors based on Government expenditure on education, total (% of GDP) – Ukraine (2020b), Expenses by function (2022), Gross domestic product (GDP) in Ukraine (2023), GDP per capita, PPP (current international $) – Ukraine (2022)

The data from the tables was used in the course of the study to build econometric models. The least squares method (LSM) was used to build the models, the basis of which is the requirement to minimize the sum of squares of random errors. The application of LSM requires the fulfilment of certain conditions, which are formulated in the form of the Gauss-Markov theorem. According to this theorem, one of the requirements for building multivariate regression models is the absence of a tight correlation between exogenous (external) factors. To verify the fulfilment of this condition and to assess the significance of the influence of external factors on the internal (endogenous) factor, the Pearson pair correlation coefficients were calculated between all factors that were included in the model. When constructing all regression models, variables were defined in the units of measurement in which they are listed in the corresponding tables.

Another of the provisions of the Gauss-Markov theorem regarding the possibility of using LSM to build a regression model is the homoskedasticity of model residuals. This means that all observations must have the same variance, that is, the dispersion associated with random errors must be the same for all values of the external factor. Since among the data selected for the construction of the econometric model, there is a significant range in the GDP values of different countries, the data were checked for the presence of heteroskedasticity. To check the Goldfeld-Quandt statistical test was applied. The quality check of the model as a whole was carried out according to Fisher's criterion, to evaluate the significance of each of the parameters of the model, the Student's criterion was applied separately. All calculations that were carried out when building econometric models, checking the quality of these models and

evaluating the significance of their parameters were carried out using the MS Excel spreadsheet processor.

## RESULTS AND DISCUSSION

The construction of a mathematical model based on empirical data, which describes the dependence of the level of education costs on GDP both in total and per capita, allows to determine the effectiveness of investing funds in the development of the educational sector and to identify possible ways of its optimization. To determine the influence of economic factors on the total volume of education government expenditure, a multivariate regression model was built, based on the data of Tables 1 and 2. Since education government expenditure per capita were calculated as a share of total expenditures on education taking into account the proportionality coefficient, and the ratio of GDP per capita to the total volume of GDP was chosen as this coefficient, then these four indicators are functionally related, so one of them had to be excluded from the model. The primary model included the following factors: the total volume of government expenditure on education ($y_0$), which is an internal (exogenous) factor, and also the total volume of GDP ($x_1$) and the volume of GDP per capita ($x_2$) were chosen as endogenous (external) factors. A preliminary check of the pairwise correlation coefficient between external factors showed that it is equal to 0.035, therefore, there is no multicollinearity between these factors, they can be simultaneously present in the model. A close correlation between total education government expenditure and GDP (pairwise correlation coefficient is 0.975) and a close correlation between GDP per capita and per capita education expenditures (pairwise correlation coefficient is 0.874) were revealed. For the model with two external factors, the regression equation is:

$$y_0 = -16.89 + 0.052x_1 + 0.32x2 + e, \quad (1)$$

where $e$ is random model error. For the regression model (1), the following value of the coefficient of determination was obtained: $R^2 = 0.9477$, i.e., 94.77% of the variability of the total amount of government expenditure on education is related to the influence of the factors present in the model. The empirical value of Fisher's test is 543.5, which is much higher than the critical one, thus at the significance level $\alpha = 0.05$ the critical value of Fisher's test is $F_{0.05}(2;60) = 3.15$. It follows that the model is significant in general. Checking the significance of each of the parameters of the model according to the Student's test showed that only the regression coefficient for the variable ($x_1$) corresponding to GDP is significant. The empirical value of the Student's criterion was $t_{em} = 32.86$. For the free term of the equation, $t_{em} = 1.65$, and for the regression coefficient for the variable ($x_2$), which corresponds to GDP per capita, $t_{em} = 1.47$. But for the significance level $\alpha = 0.05$ , the critical value of the Student's test is $t_{0.05}(df_e = 60) = 2.00$. Therefore, the model can be provided as:

$$y_0 = 0.052x_1 + e. \quad (2)$$

As a result, the coefficient of determination increased to 0.9513. It should be noted that the regression coefficient in model (2) exceeds the population mean of share of GDP allocated to education. For the sample population as a whole, its value is 0.048. Such a difference means that the law of distribution in this population is not normal, but has a significant positive asymmetry, i.e., there are some countries for which the total volume of GDP is significantly larger than for other countries. This is also confirmed by the graph of the dependence of the general level of education government expenditure on the GDP of the country (Fig. 1).

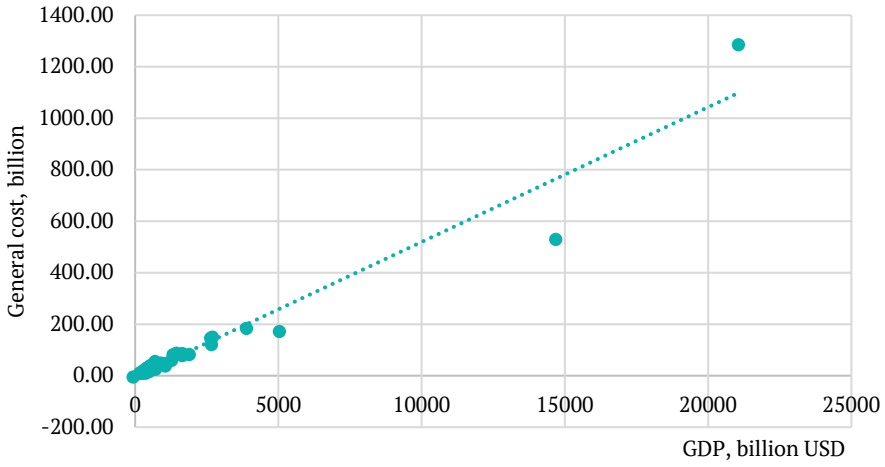


**Figure 1.** Dependence of the total amount of education government expenditure on the country's GDP

**Source:** developed by the authors based on the data presented in the Table 1 and Table 2

However, state financing of education involves spending on the creation and development of the education system as a whole and on ensuring the opportunity to receive education for each citizen of the country separately. The countries under consideration have a sufficiently developed system of educational institutions, so it is appropriate to consider not only the total amount of government expenditure on education, but also the amount of government expenditure per capita. Therefore, an econometric model was built, for which the volume of education government expenditure per capita ($y$) was considered as an internal factor, and the volume of GDP per capita ($x_2$) was considered as an external factor. Such a model is represented by a pairwise regression equation of the form:

$$y = 0.196 + 0.045x_2 + e. \quad (3)$$

For model (3), the coefficient of determination is 0.7644, that is, the model as a whole is significant. The significance check of the model parameters showed that for the free term of the equation, the empirical value of the Student's criterion is $t_{em} = 1.32$, while the critical value of the Student's criterion is $t_{0.05}(df_e = 61) = 2.00$. The free term of the equation can be excluded from the model, and the regression equation takes the form:

$$y = 0.048x_2 + e. \quad (4)$$

For model (4), the regression coefficient is equal to the mean of the share of GDP allocated on education, and the coefficient of determination of this model is 0.9355, i.e., it has increased compared to model (3). To compare countries by the level of government expenditure on education, it is advisable to consider not the total volume of expenditure, but the volume of expenditure per capita. A graphic illustration of model (4) is shown in Figure 2.

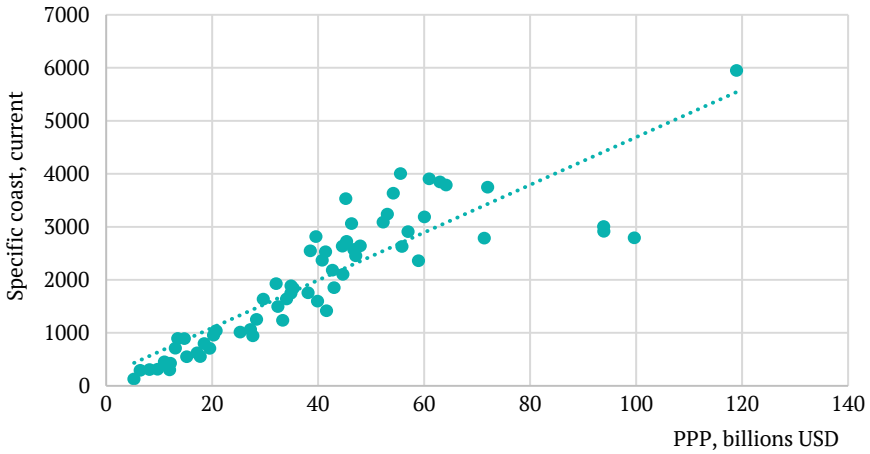


**Figure 2.** Dependence of education government expenditure per capita on the PPP

**Source:** developed by the authors based on the data presented in Table 1 and Table 2

The analysis of the dispersion of empirical points relative to the trend line in Figure 2 shows that the random errors of the econometric model increase as the value of the external factor increases. This suggests that heteroscedasticity may be present for this sample population. According to the algorithm of the Goldfeld-Quandt test, to test this hypothesis, the countries were ordered by the growth of PPP and divided into three parts. The first 21 countries with the lowest PPP values and the last 21 countries with the largest PPP values from the list of countries were selected for the further study. For convenience, Table 5 shows the data for both groups, for which these groups will be compared.

**Table 5.** Volume of PPP and education government expenditure in calculation per capita for 2020 (current international $) for countries with the lower and upper values of PPP

| Countries with the low GDP per capita | | | | Countries with the upper GDP per capita | | | |
|---|---|---|---|---|---|---|---|
| No. | Country | PPP | Specific costs | No. | Country | PPP | Specific costs |
| 42 | Pakistan | 5,278 | 127 | 31 | Kuwait | 46,328 | 3,058 |
| 22 | India | 6,449 | 290 | 61 | United Kingdom | 46,759 | 2,572 |
| 43 | Philippines | 8,199 | 303 | 8 | Canada | 47,127 | 2,451 |
| 29 | Jordan | 9,707 | 311 | 17 | France | 47,976 | 2,639 |
| 63 | Vietnam | 11,023 | 452 | 16 | Finland | 52,296 | 3,085 |
| 14 | Egypt | 12,004 | 300 | 2 | Australia | 53,066 | 3,237 |
| 23 | Indonesia | 12,146 | 425 | 5 | Belgium | 54,202 | 3,631 |
| 59 | Ukraine | 13,087 | 707 | 55 | Sweden | 55,569 | 4,001 |
| 53 | South Africa | 13,518 | 892 | 18 | Germany | 55,854 | 2,625 |
| 6 | Brazil | 14,790 | 887 | 3 | Austria | 57,000 | 2,907 |
| 24 | Iran | 15,223 | 548 | 20 | Hong Kong SAR, China | 58,950 | 2,358 |
| 9 | China | 17,189 | 619 | 38 | Netherlands | 60,091 | 3,185 |

Table 5, Continued

| Countries with the low GDP per capita | | | | Countries with the upper GDP per capita | | | |
|---|---|---|---|---|---|---|---|
| No. | Country | PPP | Specific costs | No. | Country | PPP | Specific costs |
| 57 | Thailand | 17,771 | 551 | 13 | Denmark | 60,980 | 3,903 |
| 37 | Mexico | 18,522 | 796 | 62 | United States | 63,028 | 3,845 |
| 49 | Serbia | 19,558 | 704 | 40 | Norway | 64,167 | 3,786 |
| 4 | Belarus | 20,278 | 953 | 60 | United Arab Emirates | 71,371 | 2,783 |
| 1 | Argentina | 20,763 | 1,038 | 56 | Switzerland | 71,991 | 3,744 |
| 7 | Bulgaria | 25,296 | 1,012 | 46 | Qatar | 93,894 | 3,004 |
| 36 | Malaysia | 27,246 | 1,062 | 25 | Ireland | 93,951 | 2,912 |
| 58 | Turkey | 27,724 | 0,942 | 50 | Singapore | 99,681 | 2,791 |
| 19 | Greece | 28,428 | 1,250 | 34 | Luxembourg | 118,973 | 5,949 |

**Note:** the number of the country in Table 5 coincides with its number in all other tables
**Source:** developed by the authors based on the data presented in Table 1 and Table 2

Pairwise regression models were constructed for each of the two groups of countries. For countries with lowest values of the PPP, the regression equation describing the dependence of education government expenditure per capita ($y_L$) on the volume of GDP per capita has the following form:

$$y_L = 0.041x_2 + e. \quad (5)$$

For model (5), the coefficient of determination is 0.9623, and the residual sum of squares of the model is $RSS_L = 0.4356$. For countries with upper values of the PPP, the regression equation describing the dependence of education government expenditure per capita ($y_U$) on the volume of GDP per capita has the following form:

$$y_U = 0.047x_2 + e. \quad (6)$$

For model (6), the coefficient of determination is 0.9306, and the residual sum of squares of the model is $RSS_U = 16.3636$. Based on the obtained results, an $F$ -statistic was constructed, taking into account the fact that both groups have the same number of countries selected for the study:

$$F = \frac{RSS_U}{RSS_L}. \quad (7)$$

According to the ratio (7), it was obtained that $F = 37.56$, while the critical value of Fisher's test at the significance level $\alpha = 0.05$ is equal to $F_{0.05}(20;20) = 2.12$. Since the empirical value of the F-statistic exceeds the critical one, it can be asserted with 95% confidence that for the studied population of 63 countries, heteroskedasticity is statistically significant. For countries with a low level of PPP, differences in per capita education government expenditure are significantly smaller than for countries with a high level of PPP. For example, both Ireland and Singapore have the PPP, which is almost twice that of Finland or Australia, while education government expenditure per capita for these countries is lower than in Finland and Australia. Such results are debatable and require further investigation.

It can be assumed that the heteroskedasticity that was found in this study is conditional. This means that although all the proposed econometric models have a large coefficient of determination, there are some factors that were not taken into account when building the model. These can be factors related to the specialization of the economy of this country, or historical traditions, etc. For example, when looking at the education government expenditure in Australia, it is worth paying attention to the work of B. Bentley *et al*. (2022), in which the issue of STEM education (Science, Technology, Engineering and Mathematics) is considered. This country's public policy aligns with future fiscal targets, which suggest that Australia's economic future is tied to the development and use of STEM. That is why significant funds are being directed to education, and with them are growing educational services related to STEM, which is becoming a matter of national priority. The assumption regarding the influence of a certain direction of the national education policy on education government expenditure is consistent with the material of the work of M. Nikšić Radić & H. Paleka (2020), where the cause-and-effect relationship between spending on higher education and GDP in Croatia was investigated using variance analysis. The authors believe that in the future government expenditure on higher education should be increased, which will allow to accelerate economic growth and create conditions for sustainable development. Therefore, the results of this study have important political implications, as they draw the attention of the government to the importance of improving higher education as a way to ensure the country's competitiveness.

Indirect confirmation of the fact that, in addition to financial support, the direction of state policy in this field, as well as the education system itself, the general culture of the population, national traditions, etc., are important for the effectiveness of the educational process, are the r esults of the international comparative study The Trends in International Mathematics and Science Study (TIMSS), which was carried out by the National Center for Education Statistics under the US Department of Education among 4$^{th}$-graders and 8$^{th}$-graders in mathematics and science (International comparisons..., 2021). The results of the study are presented in Figure 3.

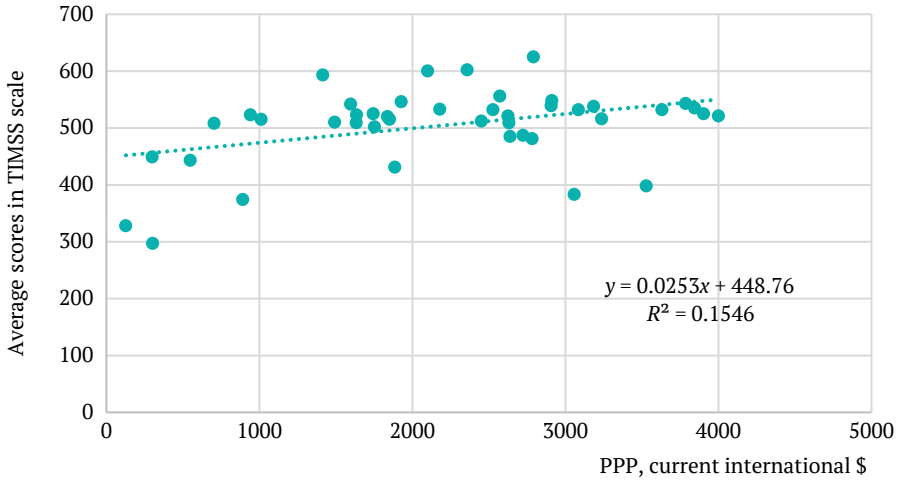


**Figure 3.** The average score of the mathematics and science skills of 4th-graders and 8th-graders according to the TIMSS scale, depending on the country's PPP

**Source:** developed by the authors based on GDP per capita, PPP (current international $) (2020), International comparisons: Mathematics and science achievement at grades 4 and 8 (2021)

Along with the graph, Figure 3 also shows the equation of the trend line and the value of the coefficient of determination. There is a positive correlation between the country's PPP and students' achievements in mathematics and science, but only 15.46% of the variability of the average score is determined by the influence of the PPP. A similar conclusion can be reached based on the analysis of the results of the Program for International Student Assessment (PISA), which assesses reading, mathematics and science skills among 15-year-old students (Yau, 2022). Figure 4 shows the scores in reading, mathematics, and science obtained by schoolchildren from the country's groups with, respectively, the lower and upper amount of PPP among the studied countries, using the example of several countries.

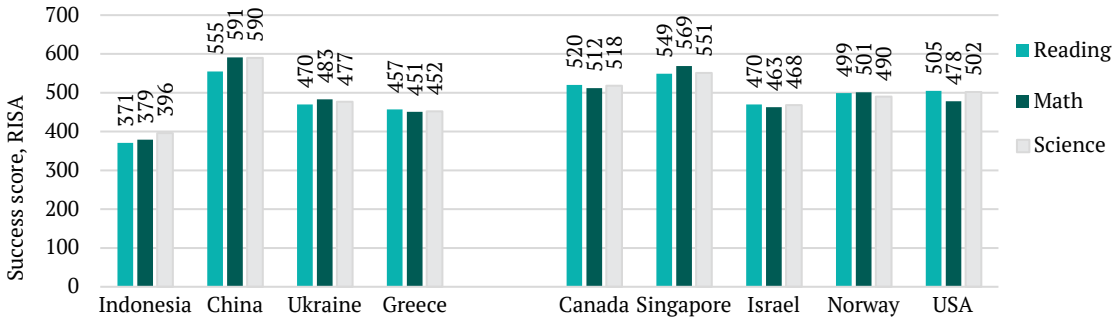


**Figure 4.** The average score of 15-year-old students in reading, mathematics, and science according to RISA data for the least and most well-off countries by the level of the PPP

**Source:** developed by the authors based on N. Yau (2022)

Therefore, the conducted studies confirm the existence of a close correlation between the PPP and education government expenditure per capita. However, the significant dispersal of indicators of the quality of education, observed for countries with a high level of PPP, indicates that in the future, an important issue is the analysis of the effectiveness of these costs in the light of comparing the priorities of state policy in the field of education for different countries. Ukraine's economic policy regarding state financing of education needs to be considered in more detail. For this, in addition to spatial regression models, it is necessary to apply dynamics models to investigate this problem.

Ukraine is a country with an average level of economic development, in terms of GDP in different years according to World Bank ratings, it was in the 50-100th place in the world (GDP (current US$), 2020). For example, in 2022, Ukraine ranked 57th among 196 countries in the world (GDP by country, 2023). According to the rating of the world's most influential countries, Ukraine took 42nd place (Ranked: World's most influential countries, 2021). Government expenditures on education as a percentage of GDP in Ukraine average 5.4%, which corresponds to the level of similar expenditures in the countries of EU and OECD (Organization for Economic Cooperation and Development) (Government expenditure..., 2020a). However, in monetary terms, per capita or even per student, these indicators are different in different countries. In Ukraine in 2020, government expenditure on education per capita amounted to $710, while in Poland they were equal to $1,840, in Latvia – $1,930, in Estonia – $2,540 (Table 2). Note that education government expenditure with the same percentage could be larger in monetary terms if there were no shadow

economy in Ukraine, the share of which, according to the National Bank of Ukraine's assessment in 2019, was 25% (Research on the shadow economy..., 2020). According to statistic data (GDP per capita..., 2022), such an economic indicator as GDP per capita is growing in Ukraine in the period from 2001 to 2022 (Fig. 5).

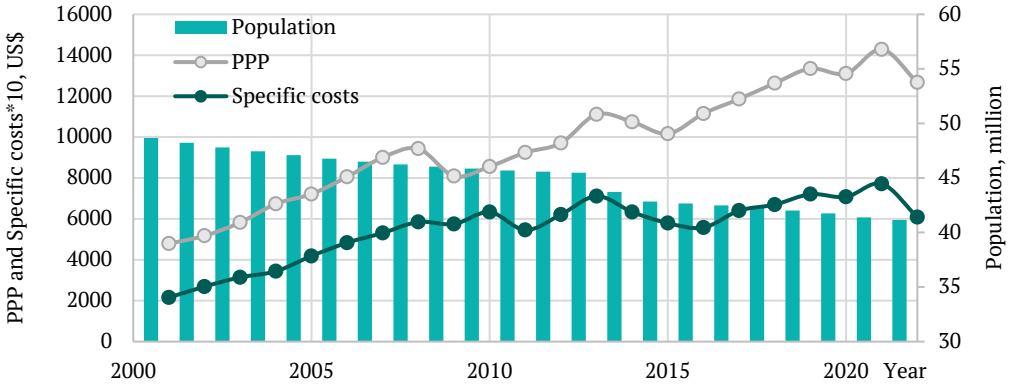


**Figure 5.** Dynamics of GDP and education government expenditure per capita and population of Ukraine for the period from 2001 to 2022

**Source:** developed by the authors based on GDP per capita, PPP (current international $) – Ukraine (2022), Gross domestic product (GDP) in Ukraine (2023)

Such an increase in education government expenditure per capita is due not only to GDP growth, but also to a steady decrease in the population (Population, total – Ukraine, 2022). As evidenced by the results of the calculation of education expenditure per capita, the nature of changes in this indicator during the period from 2001 to 2013 repeats the nature of changes in the PPP, and the growth rate averaged 11% per year. Starting in 2015, PPP continues to grow at about the same rate, while education government expenditure also grows, but at a much slower rate. The average rate of growth of government expenditure on education decreased to 5% per year. Therefore, the data for the period 2001-2022 cannot be considered as a homogeneous population.

Despite the fact that education government expenditure in Ukraine are much smaller than in EU countries, as well as in countries with highly developed economies, the level of education in Ukraine is quite high (Figure 4). Knowledge and skills in science, especially skills in mathematics, adequately reflect a person's ability to obtain a high-quality higher education, as it forms a person's logic and consistency of thinking, the ability to justify his judgments and conclusions and further realize himself in a professional activity (Ponomarenko, 2020). For example, Israeli schoolchildren (470, 463 and 468) and Luxembourgish schoolchildren (470, 489 and 477) received approximately the same scores as Ukrainian schoolchildren, although Luxembourg belongs to the countries with a high level of PPP and a high level of education government expenditure per capita. However, schoolchildren from Poland received 512, 516 and 511 scores, from Estonia – 436, 523 and 530 scores, respectively. The highest level according to these indicators belongs to China, whose students received 555, 591 and 590 scores (Yau, 2022). Per capita government expenditure on education in 2020 was $619 in China and $707 in Ukraine, the largest per capita government expenditure on education is in Luxembourg, it reaches $5,949 (Table 5). This once again proves that, in addition to the economic support of the educational process, attention should be paid to the motivation of students and the education system should be improved.

When calculating education government expenditure per capita, the size of the entire population was taken into account, as well as the purchasing power parity of the national currency. However, education government expenditure is not distributed to the entire population, but mainly to young people aged 5 to 25. This contingent in Ukraine in 2020 was 21.47% of the total population (Age structure..., 2022). In fact, in 2020, $3,239 were allocated to each Ukrainian studying. To determine the main factors affecting the level of education government expenditure per capita, an econometric model was built, for which the volume of education government expenditure per capita ($y$) was considered as an internal factor, and as external factors in the model total GDP ($x_1$) and population size ($x_3$) were included. Such a model is represented by a multivariate regression equation of the form:

$$y = 1741.99 + 1.85x_1 - 31.73x_3 + e. \quad (8)$$

For model (8), the coefficient of determination is 0.9050, therefore, only 9.5% of the variability of the amount of education government expenditure is determined by the influence of factors, which were not included in the model. The test showed that the model is significant overall by Fisher's test, and all parameters of this model are significant by Student's test. The correlation coefficient between external factors, which are GDP per capita and population size, is negative and amounts to -0.4995. Since the correlation between these factors exists, but is not tight, both external factors can be present in the model without violating the conditions of the Gauss–Markov theorem. A model with lagged variables was built to test the effect of GDP of previous years on education government expenditure in the current year. This made it possible to test the assumptions about the existence of a cumulative effect. This model looks like this:

$$y_o = -0.32 + 0.061x_t - 0.009x_{t-1} + 0.023x_{t-2} + e, \quad (9)$$

where $y_o$ is total government expenditure on education in the current year; $x_t$ is GDP of the current year; $x_{t-1}$ is GDP of the previous year; $x_{t-2}$ is GDP, which was obtained 2 years ago. At the first stage, a model containing information on 5 lag variables was considered, however, starting with the variable $x_{t-3}$, the regression coefficients were already an order of magnitude smaller than the regression coefficient for the variable $x_{t-1}$. That is why only 2 lag variables were left in the model. According to Fisher's test, model (9) is significant in general, and the coefficient of determination for it is 0.8758. However, according to Student's test, only the regression coefficient before $x_t$ is significant, that is, only the effect of the current year's GDP is significant. This made it possible to conclude that during the studied period the cumulative effect was not observed, which in turn determines the lack of state planning for the future.

Ensuring the conditions for economic growth in Ukraine requires the accumulation and use of the experience of the leading countries of the world, which determines the importance of analysing the dynamics of government expenditure on education, evaluating efficiency of their use and the dependence of the volume of these expenses on the level of the most important macroeconomic indicators. The term "economic growth" implies an increase in such economic indicators as real national income, gross domestic product, per capita income (Radionov, 2019), although the most common macroeconomic indicator used to obtain objective information about the state of the country's economy, and also allows identifying and measuring reserves to ensure its sustainable development, is GDP. It should be emphasized that this paper considers the approach to financing education at the state level, while in addition to the macro level, this problem can be considered at the meso- or micro-level, that is, at the level of an individual family (Li, 2021; Rahman *et al*., 2023). This is due to the fact that attention is paid to such an aspect of the problem as the development of human potential at the state level, and the financing of education from the side of the state was considered as the implementation of a policy aimed at accumulating human potential.

Since education is financed not only from the state budget, but also from the local budget, total education expenses can be considered as a percentage of the consolidated budget expenses (Komarova, 2011). However, for Ukraine, there is a significant difference between the values of this indicator for different regions. In 2020, for the country as a whole (i.e., at the macro level), state expenditures on secondary education per student amounted to UAH 24.7 thousand, but in the Kharkiv region (at the meso level) it amounted to only UAH 21.7 thousand, while in Luhansk, it was equal to UAH 30.2 thousand. (Budget expenditures…, 2021). If the average amount of spending on education in Ukraine is considered as a percentage of the consolidated budget, then for the period from 2015 to 2021, in percentage terms, this indicator ranged from 15.49% to 16.97%, although in monetary terms a rather slow growth was observed (Expenditures of the consolidated…, 2023). However, in 2022 this indicator fell to 9.55%, and in 2023 – to 7.84%. Such a significant drop in education expenditure is associated with an increase in defence expenditure. If in 2021 this indicator was 6.91%, then in 2023 it increased to 48.62%. If these results are compared with the data presented in Figure 5, it can be concluded that at the macro level, the same regularities are observed regarding the dynamics of changes in economic indicators.

In contrast to the above-mentioned studies (Efthalitsidou *et al*., 2021), the results presented in this article confirm the hypothesis of the presence of the influence of the total volume of GDP and PPP on the total amount of government expenditure on education and per capita expenditure on education. Due to the increase in the number of researched countries and the selection of the most developed countries of the world as research objects, the spatial coverage of the problem was expanded. The substantive characteristics of the influence of GDP on the implementation of educational policy at the state level have been clarified thanks to the consideration of per capita education government expenditure. This approach can be considered a further development of the work of A.C. Coman Nuţă *et al*. (2023), which conducted a thorough analysis of the impact of public education spending over the years 1990-2020 on economic growth in 11 former socialist republics of Eastern Europe that acquired EU membership. These researchers noted that education government expenditure as the percentage of GDP is different in the countries of Eastern Europe. The lowest percentage of GDP allocated to education was inherent Romania (3.35% of GDP), followed by Bulgaria (3.72% of GDP), Slovakia (4.11%) and the Czech Republic (4.19%). In other countries of Eastern Europe, a higher percentage of GDP is allocated to education financing (Poland – 4.9%, Hungary – 5.1%, Latvia – 5.36%, Estonia – 5.4%, Slovenia – 5.47%). The analysis of data relative to individual EU member states, including countries whose economy was planned in the past, confirms the presence of a statistically significant relationship between the level of population qualification and spending on higher education, as well as between GDP growth and the level of personnel qualification (Pelinescu, 2015; Agasisti & Bertoletti, 2022; Molchanova & Guliyeva, 2023).

This study has proven the feasibility of separating the analysis of the amounts of PPP and education government expenditure per capita for countries with the smallest and largest values of PPP. The difference between the built models clearly demonstrates the influence of the PPP, which is consistent with the conclusions of the study of M. Marto *et al*. (2022), which measured differences between EU regions in terms of GDP per capita and level of higher education. The econometric models proposed in this paper also complement the study of the evolution of people's well-being depending on GDP per capita (Wu *et al*. 2022), in which the relationship between the indicator of real progress and GDP per capita, and adjustment of social policy was analysed using statistical data of China during 1995-2017. The presence of a positive correlation relationship between human well-being and country`s economic growth at the level of planning public spending on education can be explained as a means of ensuring the educational component of well-being through the development of human potential in both quantitative and qualitative terms.

The research, the results of which are presented in this article, complements existing scientific approaches, providing additional comparative information on how the GDP of countries and their PPP effect on education government

expenditure in Ukraine and in the world and also on the effectiveness of education. Determination of the impact of macroeconomic indicators characterizing the level of economic development of the country on education government expenditure, which was carried out on the example of the most influential countries in the world, allowed to clarify the idea of the density of the correlation between these factors. The analysis of the econometric models proposed in this study shows that it is appropriate to consider not so much the relationship between total education expenses and the volume of GDP, as is done in most researches, but the relationship between education expenses per capita and PPP. This result can be explained by the fact that the countries under consideration already have a sufficiently extensive education system and, accordingly, government expenditure are primarily aimed at creating conditions for the realization of the right to education by every citizen of the country.

## CONCLUSIONS

The study of the impact of the PPP on education government expenditure per capita made it possible to conclude that a close correlation between these factors is inherent only in countries with a not very large amount of PPP per capita, which includes Ukraine, but for countries with a high level of PPP per capita, there is a significant the discrepancy this indicator for different countries. Although there is a positive correlation between educational effectiveness, as measured by PISA and TIMSS reading, mathematics and science performance, and government expenditure on education, this correlation is not strong. It is reasonable to assume that the effectiveness of education is high in those countries where the state motivates its citizens to achieve results. It is in these countries also the rapid economic growth is observed. Although the research indicates the existence of a close correlation between the volume of education government expenditure per capita and the PPP, in the future, an important issue is the analysis of the effectiveness of these expenditures and the determination of the priorities of the state policy in the field of education. The construction of a mathematical models based on empirical data, which describe the dependence of the level of education costs on GDP both in total and per capita, allows to determine the effectiveness of investing funds in the development of the educational sector and to identify possible ways of its optimization. The analysis of econometric models of dynamics shows that in Ukraine during 2015-2022, education funding lags behind the growth of GDP, but even such a small increase in education deductions per capita is largely due to the decrease in the population of Ukraine, but not an increase in funding. However, the effectiveness of education in Ukraine remains at a fairly high level, even if compared with some countries where education government expenditure per capita are much higher. At the stage of formation of the state education policy, the planning of government expenditure on education in Ukraine using the econometric models proposed in this article will contribute to the strengthening of the analytical justification of certain management decisions in the field of financing and the improvement of the evaluation mechanism of measures aimed at economic growth.

In further research, it is advisable to diversify the proposed models by adding new groups of countries and extending time periods. Also, in the future, the analysis of the effectiveness of public spending on education in countries with a high and low level of PPP should be considered an important direction. Supplementing the list of economic factors influencing the amount of education expenses in Ukraine with factors of an intangible nature will allow identifying promising directions for reforming the education sector and, as a result, will contribute to the growth of the country's economy.

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## CONFLICT OF INTEREST

None.

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## Державні витрати на освіту в світлі парадигми сталого розвитку: економетричні просторові моделі та моделі динаміки

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**Анотація.** Економіка знань є парадигмою постіндустріального етапу розвитку суспільства, тому дослідження взаємозв'язку між рівнем основних економічних показників і державними витратами на освіту є актуальними. Метою даної статті було оцінювання впливу основних економічних показників на державні витрати на освіту як у загальному обсязі, так і в розрахунку на душу населення. Економетричні моделі побудовано з використанням просторових даних і моделі динаміки, проведено тест Голдфелда-Квандта. Дослідження проводилося на прикладі найвпливовіших країн світу та країн-членів Євросоюзу. Показано, що зростання загального обсягу валового внутрішнього продукту та паритету купівельної спроможності супроводжується зростанням загального обсягу державних відрахувань на освіту та відрахувань на освіту в розрахунку на душу населення. Для країн із відносно низьким паритетом купівельної спроможності кореляційний зв'язок між цими показниками є щільним, а розпорошення емпіричних даних відносно теоретичних, що випливають з економетричної моделі, є статистично несуттєвим. Навпаки, для країн з високим паритетом купівельної спроможності залежність між цими показниками хоча й існує, але спостерігається суттєве розпорошення емпіричних даних відносно теоретичних. Перевірка за тестом Голдфелда-Квандта показала, що ці країни не можна об'єднувати в одну вибіркову сукупність. Виявлено, що обсяг відрахувань на освіту на душу населення мало впливає на ефективність освітнього процесу. Дослідження динаміки витрат на освіту показали, що хоча Україна належить до країн з відносно низьким паритетом купівельної спроможності і протягом 2015-2022 років швидкість зростання витрат на освіту суттєво відставала від швидкості зростання економічних показників, ефективність освіти залишається відносно високою. Отримані результати дослідження на практиці доцільно враховувати з метою оптимізації витрат на фінансування освітньої галузі

**Ключові слова:** економіка знань; валовий внутрішній продукт; паритет купівельної спроможності; ефективність навчання; багатофакторна регресія; умови теореми Гаусса-Маркова

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# Digital maturity and digital transformation in human resources management: Stability vs development

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**Abstract.** Digital transformation has impacted all areas of life, including human resources management. Studying digital maturity is relevant because it can help organizations adapt to change and improve human resources strategies for successful transformation. This study explored the relationship between digital maturity, transformation, and human resources management and how organizations can use digital technologies to increase maturity and opportunities and cope with obstacles. Complex analysis, synthesis, induction, deduction, and analogy methods were used as methodical tools to analyse literary sources, information, and communication technologies. The importance of digital maturity for human resources management practices and processes and the digital transformation process in management functions was explored. The drivers, challenges, and outcomes associated with digital transformation initiatives were identified, and the impact of digital maturity and transformation on stability was analysed. The study also examined the possible trade-offs between maintaining stability and promoting development through digital technologies. The importance of continuous learning, training, and skill development in human resources management was assessed to achieve and maintain digital maturity. A conceptual framework focused on the relationship between sustainability and development in the context of digital maturity and transformation in human resources management, providing a comprehensive understanding of these dynamics. The research can help manage digital transformation effectively, provide helpful information for academic and practical human resources management applications, and bring a new perspective to the balance between sustainability and development

**Keywords:** balance; organizational change; innovation; strategic personnel management; electronic tools and technologies

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## INTRODUCTION

As technology advances at an unprecedented pace, digital transformation has become ubiquitous, influencing all aspects of life, including human resource management. By exploring digital maturity and transformation in the context of Human Resources (HR), organizations can learn to navigate the rapidly evolving technological and societal landscape while maintaining stability. Research in this field can uncover innovative strategies and approaches to Human Resource Management (HRM), ensuring the organization's digital maturity and successful digital transformation. Stability in HRM ensures the smooth functioning of core HR processes, such as payroll, benefits administration, and employee record management. At the same time, development focuses on leveraging digital tools and technologies

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to drive innovation, improve efficiency, and enhance the overall HR function's strategic value. This delicate balance between stability and development challenges HR leaders and organizations. On one hand, stability ensures business continuity, employee satisfaction, and compliance with regulatory requirements, as indicated by R. Pannell (2022). On the other hand, development allows organizations to unlock the full potential of digital technologies, streamline HR processes, and improve employee experience.

Digital maturity refers to the level of an organization's digital capabilities and how well it can leverage technology to achieve its goals. On the contrary, as L. Hamberg (2022) noted, digital transformation refers to using technology to fundamentally change how an organization operates and delivers value to its customers. J.M. Montero Guerra *et al*. (2023) stated that in personnel management, digital transformation can help organizations improve talent management by leveraging big data, people analytics, or HR analytic systems. However, there is a debate on whether organizations should prioritize stability or development regarding digital maturity and digital transformation (Hamberg, 2022). According to Yu. Shulzhyk *et al*. (2022), the success of digital transformation requires effective management, a new attitude toward employees, increased innovation and flexibility, greater cooperation, and greater readiness for constant changes on the part of not only managers but also all employees, which requires the possession of new digital competencies. They considered the organization's digital maturity an influential factor in the success of digital transformation.

Developing a clear roadmap for digital transformation activities can significantly benefit management and employees by improving their level of digital maturity. To effectively manage and guide digital transformation, various maturity models have been developed to conceptualize and assess digital maturity in organizations. Despite previous reviews on the subject, such as that conducted by G. Remane *et al*. (2017) and L. Canetta *et al*. (2018), there is still a need to understand the most common maturity dimensions used across existing models. Studies prove that digital maturity determines the ability of an organization or individual to use digital technologies effectively, and digital transformation has the potential to improve HR efficiency and productivity. Nevertheless, the relationship between digital maturity, digital transformation, and organizational human resources management has remained relevant.

The research aimed to investigate the correlation between digital maturity, digital transformation, and human resource management and identify strategies organizations can implement to effectively leverage digital technologies, enhance digital maturity, overcome challenges, and seize opportunities in HRM due to digital transformation. To achieve the goal, various methodological tools were used, such as complex analysis (a thorough study of digital maturity and digital transformation in human resources management by breaking it down into separate components), synthesis (the study of human resources management in its integrity, in a unified and interconnected its parts), induction (analysis of the facts of advantages and disadvantages of stability and development in HRM), deduction (analysis of the concept of digital maturity, digital transformation, stability, development), analogy (allows to establish the relationship of equivalence between digital maturity and digital transformation, according to some characteristics such as stability and development), analysis of literary sources and information, as well as communication technologies.

## THE CONCEPT OF DIGITAL MATURITY IN THE CONTEXT OF HRM AND THE PROCESS OF ITS DIGITAL TRANSFORMATION

In HRM, digital maturity refers to the extent to which an organization has developed its capabilities and readiness to effectively leverage digital technologies and tools within its HRM practices and processes. It represents the organization's ability to utilize digital resources and strategies to enhance HRM outcomes, streamline operations, and improve overall effectiveness. Digital maturity holds excellent significance in academic research, as it indicates the varying degrees of transformation adopted by different organizations. It enables a thorough exploration of this socio-technical phenomenon (Tilson *et al*., 2010).

To define and understand digital maturity in HRM, it is important to explore several key aspects. Adoption of digital technologies: digital maturity in HRM involves the adoption and integration of digital technologies and tools, talent management software, e-recruitment platforms, and digital communication tools (Petko, 2023). These technologies enable automation, data analysis, collaboration, and decision-making support in HRM processes. Digital maturity also encompasses developing digital skills and competencies among HR professionals and employees. It involves ensuring that HR staff have the necessary knowledge and abilities to effectively utilize digital tools, analyse data, and make informed decisions in the digital era (Awdziej *et al*., 2023). Data-driven HR practices: digital maturity in HRM emphasizes using data and analytics to drive evidence-based decision-making in recruitment, performance management, employee engagement, and talent development. It involves leveraging data to gain insights, identify trends, and optimize HR strategies and processes (Tiahunova & Tiahunova, 2020; Empowering data-driven..., 2023). Integration and connectivity: a digitally mature HRM function is characterized by seamless integration and connectivity across different HR systems, allowing for efficient data flow and information exchange. This integration may involve linking HRM systems with other organizational systems, such as finance or operations, to enable cross-functional collaboration and alignment (Kane *et al*., 2017). The levels of digital readiness and capability within organizations can vary. Some organizations may be in the early stages of digital transformation, with limited adoption of digital technologies and low digital skills among HR professionals. Others may have advanced digital capabilities, utilizing sophisticated Human Resources Information System (HRIS) platforms, advanced analytics, and AI-powered (artificial intelligence) tools to enhance HRM practices.

The impact of digital maturity on HRM effectiveness can be significant. A digitally mature HRM function can improve HR processes' efficiency, accuracy, and timeliness, reducing administrative burdens and enhancing productivity. It can also enable HR professionals to focus more on strategic activities, such as talent management, succession

planning, and organizational development. Additionally, digital maturity in HRM can improve the employee experience by providing self-service portals, mobile applications, and personalized communication channels, enhancing engagement and satisfaction levels (What are the benefits…, 2023). It can also facilitate data-driven decision-making, enabling HR professionals to identify patterns, predict future trends, and proactively address HR challenges. Understanding and achieving digital maturity in HRM is crucial for organizations to effectively leverage digital technologies and drive HRM practices toward greater efficiency, effectiveness, and strategic impact. The digital transformation process in HRM involves integrating and adopting digital technologies, strategies, and practices to reshape and optimize organizational HRM functions (Mardani *et al.*, 2023). Investigating this process involves exploring various aspects, including key drivers, challenges, and outcomes associated with digital transformation initiatives in HRM, an overview of which is provided below.

Critical drivers of digital transformation in HRM. Technological advancements: rapid advancements in digital technologies create opportunities for HRM functions to enhance efficiency, streamline processes, and improve decision-making. Changing workforce dynamics: the evolving expectations of the modern workforce, including digital natives, remote work, and flexible arrangements, push organizations to adopt digital solutions for improved employee experiences. Data-driven decision-making: the need for data-driven insights in HRM, including talent acquisition, performance management, and learning and development, drives the adoption of digital tools for data collection, analysis, and reporting. Competitive advantage: organizations seek a competitive edge by leveraging digital transformation to attract and retain top talent, increase operational agility, and drive innovation in HRM practices (Montero Guerra *et al.*, 2023).

Challenges of digital transformation in HRM. Change management: implementing digital transformation requires organizational change and often encounters resistance from employees accustomed to traditional processes. Data privacy and security: adopting digital HRM solutions necessitates robust data privacy and security measures to protect employee information and comply with regulations. Skills gap: digital transformation may require upskilling or reskilling HR professionals to utilize and manage new digital tools and technologies effectively. Integration complexities: integrating disparate HR systems and ensuring smooth interoperability between digital tools can present challenges.

Outcomes of digital transformation initiatives in HRM. Enhanced operational efficiency: automation of HR processes, self-service portals, and digitized workflows streamline administrative tasks, reducing manual effort and allowing HR professionals to focus on strategic initiatives. Improved employee experience: digital HRM tools enable self-service options, personalized communication, and access to information, enhancing employee engagement, satisfaction, and empowerment. Data-driven insights: digital transformation facilitates the collection, analysis, and interpretation of HR data, enabling evidence-based decision-making and strategic workforce planning. Agile talent management: digital solutions enable real-time talent acquisition, performance management, and learning and development, supporting agility and adaptability in HRM practices.

Research by G.C. Kane *et al*. (2015) showed that good employees want to work in more mature digital organizations and constantly develop their competencies. Thus, more digitally mature organizations have an advantage in acquiring new promising personnel. However, the less mature are at risk of being left behind by existing workers who need adequate training and career development. For successful digital transformation, managers must consider digital orientation, intensity, and maturity as crucial strategic elements. These elements have a collective impact on financial performance. Hence, managers must review and assess them simultaneously to make informed strategic decisions that boost financial success. Managers must recognize the significant mediating role of digital maturity in achieving financial success in digital transformation. They should understand that digital maturity is a continuous process that involves skills and techniques. By internalizing this, managers can prepare their companies to create adequate value in rapidly changing digital environments, as M. Nasiri *et al*. (2022) highlighted. It is important to note that the specific drivers, challenges, and outcomes of digital transformation in HRM can vary depending on the organization's size, industry, and level of digital maturity. Understanding these factors is crucial for successfully planning, implementing, and managing digital transformation initiatives in HRM.

## THE IMPACT OF DIGITAL MATURITY AND DIGITAL TRANSFORMATION ON STABILITY AND THE ROLE OF DEVELOPMENT IN ACHIEVING DIGITAL MATURITY

The impact of digital maturity and digital transformation on stability within HRM processes, systems, and structures can be complex and multifaceted. How these factors can disrupt and enhance stability should be analysed, and the potential trade-offs involved need to be explored.

Disruption of stability. Changes in processes and workflows: digital transformation often involves rethinking and redesigning existing HRM processes and workflows, which can disrupt established routines and stability. Employees may need to adapt to new ways of working and may face challenges adjusting to the changes. Skills and knowledge gaps: HR professionals may need to acquire new digital skills and competencies as organizations undergo digital transformation. This learning curve can temporarily disrupt stability as employees adapt to the changes and develop the required expertise. Integration challenges: integrating various digital tools and systems may lead to technical difficulties and disruptions in the HRM infrastructure, impacting stability if the integration needs to be effectively managed.

Enhancement of stability. Efficiency and productivity improvements: digital maturity and transformation can increase efficiency and productivity in HRM processes, enabling smoother operations and reducing errors or bottlenecks. This improved efficiency can contribute to overall stability within HRM functions. Data-driven decision-making: digital maturity facilitates the collection and analysis of HR data, allowing for evidence-based decision-making.

This can lead to more informed and strategic HRM practices, enhancing stability by reducing uncertainties and increasing predictability. Streamlined communication and collaboration: it is mentioned in the study by L. Wang *et al*. (2022) that digital tools enable seamless communication and collaboration within HR teams and between HR and employees. Enhanced collaboration can improve coordination, increase transparency, and contribute to overall stability in HRM processes.

Trade-offs between stability and development. Resistance to change: stability often favours maintaining the status quo, while digital transformation requires embracing change and innovation. There can be a trade-off between the desire for stability and the need to adapt to new technologies and processes. Balancing standardization and flexibility: stability often relies on standardized processes and systems, while digital transformation may introduce more flexibility and customization. Striking the right balance between stability and flexibility is crucial to ensure that HRM practices align with organizational goals and needs. Managing risks: stability is often associated with risk mitigation, while digital transformation involves taking calculated risks to drive innovation and growth. Organizations must carefully manage risks associated with digitalization to maintain an appropriate level of stability. Organizations must navigate these trade-offs and carefully manage the disruption and enhancement of stability during digital transformation initiatives (Zhang & Chen, 2023). Successful implementation requires effective change management, upskilling employees, and ensuring a balance between stability and development to leverage the benefits of digital maturity while minimizing disruptions.

The role of development, including ongoing learning, training, and skill development, is vital in achieving and sustaining digital maturity within HRM. The importance of development and how organizations balance stability with the necessity of continuous growth in a digitally transforming environment should be examined. Keeping up with technological advancements: the digital landscape is constantly evolving, and constant learning is crucial to stay updated with emerging technologies, tools, and trends. Continuous development ensures that HR professionals have the knowledge and skills to effectively utilize digital tools and drive digital transformation in HRM (Zhang & Chen, 2023). Adapting to changing needs: digital transformation often changes HRM processes, systems, and roles. Ongoing learning enables HR professionals to adapt to these changes, acquire new competencies, and embrace innovative approaches in data analytics, automation, and digital HR strategy (Savchuk, 2020). Maximizing the potential of digital tools: digital maturity is not solely about adopting technology. It also requires the ability to leverage digital tools to their full potential. Ongoing learning and skill development empower HR professionals to effectively utilize digital tools for improved HRM practices, decision-making, and employee engagement.

Balancing stability with continuous development. Assessing the impact of change: organizations must carefully evaluate the potential impact of constant development initiatives on stability. Change management strategies should be employed to ensure that ongoing learning and development efforts do not overly disrupt stable HRM processes or create resistance among employees. Agile approaches to learning and development: adopting agile learning methodologies allows organizations to balance stability with continuous growth. By implementing shorter learning cycles, organizations can incorporate new knowledge and skills in a controlled manner, minimizing disruption and promoting adaptability. Creating a learning culture: organizations can foster a culture of continuous learning and development, where employees are encouraged and supported to enhance their digital skills. This culture facilitates ongoing development while maintaining stability by embedding learning as a core value and integrating it into performance management and career development processes.

Encouraging collaboration and knowledge sharing among HR professionals helps ensure that digital expertise is distributed and shared within the organization. By fostering a collaborative environment, organizations can harness HR professionals' collective knowledge and experience to drive digital maturity while maintaining stability through collective learning and problem-solving. In summary, development is crucial in achieving and sustaining digital maturity in HRM. Ongoing learning, training, and skill development enable HR professionals to adapt to digital transformations, leverage digital tools effectively, and drive innovation. Organizations must balance the need for stability with continuous development by carefully managing change, adopting agile approaches, creating a learning culture, and fostering collaboration and knowledge sharing.

## VIEW OF DIGITAL MATURITY AND DIGITAL TRANSFORMATION IN HRM FROM THE PERSPECTIVE OF STABILITY VERSUS DEVELOPMENT

Digital maturity and transformation in HRM involve integrating and utilizing digital technologies and strategies to enhance HR processes and practices within an organization. Several factors come into play when considering stability versus development in the context of digital maturity and digital transformation in HRM. They need to be explored in more detail.

Stability. Established processes: stability in HRM focuses on maintaining existing processes and practices that have proven effective over time. This approach emphasizes consistency and reliability, ensuring that HR functions are executed efficiently without significant disruptions. Risk mitigation: stability-oriented HRM aims to minimize risks associated with change. It prioritizes stability to avoid potential negative impacts on employee satisfaction, productivity, and overall organizational performance. Incremental changes: stability-focused organizations may adopt a conservative approach by making incremental changes in their HR processes. They may prefer implementing digital tools and technologies that align with their existing systems, making gradual improvements rather than drastic overhauls.

Development. Agility and adaptability: organizations prioritizing HRM development recognize the need to adapt to changing market dynamics and technological advancements. They embrace digital transformation to enhance agility and promptly respond to evolving business needs. Innovation and competitive advantage: development-

oriented HRM seeks to leverage digital technologies to drive innovation and gain a competitive edge. By adopting emerging tools and strategies, organizations can enhance their HR processes, attract top talent, and improve the overall employee experience. Scalability and efficiency: development-focused HRM aims to optimize HR processes by leveraging digital solutions that enable scalability and efficiency gains. Automation, analytics, and cloud-based platforms can streamline administrative tasks, improve decision-making, and free up HR resources for more strategic initiatives. Achieving a balance between stability and development in HRM is crucial. Organizations must maintain stability in core HR functions while fostering a culture of continuous improvement and innovation. This approach involves the following.

Strategic planning: organizations should develop a clear roadmap for digital transformation in HRM, aligning it with overall business objectives. This plan should account for stability and development needs, ensuring a harmonious integration of new technologies without compromising existing processes. Change management: effective change management practices are essential to address resistance to change and facilitate smooth transitions. Employees should receive the necessary training, support, and communication throughout the digital transformation journey. Iterative approach: organizations can adopt an iterative approach, implementing digital solutions in phases. This allows them to assess the impact of each implementation, make necessary adjustments, and ensure stability before moving on to the next phase. Continuous learning: encouraging a learning culture within the HR department lets employees stay updated with the latest trends and technologies. This enables HR professionals to make informed decisions and contribute to the ongoing digital transformation process. One can consider the balance between stability and progress when examining digital maturity and transformation in HRM. However, as shown in Table 1, each approach has benefits and drawbacks.

**Table 1.** View of digital maturity and digital transformation in HRM from the perspective of stability versus development

| **Stability** | |
|---|---|
| Stability in HRM refers to the ability to maintain existing processes, systems, and practices without significant disruption. In the context of digital maturity, it implies that the HR function operates with established technologies and processes that are stable and reliable. Stability may be suitable for organizations prioritizing maintaining the status quo, having limited resources for change, or operating in industries with slower technological advancements. | |
| **Advantages of stability in HRM:** | **Disadvantages of stability in HRM:** |
| *Familiarity and comfort:* stability allows HR professionals to work within a familiar framework, reducing the need for extensive training and learning curves.<br>*Minimal disruption:* stable HR systems ensure day-to-day operations run smoothly without significant interruptions, minimizing potential risks and errors.<br>*Cost-effective:* by avoiding frequent technological changes, organizations can prevent substantial investments in new HR technologies and focus their resources on other strategic initiatives. | *Limited innovation:* sticking to stable systems can hinder HR's ability to adopt innovative solutions and keep pace with evolving industry trends.<br>*Inefficiency:* outdated technologies and processes may be less efficient and time-consuming, resulting in delays and increased manual work.<br>*Competitive disadvantage:* organizations that resist digital transformation risk falling behind their competitors who leverage technology to gain a competitive edge in talent acquisition, engagement, and performance management. |
| **Development** | |
| Development in HRM refers to embracing digital transformation and continuously evolving HR practices to leverage new technologies, data analytics, automation, and digital tools. It involves rethinking and redesigning HR processes to improve efficiency, effectiveness, and employee experience through technology-driven solutions. | |
| **Advantages of development in HRM:** | **Disadvantages of development in HRM:** |
| *Enhanced productivity:* digital transformation can automate routine administrative tasks, freeing HR professionals' time to focus on strategic initiatives and value-added activities.<br>*Improved decision-making:* data analytics and digital tools enable HR to gather and analyse relevant workforce data, leading to data-driven insights for better decision-making and strategic planning.<br>*Enhanced employee experience:* technology-driven HR solutions can provide self-service portals, mobile apps, and AI-powered chatbots, improving employee engagement, communication, and satisfaction.<br>*Agility and adaptability:* embracing digital transformation allows HR to respond quickly to changing business needs, market demands, and regulatory requirements. | *Implementation challenges:* digital transformation initiatives can be complex, requiring careful planning, change management, and investment. Poor implementation can lead to delays, resistance, and cost overruns.<br>*Skills and knowledge gaps:* adopting new technologies may require upskilling HR professionals to ensure they have the skills needed to use and manage digital HR solutions effectively.<br>*Data security and privacy concerns:* increased reliance on technology and data collection raises cybersecurity risks and requires robust measures to protect sensitive employee information. |

**Source:** compiled by the authors

Achieving a balance between stability and development is crucial for successful digital transformation in HRM. While stability ensures the smooth functioning of core HR operations, development enables organizations to leverage digital technologies for continuous improvement and innovation. Here are a few strategies to strike a balance. Prioritize: identify critical HR processes that require stability and prioritize their maintenance and smooth functioning during the digital transformation journey. Incremental approach: adopt an incremental approach to digital transformation, focusing on one HR process or system at a time. This allows for gradual change while maintaining stability in other areas. Change management: invest in change management initiatives to address employee concerns and resistance to change. Communicate the benefits of digital transformation and provide training and support to ensure successful adoption. Collaboration: foster collaboration between HR and IT teams to ensure stability considerations are considered while implementing digital solutions. Work together to design and implement solutions that balance stability and development. Continuous evaluation: regularly evaluate the impact of digital transformation initiatives on stability and make adjustments as necessary. Monitor key metrics to measure the effectiveness of new digital HR systems and processes. By striking a balance between stability and development, organizations can successfully navigate the digital transformation journey in HRM, driving innovation and improving overall HR effectiveness while ensuring the stability of core HR operations (Zhang & Chen, 2023). Understanding digital maturity is crucial for academic research as it helps to comprehend the different paths taken by organizations in this ongoing socio-technical phenomenon. While a digital strategy aligns with ICT (Information and communications technology) and business strategies, a digital transformation strategy encompasses the organizational change process's vision, planning, and implementation (Montero Guerra *et al.*, 2023).

In conclusion, balancing stability and development is critical to successful digital maturity and transformation in HRM. While stability maintains operational continuity, development ensures that organizations stay agile, innovative, and competitive in an increasingly digital world. Stability and development have their merits and drawbacks in the context of digital maturity and transformation in HRM. Organizations must strike a balance based on their goals, resources, and industry dynamics. While stability provides familiarity and reliability, development enables innovation, efficiency, and agility, fostering a more advanced HR function capable of meeting evolving business needs.

## ANALYSIS OF RECENT RESEARCH AND PUBLICATIONS ON THE TOPIC

Many scientists devoted their scientific works to studying theoretical and practical aspects, the latest trends of digital maturity and digital transformation, and the balance between stability and development when implementing digital strategies and technologies in HRM. N. Verina & J. Titko (2019) emphasised that when it comes to digital transformation, many organizations fail to prioritize the human element within and outside the company. Research suggests that motivated employee involvement is crucial for successful digital transformation (Schwertner, 2017) and that the human factor is more vital than technology (Del Rowe, 2017). According to F. Trevino (2020), it is crucial for any organization to have the right people on board. Without them, any organization is bound to fail. When it comes to digital transformation, it is essential to evaluate the current personnel, their roles, and the skills they possess. The first step is to assess the level of maturity of staff members. This approach also involves understanding the cultural changes when an organization adopts digital technology.

Experts such as D.B. Minbaeva (2018) contend that digital HRM is an organizational skill that utilizes traditional data analysis, sentiment analysis, or algorithms to produce positive outcomes based on accumulated information. Digital HRM has been demonstrated to enhance decision-making quality (Van Esch *et al.*, 2019; Gal *et al.*, 2020). The organizations can become more adaptable to a fast-paced environment and gain a competitive advantage, increase HRM department involvement in strategy (Levenson, 2018), elevate employee performance and experience (Schiemann *et al.*, 2018), and improve overall organizational financial performance (Malik *et al.*, 2021). The effects of digital transformation have extended far beyond our daily lives, impacting HRM's roles and processes, as Y. Schmid & F. Pscherer (2022) outlined. As new digital technologies emerge, HR departments must adapt to changes in how data and information are handled. These technologies have revolutionized HRM processes, improving stakeholder service delivery. M. Mosca (2020) highlights such technologies as employee recruitment, performance evaluation, and human resource development. It is clear that the effects of digital transformation extend beyond our daily lives and have significant implications for the world of HR. According to M. Mosca (2020), digital HRM is a time-saving and productive solution for HRM functions. The process has been made simpler and faster due to digital transformation, as noted by D. Démeijer (2017). Consequently, HRM specialists can now focus on more meaningful initiatives for their respective areas. Digital HRM approaches have become increasingly essential and are now instrumental in shaping the HR strategy and the organization.

Organizations may encounter internal resistance during a transformation. Overcoming this resistance requires leaders with transformational skills who actively involve all affected by the changes, as highlighted by C. Matt *et al*. (2015). However, it is crucial to recognize that increased use of digital technologies may not always be beneficial. As such, evaluating the digital maturity levels is critical, though the definition of "digital maturity" may vary. For instance, S. Chanias & T. Hess (2016) referred to digital maturity as "the state of a company's digital transformation". T. Chamorro-Premuzic (2021) said that digital maturity refers to the ability of an organization or individual to effectively use digital technologies, tools, and data to achieve its goals. It includes knowledge, skills, ability to use digital resources, creativity, and flexibility in solving problems in the digital environment. In his article, S.F. Dieffenbacher (2022) substantiated that digital maturity allows the implementation of new methods of interviewing and evaluating candidates, using analytics to select the most suitable candidates, and automating the processes of job posting and interaction with applicants. Research by J. Brown (2023) about digital

maturity refers to using electronic platforms to train and develop employees and create access to online courses, webinars, and other educational resources. Digital tools enable the automation of performance appraisal processes and use performance management systems, 360-degree feedback, and analytics to assess employee progress and achievements.

L. Wang *et al*. (2022) suggested that HRM capability maturity is a crucial boundary condition for understanding the effectiveness of digital HRM practices. Companies strive for digital maturity and utilize technological advancements to enhance talent management. However, this approach can significantly hinder transformation success due to limited resources and skills. This is stated in J.M. Montero Guerra *et al*. (2023) research. Throughout the study, T. Ahmad & A. Van Looy (2020) established that digital transformation refers to the strategic process of transforming an organization, its business models, processes, products, and services using digital technologies. It involves introducing digital tools, a review of business processes, a change in the organization's culture, and the involvement of digital communication channels with customers and employees.

A.F. Barišić *et al*. (2021) research is about digital transformation in human resources management, including using digital technologies and tools to optimize and improve personnel management processes. This can have both challenges and benefits for HRM. Digital transformation has the potential to improve HR efficiency and productivity, but it also poses challenges related to cultural change, staff skills, and data security. The implementation of digital tools should be carefully planned and adequately trained to ensure success in the process, which is stated in A. Heydari *et al*. (2023) research. Researchers J. Zhang & Z. Chen (2023) substantiated that a balanced approach to stability and development in HRM allows the organization to successfully implement digital initiatives, ensuring the optimal use of digital technologies to improve personnel management and achieve strategic goals. These opinions confirm that the issue of digital maturity in human resources management is relevant for study and development in Ukraine and other countries.

## CONCLUSIONS

As organizations embark on their digital transformation journey in HRM, they must balance stability and development to succeed. This balance is essential as it enables them to take advantage of the opportunities offered by digital technologies while maintaining the core stability of HR operations. Assessing an organization's digital readiness, technological infrastructure, and level of digital literacy among employees is crucial to achieving digital maturity. Academic research provides valuable insights into successful strategies and potential pitfalls organizations can adopt during digital transformation.

A well-crafted digital strategy that effectively aligns ICT and business goals is critical to the success of digital transformation in HRM. This strategy should outline a roadmap for implementing technological advancements in HR processes and supporting the overall business strategy. While the digital strategy focuses on technological aspects, a digital transformation strategy encompasses the broader organizational change needed to embrace the digital revolution fully. Stability in HR operations is fundamental to ensure smooth functioning, compliance with regulations, and consistent service delivery. On the contrary, development is critical to foster innovation and adaptability in the digital era. Investing in training and upskilling initiatives is essential to ensure that employees can effectively leverage digital tools and embrace the digital culture.

Finding the proper equilibrium between stability and development is unique to each organization's digital transformation journey. HR leaders must assess the risks and opportunities associated with various strategies to strike the right balance. Organizations should foster a culture of innovation, continuous learning, and collaboration to achieve successful digital maturity and transformation in HRM. Through effective digital strategies and a growth-oriented mindset, organizations can navigate the complexities of digital transformation and drive positive change in HRM. To successfully integrate digital initiatives in HR, studying the impact on workplace stability, ethics, leadership, power distribution, communication, digital culture, remote work, and flexible hours is essential. Researching these areas in future studies can help make informed decisions for maximum benefits.

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## CONFLICT OF INTEREST

None.

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## Цифрова зрілість і цифрова трансформація в управлінні людськими ресурсами: стабільність проти розвитку

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**Анотація.** Цифрова трансформація вплинула на всі сфери життя, включно з управлінням персоналом. Вивчення цифрової зрілості є актуальним, адже може допомогти організаціям адаптуватися до змін і вдосконалити стратегії управління людськими ресурсами для успішної трансформації. Це дослідження мало на меті вивчити взаємозв'язок між цифровою зрілістю, трансформацією та управлінням людськими ресурсами, а також те, як організації можуть використовувати цифрові технології для підвищення зрілості, можливостей та подолання перешкод. Для досягнення мети використовувалися комплексний аналіз, методи синтезу, індукції, дедукції, аналогії як методичних інструментів для аналізу літературних джерел та використання інформаційних і комунікаційних технологій. Досліджено важливість цифрової зрілості для практик і процесів управління персоналом, а також процес цифрової трансформації у функціях управління. Визначено драйвери, виклики та результати, пов'язані з ініціативами цифрової трансформації, проаналізовано вплив цифрової зрілості та трансформації на стабільність. Дослідження також вивчало можливі компроміси між підтриманням стабільності та сприянням розвитку за допомогою цифрових технологій. Оцінено важливість безперервного навчання, тренування та розвитку навичок в управлінні персоналом для досягнення та підтримки цифрової зрілості. Розроблено концептуальну основу, яка зосереджена на взаємозв'язку між стійкістю та розвитком у контексті цифрової зрілості та трансформації в управлінні людськими ресурсами, що забезпечує всебічне розуміння цієї динаміки. Дослідження може допомогти ефективно керувати цифровою трансформацією та надає корисну інформацію як для академічного, так і для практичного застосування в галузі управління людськими ресурсами, привносить нову перспективу в баланс між стабільністю та розвитком

**Ключові слова:** баланс; організаційні зміни; інновації; стратегічне управління персоналом; електронні інструменти та технології

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