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# **The Research Journal of Business in Emerging Economics**

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# Formation of Performance Indicators for Organizations in the Field of Municipal Waste Management in the Context of Regional Sustainable Development

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## Abstract

The article presents the developed information-analytical support system for municipal waste management based on the Balanced Scorecard (BSC) concept, allowing for the assessment of ecological, economic, and social effectiveness of waste management in accordance with the strategic objectives of sustainable economic development. The study employed methods including analysis, synthesis, comparison, logical generalization, grouping, analogy-based conclusions, as well as systemic and comprehensive approaches. The municipal waste management system, based on the key performance indicators developed by us, aligns with the target priorities for the development of companies in the municipal waste sector. This enables planning, continuous monitoring, and control over the achievement of objectives in resource conservation, activation of recycling processes, and minimization of the harmful impacts of waste on the environment and society.

**Keywords:** balanced scorecard system, sustainable development strategy, municipal waste management, accounting for municipal waste, management effectiveness assessment, circular economy

## 1. Introduction

Due to the depletion of resource potential and the deterioration of the ecological state of the global ecosystem, effective management of secondary resources (waste) has become particularly relevant. This management ensures that companies meet three fundamental components of sustainable development: environmental sustainability, economic feasibility, and social acceptability, as outlined in the UN General Assembly resolution of September 25, 2015, No. 70/1, "Transforming our world: the 2030 Agenda for Sustainable Development."

In recent decades, the Republic of Belarus, like many other countries, has seen a significant increase in the volume of solid municipal waste and an increase in the content of hazardous components in waste that are harmful to health and resistant to decomposition in the natural environment. This is related to radical changes in consumption patterns.

Municipal waste is recognized as waste generated from human activities not related to economic activities, as well as certain production waste included in the list of waste classified as municipal (Ministry of Housing and Communal Services of the Republic of Belarus, 2019). The management of all types of municipal waste falls under the jurisdiction of housing and communal services organizations.

As cities grow and populations increase, waste accumulation is projected to rise by 70% by 2050, reaching an annual total of 3.4 billion tons of waste (World Bank, 2024). In the Republic of Belarus,

approximately 4 million tons of solid municipal waste is generated each year, accounting for more than 6% of the total waste generated in the country. Therefore, issues related to reducing their harmful

impact and promoting recycling are addressed at the legislative level in the National Action Plan for the Development of the "Green" Economy of Belarus (Kulbeda-Kamshilova, 2020).

Currently, the issue of municipal waste disposal has become a top priority in Belarus, as a large portion of the country's municipal waste is disposed of in landfills (there are about 156 large landfills and 5 mini-landfills in operation). Plans are in place to transform the existing landfills into 30 regional landfills that comply with environmental safety requirements .

The state policy of the Republic of Belarus in the field of waste management aims not only to reduce harmful impacts but also to promote the use of waste, as municipal waste contains valuable components that can be used as material and energy secondary resources. The Law of the Republic of Belarus dated July 20, 2007, No. 271-Z "On Waste Management" establishes the principle of prioritizing waste utilization over their disposal or landfill.

In the republic, there are eight waste processing plants located in the cities of Brest, Vitebsk, Gomel, Grodno, Mogilev, Minsk, Baranovichi, and Novopolotsk, along with 82 sorting lines. Approximately 1,600 collection points for secondary raw materials operate, and more than 200,000 modern containers have been installed in populated areas across the country. Thanks to the collection of secondary raw materials and the utilization of organic waste, the level of municipal waste utilization in the republic reached 37.9% in 2024 (Semyonkova, 2024). Guided by the National Strategy of the Republic of Belarus for the Management of Solid Municipal Waste and Secondary Material Resources, aimed at minimizing municipal waste disposal, there are plans to increase waste utilization in the country to 90% by 2035.

According to the concept of sustainable development, the waste management system must satisfy three fundamental components: environmental sustainability, economic feasibility, and social acceptability. It should aim to minimize waste generation, maximize recycling, promote reuse, and ensure environmentally safe disposal of waste. In this regard, the purpose of this article is to develop a system for assessing the effectiveness of municipal waste management, which will enable companies to ensure proper management of municipal waste to achieve strategic sustainable development goals. To achieve this, it is necessary to identify the company's target objectives in waste management and, accordingly, improve management practices to attain economic, environmental, and social sustainability. Additionally, a system of indicators should be developed for planning purposes, continuous monitoring, and evaluating the effectiveness of municipal waste management based on operational information.

The term "integrated or comprehensive waste management" was first mentioned in a technical context in the 1970s in the works of scholars Murray R.U., Shivers R.U., and Ingelfinger A.L.(Murray, Shivers, Ingelfinger, & Metzger, 1971). The issues of comprehensive sustainable waste management have been addressed by authors such as Van de Klundert A., Anschutz J., Sheinberg A., Wilson D.K., and Rodik L.(Van de Klundert & Anschütz, 2001). Thorpe S.D., Daskalopoulos E., Badr O. and Probert S.D. (Daskalopoulos, Badr, & Probert, 1998), Afzal Hussein Khan, Mufid Sharholi, Pervez Alam (Husain Khan, Sharholi, & Alam, 2022), Ruby Medina-Mihangos, Luis Segui-Amorteghi (Medina-Mijangos & Seguí-Amórtégui, 2020), Wender Freitas Reis, Christian Gomes Barreto, Mauro Guilherme Maidana Capelari (Reis, Barreto, & Capelari, 2023), Muhammad Farook, Tse Cheng, Nur Ullah Khan (Farooq, Cheng, Khan, & Saufi, 2022), Neama Derhab, Zakaria Elkhwesky (Derhab & Elkhwesky, 2023), Florence Barbara Awino, Sabine E. Apitz (Awino & Apitz, 2023) studied the circular economy, analyzed waste indicators and waste management, analyzed the costs associated with waste management. The challenges of establishing a waste management system for industrial waste within the context of a circular (zero-waste) economy and its inclusion in accounting and financial reporting systems have become the focus of research for many foreign and domestic authors, including S.G. Vegera, E.B. Maley, I.I. Sapeha, O.A. Sushko (Vegera, Malei, Sapeha, & Sushko, 2018), Sara Corrado, Carla Caldeira, Mattias Eriksson (Corrado, Caldeira, Eriksson, & others, 2019), Di Vaio A., Hasan S., Palladino (Di Vaio, Hasan, & Palladino, 2023), Almasyhari A. K., Rachmadani W. S., Priatnasari, Y (Almasyhari, Rachmadani, & Priatnasari, 2024), Sri Wahjuni Latifah, Noorlailie Soewarno (Latifah & Soewarno, 2023), O. Vysochan, V. Hyk (Vysochan, Hyk,



O. Vysochan, & Yasinska, 2024), Ralph Adler, Mansi Mansi, Rakesh Pandey (Adler, Mansi, & Pandey, 2021) and others.

In examining the problems of waste accumulation, scholars continue to refine management methods, emphasizing comprehensive management. Consequently, several approaches to waste management have emerged in the scientific literature: those based on the assessment of economic efficiency; eco-economic effects; and comprehensive sustainable management across multiple parameters (political, institutional, social, financial, economic, and technical).

Authors such as V.V. Buzirev, N.V. Vasilieva, V.F. Martynov, A.N. Ryakhovskaya, A.K. Shreiber, A.N. Kirillova, P.V. Nemkin, V.S. Chekalin (Buzyrev et al., 2016; Nemkin & Chekalin, 2017; Ryakhovskaya et al., 2019)], and others pay attention to the analysis of the activities of housing and communal services organizations. However, the issues of assessing the effectiveness of municipal waste management in housing and communal services considering the concept of sustainable development have not been addressed by these authors

Currently, municipal waste management is based on isolated economic or environmental performance indicators. However, considering the concept of sustainable development and international standards such as ISO 14000, it is important to emphasize the need to minimize municipal waste generation through the implementation of zero-waste production technologies, the activation of recycling, reuse, disposal, and landfilling practices, taking into account the harmonization of environmental, economic, and social components.

Thus, the existing municipal waste management system has several shortcomings:

1. It is based on indicators calculated for the organization as a whole, without detailing the stages of the municipal waste life cycle. This prevents the effective assessment of environmental protection measures and the achievement of target indicators for waste management from the moment of generation to disposal, whereas the EU waste management strategy implies an analysis of the entire life cycle (the "cradle-to-grave" concept).
2. It does not consider data on municipal waste in monetary terms or the actual costs incurred by the organization at each stage of the life cycle, which are necessary for assessing the economic potential of the organization in waste management, due to the lack of an appropriate information base.
3. It is not aligned with the strategic development goals of the company.

In this regard, a highly relevant and practically significant issue is the development of informational and analytical support for the municipal waste management system at all stages of its life cycle. This support would contribute to increasing the economic efficiency of housing and communal services organizations, reducing the environmental burden on the ecosystem, and enhancing social responsibility towards personnel and society.

## 2. Results

The European Union Directive "2008/98/EC on Waste and Repealing Certain Directives" (Directive 2008/98/EC, 2008) outlines the following possible stages of municipal waste management — from the most prioritized methods in terms of environmental safety to the least prioritized: from waste prevention, waste reduction (minimization), to reuse and recycling of waste, utilizing waste for energy recovery, to waste incineration without energy recovery and waste landfilling.

In the legislation of the Republic of Belarus, the prevention and reduction of waste generation is not fully regulated. Measures to facilitate this should be implemented at the design stage of products (packaging) as well as during the production of goods and construction of facilities. The country has adopted a number of legislative acts aimed at reducing the generation of the most problematic waste, such as plastic packaging and single-use dishes. Used glass packaging is collected, cleaned, and reused for bottling beverages. Waste

paper and cardboard (waste paper), glass, plastic, worn-out tires, and used oils are sent for recycling. The process of disposing of mercury-containing lamps, thermometers, and other mercury-filled devices has also been established. Hazardous components are sent for safe disposal at municipal waste landfills. In Belarus, there are specific examples of using solid municipal waste for energy recovery. For instance, waste from worn-out tires is partially used as fuel in cement plants. Additionally, landfill gas is extracted from municipal waste landfills to generate energy.

Clearly, achieving the presented sustainable development goals in the field of municipal waste management is only possible through continuous monitoring of organizational activities by developing a system of indicators that define the economic, environmental, and social effectiveness of waste management from the moment of generation to the point of disposal (landfilling). The most well-known tool for measuring the effectiveness of a company's operations in achieving strategic management goals is the Balanced Scorecard (BSC), developed by R. Kaplan and D. Norton in the early 1990s (Kaplan & Norton, 1996). The Balanced Scorecard is a management concept for implementing strategy that ensures targeted monitoring of enterprise activities, allowing for the forecasting and preemptive identification of problems. It seamlessly integrates strategic and operational management levels while controlling the most significant financial and non-financial performance indicators of the enterprise. Significant contributions to the development of scientific and practical approaches for assessing the effectiveness of enterprises using the Balanced Scorecard have been made by authors such as L.R. Batukova, T.L. Bezrukova, I.D. Bunimovich, N.A. Kalmakova, T.V. Krashennnikova, A. Tawse, P. Tabesh (Tawse & Tabesh, 2023), S. Kumar, W. M. Lim, R. Sureka (Kumar et al., 2024), [Hristov, I., Cristofaro, M.](#) (Hristov et al., 2024) and others.

The main feature of the Balanced Scorecard is that it directs company management towards sustainable strategic development, in contrast to traditional management, which tends to be overly focused on financial metrics. The Balanced Scorecard can be tailored for specific organizations and should be developed considering production conditions and strategic objectives. Accordingly, the indicators for assessing a company's effectiveness included in the Balanced Scorecard depend on its target objectives.

To date, there is no Balanced Scorecard system developed specifically for municipal waste management. In the article (Vegeera, Malei, Afanasyeva & Sushko, 2024), the authors developed a Balanced Scorecard system for managing industrial waste; however, the analysis of municipal waste management has its own specifics. In our opinion, it is necessary to create a waste management system based on the BSC concept and the strategic goals of the company to achieve economic, environmental, and social sustainability throughout the life cycle of municipal waste. This, in turn, would link potential changes in environmental and social burdens to the company's economic activities, enhance the organization's image regarding corporate social responsibility and the principles of "green economy," and increase the company's competitiveness on an international level in accordance with the concept of sustainable development.

The foundation for developing a sound methodology for municipal waste management is a reliable information base, which should be continuously accessible for operational management purposes. The primary database for municipal waste management should be the accounting system. Although the entities managing municipal waste include legal persons, individual entrepreneurs (as waste producers), legal entities servicing residential buildings, property owners transferring buildings and other facilities for use, and citizens (individuals who are not individual entrepreneurs), the necessary information base in the accounting system and document flow for municipal waste is formed only by legal entities. Therefore, the methodology for assessing the efficiency of municipal waste management will be developed only for legal entities involved in the life cycle processes of municipal waste.

However, at the current stage, the existing accounting system for legal entities regarding municipal waste is insufficiently informative to ensure a comprehensive and thorough assessment of effectiveness. This lack of informativeness from organizations leads to a decrease in their investment attractiveness, which somewhat hinders the development of a circular economy. In this regard, we propose the following innovations:



1. After studying various approaches to identifying the stages of the waste life cycle in the Republic of Belarus, the Russian Federation, European Union countries, and the United States of America, we suggest considering the life cycle of municipal waste for building an accounting system, analysis, and management of municipal waste consisting of the following stages:

Generation of municipal waste (formation of municipal waste during human activities not related to economic activity, waste generated in consumer cooperatives and gardening associations, waste produced by legal entities and individual entrepreneurs during economic activities, identification of waste types, classification and coding, sorting of municipal waste)

-Collection and/or accumulation of municipal waste (activities aimed at concentrating municipal waste at temporary storage sites)

-Recycling of municipal waste (preparation for the use of municipal waste, storage of municipal waste)

-Disposal (destruction) of municipal waste (incineration without energy recovery, landfilling, and using municipal waste for energy recovery).

2. To reflect the connection between the indicators of municipal waste utilization and the performance indicators of the enterprise, it is proposed to organize analytical accounting of municipal waste on the balance sheet of legal entities involved in the life cycle processes of municipal waste, with a division into the following management objects:

- The volume of municipal waste in physical terms and at fair value by types, hazard classes, and locations of collection, accumulation, recycling, and disposal;
- Actual costs for the collection, accumulation, recycling, and disposal of municipal waste;
- Revenue from the sale (recycling) of municipal waste by types, hazard classes, and accumulation locations.

Special attention should be given to the organization of accounting for entities that carry out the disposal of municipal waste and extract landfill gas from the landfill body. Various users of the accounting information from these organizations are interested in data about the economic potential of the landfill. However, currently, in the accounting and financial reporting of organizations involved in municipal waste disposal, data on the incoming organic municipal waste (as a resource in the production process), as well as the formed stocks of organic matter and landfill gas within the landfill, are not recorded. As a result, this distorts the cost indicators of the produced energy, the organization's income, and the financial results generated.

Based on the studied principles of ecological-economic waste accounting, approaches to financial reporting according to GRI (Global Reporting Initiative) standards, and the requirements of the international system of national accounts, as well as relying on researched definitions of concepts such as "organic waste," "municipal waste," and "biomass" by both foreign and domestic authors, new accounting objects have been identified for organizations operating landfills (Malei & Trubovich, 2024):

- "Biomass of municipal waste," which represents organic substances (resources) within municipal waste that possess energy potential, transforming under natural processes from a material-state heterogeneous form to a gaseous state, subsequently suitable for use in energy production (waste from parks, squares, and yards of plant origin, as well as consumption and production waste, predominantly food waste);
- "Gaseous resource produced from the biomass of municipal waste" - a short-term asset within the "Materials" account, reflecting the transformation of biomass from solid to gaseous state and showing the energy potential of the landfill.

Alongside the recognition of the gaseous resource produced from the biomass of municipal waste, it is necessary to account for a long-term asset, "renewable gaseous resource," which reflects the stocks of

biogas within mineral resources and possesses energy potential that is maintained over a long period and is renewed as biomass of municipal waste is landfilled.

The introduction of new accounting objects allows for the formation of an information base regarding the energy potential of municipal waste in organizations that carry out disposal and extraction of landfill gas. Recording in accounting the information about the incoming stocks of biomass of municipal waste within the landfill and its energy potential for energy production will provide stakeholders with the necessary information to assess the economic potential of the landfill; account for the residual value of organic waste (in the substance transformation chain "product - waste - secondary resource") in energy production; and analyze the utilization level of the secondary resource in the overall cost of energy resources in the region, area, or republic.

Since the market for the organic fraction of municipal solid waste (MSW) is not developed in domestic practice, it seems appropriate to consider the value of biomass from municipal waste, referring to its qualitative characteristics (energy potential) and the fair value of an identical (comparable) resource in another market. The value of biomass is determined by its energy potential in the production of combustible substances, characterized by the volume of biogas produced and its methane content. Cow manure produces biogas at a yield of 0.34 m<sup>3</sup> per 1 kg of raw material and contains 65% methane (Malei & Trubovich, 2024). The yield of biogas from municipal waste exceeds that from cow manure by 0.06 m<sup>3</sup> per 1 kg of raw material, with the same methane content.

In this regard, we propose to determine the fair value of biomass from municipal waste based on the current market price of a benchmark raw material (manure), adjusted for the methane content percentage in the biomass of municipal waste and in the "benchmark" resource. The gaseous resource produced from the biomass of municipal waste is assessed based on expert evaluations of the established biogas reserves within the landfill at the fair value of decomposed biomass. The renewable gaseous resource is suggested to be evaluated at fair value, based on the market price of the "benchmark" resource (natural gas), adjusted for the methane content percentage in the biomass of municipal waste and in the "benchmark" resource.

Reflecting municipal waste at various stages of its life cycle in both physical indicators and fair value will contribute to assessing the economic potential of municipal waste and reducing environmental damage risks. Separate accounting for actual costs related to the collection, accumulation, recycling, and disposal of municipal waste, as well as revenues from the sale and use of municipal waste, will enhance the evaluation of the effectiveness of waste management activities. Furthermore, this will ensure integration with the national accounting system, allowing for accurate statistical analysis of environmental protection expenditures in key sectors of the economy.

The recommended changes in accounting practices will establish an information base for developing a system of indicators to assess the ecological, economic, and social effectiveness of municipal waste management in line with the strategic objectives of economic entities.

Based on the improvement of the information base for municipal waste management, we have identified management objects for the waste management process at each stage of the municipal waste life cycle and developed strategic goals for the company in the field of waste management, which should serve as the foundation for a balanced scorecard system (Table 1).

Thus, at each stage of waste management, the organization should strive to achieve the defined strategic goals in ecological, economic, and social directions. Therefore, for the purposes of municipal waste management, it is necessary to develop indicators that allow for setting target quantitative and qualitative benchmarks and planning activities related to waste management throughout the life cycle. Ultimately, this will help determine the effectiveness of the implemented measures.

The evaluation of waste management effectiveness should consider both the specifics of the life cycle and the management's efforts to implement measures aimed at achieving strategic sustainable development goals. In support of this, the ISO 14031 standard for assessing environmental performance



highlights two groups of indicators: 1) Management Performance Indicators: Provide information about the management actions taken to impact the organization’s environmental performance; 2) Operational Performance Indicators: Inform about the environmental performance of the organization based on the specifics of the production process.

This approach can be used to assess not only the ecological but also the economic and social effectiveness of municipal waste management. The social effect is manifested in the reduction of disease incidence among the population due to the harmful effects of waste, as well as improvements in working and resting conditions for personnel involved in waste collection, accumulation, recycling, and disposal, which do not have a monetary form. The economic effectiveness of municipal waste management is determined by the full utilization of resources through the development of recycling processes, reduction of actual costs related to waste management, and generation of additional income from waste sales and gas recovery at landfill sites.

**Table 1.** – The connection between municipal waste management objects and the strategic goals of sustainable development of the organization within the life cycle framework

Stage of the Life Cycle of Municipal Waste	Stage I: Generation of Municipal Waste	Stage II: Collection and/or Accumulation of Municipal Waste	Stage III: Recycling of Municipal Waste	Stage IV: Disposal (Destruction) of Municipal Waste, Including Waste Utilization for Energy Recovery
Management Object	- Volume of Municipal Waste in Physical Terms (by types, hazard classes, and sources) - Volume of Municipal Waste in Monetary Terms (fair value) (by types, hazard classes, and sources)	- Volume of Municipal Waste in Physical Terms (by types, hazard classes, and collection/accumulation points) - Volume of Municipal Waste in Monetary Terms (fair value) (by types, hazard classes, and collection/accumulation points)	- Volume of Municipal Waste Subject to Recycling in Physical Terms (by types, hazard classes, and recycling locations) - Volume of Municipal Waste in Monetary Terms (fair value) (by types, hazard classes, and recycling locations)	- Biomass of Municipal Waste for Disposal (Destruction) in Physical Terms (by disposal locations) - Biomass of Municipal Waste for Disposal (Destruction) in Monetary Terms (fair value) (by disposal locations)
	-Actual Costs Related to the Generation of Municipal Waste	-Actual Costs Related to the Collection and Accumulation of Municipal Waste (by types, hazard classes, and accumulation points)	-Actual Costs Related to the Recycling of Municipal Waste (by types, hazard classes, and recycling locations)	- Actual Costs Related to the Disposal of Municipal Waste (by disposal locations) - Actual Costs Related to the Use of Disposed Biomass from Municipal Waste (by disposal locations)
	-	-Revenue from the Sale of Municipal Waste (by types, hazard classes, and accumulation points)	-Revenue from the Recycling of Municipal Waste (by types, hazard classes, and recycling locations)	-Revenue from the Use of Biomass from Municipal Waste (by disposal locations)
	-	-	-	- Gaseous Resource Produced from Biomass of Municipal Waste in Physical Terms (by disposal locations) - Gaseous Resource Produced from Biomass of Municipal Waste in Monetary Terms (by disposal locations)
	-	-	-	-

# Formation of Performance Indicators for Organizations in the Field of Municipal Waste Management in the Context of Regional Sustainable Development

*D.Pankov et al,*

				<ul style="list-style-type: none"> <li>- Renewable Gaseous Resource in Physical Terms (by disposal locations)</li> <li>- Renewable Gaseous Resource in Monetary Terms (Fair Value) (by disposal locations)</li> </ul>
Strategic Goals of Municipal Waste Management, including:	Reduction of Waste Volume Generated by All Types, Hazard Classes, and Points of Origin	<ul style="list-style-type: none"> <li>- Reduction of Accumulated Municipal Waste Volume by All Types and Accumulation Locations</li> <li>- Increase in the Share of Municipal Waste Sold Externally by All Types and Hazard Classes</li> </ul>	Increase in the Volume of Waste Involved in Secondary Circulation by All Types, Hazard Classes, and Recycling Locations	<ul style="list-style-type: none"> <li>- Reduction of Waste Volume for Landfilling (Disposal) by All Types and Hazard Classes</li> <li>- Increase in the Volume of Landfilled Waste Used for Producing Gaseous Resources by All Types and Hazard Classes</li> </ul>
Environmental	Reduction of Environmental Damage from Waste of Hazard Classes I-IV			
<i>Economic</i>	Savings of Material Resources	<ul style="list-style-type: none"> <li>- Reduction of Actual Costs for Waste Collection and Accumulation</li> <li>- Gaining Additional Benefits from Waste Sales</li> </ul>	<ul style="list-style-type: none"> <li>- Reduction of Actual Costs for Waste Collection and Accumulation</li> <li>- Generation of Additional Benefits from Waste Sale</li> </ul>	<ul style="list-style-type: none"> <li>- Reduction of Environmental Tax</li> <li>- Gaining Economic Benefits from Using Waste for Energy Recovery</li> </ul>
<i>Social</i>	Reduction of Harmful Effects of Generated Waste on Personnel and Society			

Note- own development

After studying the existing approaches to waste management, we have developed a comprehensive system of ecological, economic, and social indicators (coefficients) to assess the effectiveness of municipal waste management within the context of the waste life cycle stages. This system will allow us to determine the degree of achievement of the organization's strategic sustainable development goals (see Table 2).

The proposed methodology is based on a multidimensional comparative analysis. For an overall assessment of the effectiveness of municipal waste management, we suggest calculating a composite index based on the calculation of indices for each type of indicator from Table 2: social, economic, and ecological. When calculating each component of the composite effectiveness index, it is essential first to establish the minimum and maximum values of the indicators (coefficients) based on the standards of the housing and communal services sector, against which actual results will be compared.

The methodology for determining the composite effectiveness index is presented in Table 3.

**Table 3.** - Methodology for Determining the Composite Effectiveness Index for Municipal Waste Management

Analysis Stage	Calculation Formula	Explanation
Calculation of effectiveness indices for municipal waste management for each indicator (coefficient) to convert them to relative values and a unified measurement scale.		
-If the improvement in the dynamics of the analyzed indicator is expressed in its growth.	$I_i = \frac{F_i - \min_i}{\max_i - \min_i}$	Where: <i>I<sub>i</sub></i> – index for a specific indicator (coefficient); <i>F<sub>i</sub></i> – actual value of the indicator (coefficient);
-If the improvement in the analyzed indicator is expressed in its reduction	$I_i = \frac{\max_i - F_i}{\max_i - \min_i}$	<i>mini</i> – minimum value of the indicator (coefficient); <i>maxi</i> – maximum value of the indicator (coefficient).



<p>Calculation of social (<math>I_s</math>), economic (<math>I_e</math>), and environmental (<math>I_{ec}</math>) effectiveness indices for municipal waste management.</p>	$I_x = \sum I_i$	<p>где:  <math>I_i</math>– index for a specific indicator (coefficient) of environmental, economic, or social direction;  <math>I_x</math>– index of environmental (economic, social) effectiveness for municipal waste management.</p>
<p><b>Comparison of social, economic, and environmental effectiveness indices to determine which direction is developing more effectively:</b></p> <p>-If the environmental effectiveness index is higher, then waste management is aimed at implementing the principles of a green economy, even with a low economic effect;</p> <p>-If the economic effectiveness index is higher, the organization pays more attention to the efficient use of resources, etc.</p>		
<p>Calculation of the composite index of effectiveness in municipal waste management (<math>I_y</math>) as a summary indicator using the geometric mean of the social, economic, and environmental effectiveness indices.</p>	$I_y = \sqrt[3]{I_{ec} \times I_e \times I_s}$	<p>где:  <math>I_{ec}</math>– Index of environmental effectiveness in municipal waste management  <math>I_e</math>– Index of economic effectiveness in municipal waste management  <math>I_s</math>- Index of social effectiveness in municipal waste management.</p>

Note- own development

The composite index of effectiveness in municipal waste management will capture the level of efficiency of an organization's waste management practices and can be used to compare the activities of different organizations in the housing and communal services sector, operating under various conditions and performing their tasks differently.

Table 2. – Proposed system of indicators for assessing the effectiveness of municipal waste management in an organization.

Type of indicators	Indicator	Formula	Characteristic
<p><b>1) Indicators of the effectiveness of the organization's functioning in the field of municipal waste management</b></p>			
<p>ENVIRONMENTAL</p>	<p>Indicators of the dynamics of waste generation (recycling, disposal) of municipal solid waste (by types of waste, by hazard classes of waste, by locations of occurrence), in natural terms:                      -Growth coefficient (<math>C_g MW_i</math>)                      -Increase coefficient (<math>\Delta C_g MW_i</math>)</p>	<p><math>C_g MW_i = MW_{i1} / MW_{i0}</math>  <math>\Delta C_g MW_i = C_g MW_i - 1</math>  <math>MW_{i1}</math> – Volume of municipal solid waste in natural terms during the reporting period at the stage of generation (recycling, disposal) (by types of waste, by hazard classes of waste, by locations of occurrence).  <math>MW_{i0}</math> - Volume of municipal solid waste in natural terms during the base period at the stage of generation (recycling, disposal) (by types of waste, by hazard classes of waste, by locations of occurrence).</p>	<p>Reflect changes in the volumes of municipal solid waste in natural terms during the reporting period compared to the base period at various stages of the waste life cycle (generation, recycling, disposal). This is conducted by types of waste, by hazard classes of waste, and by locations of occurrence.                      If waste is accounted for in different natural indicators (pieces, tons, cubic meters, etc.), the analysis of dynamics as a whole across the life cycle stage (location, organization) is only possible in natural mass units.                      An increase in dynamic indicators of municipal solid waste in natural terms at the generation or disposal stage reflects a decrease in the efficiency of waste management processes. Conversely, an increase in dynamic indicators at the recycling stage reflects an improvement</p>

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			in the efficiency of waste management processes.
Indicators of the structure of generation, use, treatment, and disposal of municipal solid waste (by types of waste, hazard classes of waste, locations of occurrence), in natural terms:  -Share of waste type <i>i</i> (hazard class, location of occurrence) ( <i>d MW<sub>i</sub></i> );  -Structural shifts of waste type <i>i</i> (hazard class, location of occurrence) ( $\Delta d MW$ )	$d MW_i = MW_i / MW$ Where:  $MW_i$ - volume of municipal solid waste at the generation (recycling, disposal) stage of type <i>i</i> (hazard class, location of occurrence) in natural terms;  $MW$ - total volume of municipal solid waste at the generation (recycling, disposal) stage in natural terms.  $\Delta d MW = d MW_1 - d MW_0$ Where:  $d MW_1$ - share of waste type <i>i</i> (hazard class, location of occurrence) at the stages of generation (recycling, disposal) in the reporting period;  $d MW_0$ - share of waste type <i>i</i> (hazard class, location of occurrence) at the stages of generation (recycling, disposal) in the base period.	Reflect the structure and changes in the structure of municipal solid waste production in natural terms at various stages of the waste life cycle (generation, recycling, disposal). This is conducted by types of waste, by hazard classes of waste, and by locations of occurrence. An increase in the share of waste of hazard classes I-IV leads to a decrease in the ecological efficiency of municipal waste management.	
Share of utilized (treated, disposed of) municipal solid waste in the total amount of generated municipal solid waste ( <i>d MW<sub>y</sub></i> )	$d MW_y = MW_y / MW$  $MW_y$ - volume of utilized (treated, disposed of) municipal solid waste in natural terms;  $MW$ - volume of generated municipal solid waste in natural terms.	Reflects what portion of municipal solid waste in natural terms is utilized (treated, disposed of) from the total volume of waste. An increase in the share of waste utilization (treatment) indicates an improvement in the ecological efficiency of public utility organizations. Conversely, an increase in the share of waste disposal indicates a decrease in the ecological efficiency of public utility organizations.	
Recovery coefficient of municipal solid waste ( <i>d MW<sub>i y</sub></i> )	$d MW_{i y} = MW_{i y} / MW_{i y-1}$  $MW_{i y}$ - volume of municipal solid waste of type <i>i</i> (hazard class, location of occurrence) at the recycling (utilization) stage in natural terms;  $MW_{i y-1}$ - volume of municipal solid waste of type <i>i</i> (hazard class, location of occurrence) at the generation stage in natural terms.	Reflects what portion of municipal solid waste in natural terms is reused from the total volume of waste. An increase in this indicator indicates an improvement in production ecological efficiency. The value of the indicator should strive towards one.	
Resource provision ( <i>R<sub>g</sub></i> )	$R_g = G / G_d$  $G$ - gaseous resource generated from the biomass of municipal solid waste in natural terms, m <sup>3</sup> ;  $G_d$ - volumes of utilized (extracted) gaseous resource, m <sup>3</sup> .	Resource provision characterizes the ratio of renewable gaseous resource reserves to the volumes of their utilization. Calculating resource provision is necessary for long-term forecasting of the use of available resources. The higher the indicator, the longer the duration for which the gaseous resource reserves should last.	



	<p>Coefficient of energy value of the landfill (Ce)</p>	<p><math>C_e = G / MW_b</math></p> <p>G - gaseous resource generated from the biomass of municipal solid waste in natural terms, m<sup>3</sup>;</p> <p>MW<sub>b</sub> - biomass of municipal solid waste in natural terms, m<sup>3</sup></p>	<p>It reflects the output of gaseous resource in natural terms from 1 m<sup>3</sup> of biomass of municipal solid waste. The higher the indicator, the greater the energy value of the landfill.</p>
ECONOMIC	<p>Indicators of the dynamics of waste generation (recycling, disposal) from production (by types of waste, by hazard classes, by places of origin), in monetary terms:</p> <p>Growth coefficient (Cg MWsi)</p> <p>Increase coefficient (ΔCg MWsi)</p>	<p><math>C_g MW_{ci} = MW_{ci} / MW_{ci0}</math></p> <p><math>\Delta C_g MW_{ci} = C_g MW_{ci} - 1</math></p> <p>MW<sub>si</sub> – volume of waste in monetary terms in the reporting period at the stage of generation (recycling) (by types of waste, by hazard classes, by places of origin).</p> <p>MW<sub>si0</sub> – volume of waste in monetary terms in the baseline period at the stage of generation (recycling) (by types of waste, by hazard classes, by places of origin).</p>	<p>They reflect changes in waste volumes in monetary terms in the reporting period compared to the baseline period at various stages of the waste life cycle (generation, recycling). This is conducted by types of waste, by hazard classes, and by places of origin. The monetary valuation of waste is established at current market prices. At the disposal stage, the biomass of municipal solid waste is valued at fair market value.</p> <p>An increase in waste dynamics indicators in monetary terms at the generation stage reflects a decrease in the efficiency of production processes. An increase in waste dynamics indicators in monetary terms at the recycling stage reflects an improvement in waste management efficiency.</p>
	<p>Indicators of the structure of waste generation, utilization, treatment, and disposal (by types of waste, by hazard classes, by places of origin), in monetary terms:</p> <p>Share of waste in monetary terms of type <i>i</i> (hazard class, place of origin) (d MWsi)</p> <p>Structural shifts of waste of type <i>i</i> (hazard class, place of origin) (Δd W)</p>	<p><math>d MW_{ci} = MW_{ci} / MW_c * 100</math></p> <p>MW<sub>si</sub> - volume of waste in monetary terms at the generation (recycling) stage of type <i>i</i> (hazard class, place of origin).</p> <p>MW<sub>s</sub> - total volume of waste in monetary terms at the generation (recycling) stage.</p> <p><math>\Delta d MW = d MW_1 - d MW_0</math></p> <p>d MW<sub>1</sub> - share of production waste of type <i>i</i> (hazard class, place of origin) at the stages of generation (recycling) in the reporting period.</p> <p>d MW<sub>0</sub> - share of production waste of type <i>i</i> (hazard class, place of origin) at the stages of generation (recycling) in the baseline period.</p>	<p>They reflect the structure and changes in the structure of waste in monetary terms at various stages of the waste life cycle (generation, recycling). This is conducted by types of waste, by hazard classes, and by places of origin.</p> <p>An increase in the share of waste of type <i>i</i> at the generation stage indicates a decrease in the effectiveness of waste reduction policies. An increase in the share of waste of type <i>i</i> at the recycling stage indicates an improvement in the effectiveness of waste reuse policies.</p>
	<p>Share of municipal solid waste in monetary terms (by types of MSW, by hazard classes of MSW, by places of origin) that is being recycled, in the volume of generated MSW (d MWsi y)</p>	<p><math>d W_{ci} y = MW_{ci} y / MW_{ci} y-1</math></p> <p>MW<sub>si y</sub> - volume of municipal solid waste (MSW) in monetary terms of type <i>i</i> (hazard class, place of origin) at the recycling stage of MSW.</p> <p>MW<sub>si y-1</sub> - volume of municipal solid waste (MSW) in monetary terms of type <i>i</i> (hazard class, place of origin) at the generation stage of MSW.</p>	<p>It reflects what portion of municipal solid waste in monetary terms is being reused from the total volume of MSW. An increase in this indicator indicates an improvement in economic efficiency of production. The value of the indicator should aim to approach one.</p>
	<p>Waste intensity (MWEi)</p>	<p><math>MWE_i = MW_{ci} / V_i</math></p> <p>MW<sub>ci</sub> - volume of municipal solid waste in monetary terms at the generation stage of type <i>i</i> (hazard class, place of origin), in rubles.</p>	<p>It reflects how many rubles of municipal solid waste (MSW) are generated per 1 ruble of services provided (or work performed) that resulted in waste. An increase in this indicator signifies a decrease in the economic efficiency</p>

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		<p><math>V_i</math> - volume of product output in monetary terms from which waste of type <math>i</math> (hazard class, place of origin) is generated, in rubles.</p>	of production processes in the housing and utilities sector.
	<p>The share of municipal solid waste (MSW) in material costs (<math>d w_{mi}</math>)</p>	<p><math>d w_{mi} = MW_{ci} / M</math></p> <p><math>W_{si}</math> - volume of municipal solid waste (MSW) in monetary terms at the generation stage of type <math>i</math> (hazard class, place of origin), in rubles.</p> <p><math>M</math> - cost of materials used in the production of goods that generate waste.</p>	It reflects how many rubles of municipal solid waste are generated per 1 ruble of material costs. This indicates the efficiency of material resource usage. The higher the share of MSW, the lower the efficiency of material resource utilization.
	<p>Coefficient of economic value of the landfill (<math>E_c</math>)</p>	<p><math>E_c = G / MW_b</math></p> <p><math>G</math>- renewable gaseous resource in monetary terms.</p> <p><math>W_b</math> - biomass of municipal waste in natural terms, in cubic meters (<math>m^3</math>).</p>	It reflects the output of gaseous resources at market prices from 1 $m^3$ of biomass of municipal waste. The higher the indicator, the greater the economic value of the landfill.
SOCIAL	<p>Harm coefficient for personnel (<math>d w / sw</math>)</p>	<p><math>d w / sw = \sum(k_i * MW_j) / Sw</math></p> <p><math>k_i</math> – concentration of the <math>i</math>-th harmful substance in 1 ton of <math>j</math>-th generated municipal waste of hazard classes I-IV, kg/ton</p> <p><math>MW_j</math> – total mass of <math>j</math>-th generated municipal waste of hazard classes I-IV, tons</p> <p><math>Sw</math> – number of workers directly involved in waste management, persons</p>	It reflects the mass of harmful substances attributed to one worker. An increase in this indicator signifies a rise in harmful impact on the personnel of the enterprise and a decrease in the social efficiency of waste management.
	<p>Coefficient of harmful impact of municipal waste on society (<math>d w/s</math>)</p>	<p><math>d w/s = MW_v / S</math></p> <p><math>MW_v</math> – volume of municipal waste of hazard classes I-IV to be landfilled, tons</p> <p><math>S</math> – population of the city (country, region) according to statistical data, persons</p>	It reflects the volume of harmful municipal waste to be landfilled per resident of the region. An increase in this indicator signifies a rise in harmful impact on society and a decrease in the efficiency of municipal waste utilization.
<b>2) Indicators of management efficiency in waste management</b>			
ENVIRONMENTAL	<p>Percentage of compliance with the plan (norm) for the volume of generated (used, realized, landfilled) municipal waste (<math>PI</math>)</p>	<p><math>PI = MW_{if} / MW_{ipl} * 100 \%</math></p> <p><math>MW_{if}</math> – actual volume of municipal waste in physical terms at the stage of generation (use, realization, landfilling) (by types of municipal waste, by hazard classes, by sources of generation).</p> <p><math>MW_{ipl}</math> – planned (normative) volume of municipal waste in physical terms at the stage of generation (use, realization, landfilling) (by types of municipal waste, by hazard classes, by sources of generation).</p>	Waste management will be effective if the percentage of compliance with the plan does not exceed 100% for the volume of generated and landfilled municipal waste, and is achieved at 100% for the volume of used and realized municipal waste.
	<p>Percentage of compliance with the plan (norm) for the volume of landfill gas extracted (<math>PI_g</math>)</p>	<p><math>PI_g = MW_{gf} / MW_{gpl} * 100 \%</math></p> <p><math>MW_{gf}</math> – actual volume of extracted gaseous resource in physical terms (by sources of generation).</p> <p><math>MW_{(g)pl}</math> – planned (normative) volume of gaseous resource in physical terms (by sources of generation).</p>	Waste management will be effective if the percentage of compliance with the plan is achieved at 100% for the volume of extracted gaseous resource.



	Share of the organization's divisions that have achieved compliance with the established environmental targets and planned indicators for the generation (collection, realization, recycling, landfilling) of municipal waste.	$d_j = N_j / N$ $N_j$ – Number of the organization's divisions that have achieved compliance with the established environmental targets and planned indicators for the j-th stage of the waste management life cycle. $N$ – total number of the organization's divisions where municipal waste is generated.	The value of the indicator in effective management should approach 1.
	Activity coefficient of the organization in managing industrial waste. (d Cm <sub>w</sub> )	$d Cm_w = Cm_w / C$ $Cm_w$ Total costs for managing municipal waste, rub. $C$ – total expenses of the organization for environmental protection, rub	Reflects what portion of environmental expenses is made up of costs for managing municipal waste. An increase in the indicator indicates enhanced activities in waste management.
	Effectiveness of implementing environmental protection measures aimed at preventing pollution from waste. (E)	$E = E_f / C_w$ , $E_f$ – Annual effect from the management of industrial waste production, RUB. $C_w$ – total costs for waste management, RUB.	The higher this indicator, the more effective the environmental protection measures were in preventing (reducing) pollution from municipal waste. The annual economic damage ( $E_f$ ) from managing municipal waste is the change in the amount of the environmental tax influenced by the damage caused. If the environmental tax rate changes, the impact of this factor should be eliminated. If the environmental tax has increased, the effect of waste management is negative. Revenues from recycling municipal solid waste can be determined by the monetary valuation of the products obtained from recycling.
ECONOMIC	Indicators of the dynamics of waste management costs (by types of municipal solid waste, by hazard classes, by stages of management):  -Absolute deviation, RUB ( $\Delta Cm_w$ )  -Growth coefficient ( $C_g Cm_w$ )  -Increase coefficient ( $\Delta C_g Cm_w$ )	$\Delta Cm_w = Cm_w 1 - Cm_w 0$  $C_g Cm_w = Cm_w 1 / Cm_w 0$  $\Delta C_g Cm_w = C_g Cm_w - 1$  $Cm_w 1$ – Total costs for waste management in the reporting period (by types of municipal solid waste, by hazard classes, by stages of management), RUB.  $Cm_w 0$ - total costs for waste management in the base period (by types of municipal solid waste, by hazard classes, by stages of management), RUB.	Reflect changes in the volume of waste management costs in the reporting period compared to the base period. This is conducted overall for the organization, by stages of the municipal solid waste life cycle (collection, recycling, disposal), by types of municipal solid waste, by hazard classes, and by cost locations.  An increase in costs for managing industrial waste at the stages of generation, collection, and disposal indicates a deterioration in the effectiveness of waste management. An increase in costs for managing industrial waste at the recycling stage indicates enhanced activity in the recycling of municipal solid waste.
	Indicators of the structure of waste management costs (by types of municipal solid waste, by hazard classes,	$d Cm_w i = Cm_w i / C$ $Cm_w i$ Total costs for waste management (by types of costs) for the i-th type of municipal	Reflects the structure and changes in the structure of waste management costs. This is conducted overall for the organization, by stages of the municipal solid waste life cycle (collection, recycling, disposal), by types of

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<p>by stages of management):</p> <p>-Share of costs (by types of costs) in total costs for managing industrial waste (<math>d C_{wi}</math>)</p> <p>-Structural shifts in costs for management (by types of costs) (<math>\Delta d C_{wi}</math>)</p>	<p>solid waste (hazard class, stage of management), RUB.</p> <p><math>C_{mw}</math> – total costs for waste management, RUB.</p> <p><math>\Delta d C_{mwi} = d C_{wi1} - d C_{wi0}</math></p> <p><math>d C_{mwi1}</math> – share of costs for managing waste (by types of costs) for the <math>i</math>-th type (hazard class, stage of management) in the reporting period.</p> <p><math>d C_{mwi0}</math> – share of costs for managing waste (by types of costs) for the <math>i</math>-th type (hazard class, stage of management) in the base period.</p>	<p>municipal solid waste, by hazard classes, by locations of generation, and by types of costs.</p>
<p>Specific costs for waste management (by types of municipal solid waste, by hazard classes, by locations of generation) (<math>UC_{mwi}</math>)</p>	<p><math>UC_{mwi} = C_{mwi} / W_i</math></p> <p><math>C_{mwi}</math> – Total costs for managing waste of the <math>i</math>-th type (hazard class, location of generation), RUB.</p> <p><math>MW_i</math> – volume of municipal solid waste in physical terms for the <math>i</math>-th type (hazard class, location of generation) at the generation stage.</p>	<p>Reflects the total costs for waste management allocated to a unit of municipal solid waste in physical or monetary terms for the <math>i</math>-th type (hazard class, location of generation) at the generation stage. An increase in this indicator characterizes a rise in the cost of managing a specific <math>i</math>-th type (hazard class, location of generation) and indicates an increase in the intensity of waste operations.</p>
<p>Cost intensity of municipal solid waste</p>	<p><math>Z_i = C_{mwi} / MW_{ci}</math></p> <p><math>C_{wi}</math> – Total costs for managing waste of the <math>i</math>-th type (hazard class, location of generation), RUB.</p> <p><math>W_{ci}</math> – volume of municipal solid waste in monetary terms for the <math>i</math>-th type (hazard class, location of generation) at the generation stage.</p>	
<p>Turnover coefficient of municipal solid waste, turnovers (<math>Tr_i</math>)</p>	<p><math>Tr_i = R_{vi} / MW_{ci}</math></p> <p><math>R_{vi}</math> – Revenue from the sale of products obtained from the recycling of municipal solid waste of the <math>i</math>-th type (hazard class, location of generation).</p> <p><math>MW_{ci}</math> – volume of municipal solid waste in monetary terms for the <math>i</math>-th type (hazard class, location of generation) at the generation stage.</p>	<p>Reflects the number of turnovers of municipal solid waste subject to recycling. An increase in this indicator indicates an acceleration of waste management processes.</p>
<p>Duration of municipal solid waste turnover, days</p>	<p><math>Td_i = d / Tr_i</math></p> <p><math>d</math> – Duration of the analyzed time period, days</p> <p><math>Tr_i</math> – turnover coefficient of municipal solid waste, turnovers</p>	<p>Reflects the duration of municipal solid waste turnover in the organization. A decrease in this indicator indicates an acceleration of waste management processes.</p>
<p>Profitability of secondary use of municipal solid waste (<math>P_i</math>), %</p>	<p><math>P_i = P_i / C_i</math></p> <p><math>P_i</math> – Profit derived from the processing (use) of the <math>i</math>-th type of municipal solid waste;</p> <p><math>C_i</math> – total actual costs for the processing (use) of the <math>i</math>-th type of municipal solid waste.</p>	<p>Reflects the efficiency of recycling the <math>i</math>-th type of municipal solid waste. The higher the indicator, the more effective it is to subject the <math>i</math>-th type of waste to secondary use. If, as a result of processing, the income from secondary use is lower than the costs of</p>



			processing, then recycling the i-th type of waste is economically unfeasible.
SOCIAL	Percentage of plan execution for the number of activities aimed at protecting personnel from the harmful effects of municipal solid waste.	$Pp = Nf / Np * 100 \%$ Nf - Number of activities actually implemented to protect personnel from the harmful effects of municipal solid waste Np - Number of planned activities aimed at protecting personnel from the harmful effects of municipal solid waste.	Reflects the execution of the plan for activities aimed at protecting personnel from the harmful effects of municipal solid waste. The closer the result is to 100%, the higher the social effectiveness of the waste management system.
	Coefficient of municipal solid waste load per resident in the service area. (d w/s)	$d w/s = W / S$ W – Volume of collected municipal solid waste in physical terms; S – Population in the service area, persons.	Reflects the volume of generated municipal solid waste per resident in the service area.  An increase in this indicator reflects a decrease in the effectiveness of waste reduction strategies among the population.
	Level of staff qualification in waste management.	$d s = SI / Sw$ SI - the number of employees trained in waste management, people Sw – number of employees directly involved in waste management, people	Reflects the proportion of employees who have received training in waste management

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### 3. Conclusion

In summary, it should be noted that due to the annual increase in the generation of solid municipal waste worldwide and the deterioration of the ecological state of ecosystems, the aspects of effective waste management have become particularly relevant. This management must ensure the fulfillment of three fundamental components of sustainable development: environmental sustainability, economic feasibility, and social acceptability.

The result of this study is a developed methodology for assessing the effectiveness of municipal waste management throughout the stages of their life cycle for management purposes, which:

1. Is based on an enhanced information base in the accounting system, allowing for the formulation of data on the fair value of municipal waste and the actual costs of managing it across the stages of waste management: generation, collection (accumulation), recycling, and disposal.
2. Includes a comprehensive system of ecological, economic, and social indicators (coefficients) of organizational performance and management effectiveness in the field of municipal waste management, aligned with the Balanced Scorecard concept and the developmental priorities of organizations.
3. Is linked to the strategic business objectives in the area of waste management, defined by the concept of sustainable economic development.

The waste management system, based on the key performance indicators we developed for organizational functioning and management effectiveness, which align with the strategic goals of sustainable development across the stages of waste management, allows for planning, continuous monitoring, and control over the completion of tasks related to resource conservation, the activation of recycling processes, and the minimization of the harmful impact of waste on the environment and society.

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# The Continuity of Management Marketing and Lean Production in the Era of Industry 5.0

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## Abstract

The emergence of Industry 5.0 brings to the forefront new approaches to the organization of managerial and marketing processes that focus not only on efficiency but also on process optimization and the creation of maximum added value for society and individuals through the development of sustainable business models. Such models are capable of ensuring enterprise flexibility in a dynamic environment, integrating digital technologies with a focus on individual customer needs, and achieving strategic competitiveness. While the previous stage of industrial development - Industry 4.0 - emphasized digitalization, automation, and the integration of cyber-physical systems, the current stage is characterized by a strengthened human-centric orientation, the synergy of innovative technologies, and the promotion of humanistic values. Under these conditions, there arises a need to develop conceptual models that ensure the continuity of the development of managerial and marketing systems and their harmonious integration with the principles of lean production. Thus, the study of the continuity of management marketing in the context of lean production principles within Industry 5.0 represents an important scientific task that enables not only the identification of new opportunities for enterprises but also the determination of economic development prospects, where innovation, sustainability, and human centrality become key priorities.

**Keywords:** continuity, continuous-lean concept, marketing, management, Industry 5.0, lean production, sustainable development, competitiveness, synergy, systematicity, model, synergy, hybrid cognitive management systems, self-renewing business model.

## 1. Introduction

The continuous model of management marketing is based on the idea of continuity as a key principle in the development of managerial and marketing systems. The term *continuum* reflects the dynamic interconnection of all stages and elements of management, production, and marketing, which do not exist in isolation but instead form a unified evolutionary space.

Many scholars from different countries have explored issues of management, marketing, and lean production within the context of Industry 5.0, as reflected in several publications on the topic (**Chaikovska & Shkeda, 2023**; Deinega & Deinega 2021; Nechyporuk & Kocherhina, 2024; Rudan & Pidhaets, 2024; Ryvak 2022; Verkohliadova, 2023; Verkohliadova et al., 2024 and other authors). However, none have yet examined hybrid models that integrate all these components, nor have they analyzed the internal processes occurring within such models. Furthermore, there have been no studies addressing hybridization as a mechanism that enables the integration of managers' intuitive and value-based decisions with formalized analytical algorithms - an approach that enhances the accuracy, speed, and quality of managerial decision-making. A hybrid self-learning enterprise management system represents a new type of managerial architecture in which the organization functions as a living, intelligent organism endowed with the abilities of learning, self-regulation, and evolutionary development.

The modern conditions of economic development, digitalization, and the transition to Industry 5.0 necessitate a revision of traditional approaches to management and marketing. There is a growing need to

form continuous management systems in which marketing, management, and production processes are integrated into a single value creation flow. In this context, the integration of the lean approach (lean production) with modern digital and relational marketing mechanisms creates opportunities for the development of a new type of model - the continuous-lean model.

In management, this is manifested in the transition from linear process control to a system of continuous improvement. In marketing, it is reflected in the evolution from transactional interaction to continuous customer relationships (relationship and lifecycle marketing). Thus, continuity implies the elimination of gaps between the stages of management, marketing, and production, the integration of all enterprise functions into a unified value stream system, and mutual learning and adaptation based on feedback mechanisms.

In management, continuity is manifested through the cyclicity of managerial actions, where planning, implementation, control, and improvement form a closed and self-renewing process. In marketing, this principle is realized through the transition from transactional logic (focused on individual sales) to relational and continuous logic, which entails ongoing interaction with the consumer, the creation of long-term value, and the development of relationships based on trust and knowledge exchange. Continuity thus unites two key dimensions - the managerial (organizational) and the marketing (market-oriented) - into a single evolutionary system that ensures the enterprise's sustainability and adaptability within a dynamic digital environment.

The purpose of this study is to provide a theoretical and methodological foundation and to develop conceptual approaches to ensuring the continuity of management marketing based on the principles of lean production in the context of Industry 5.0. It also aims to identify strategic guidelines that enable the integration of digital technologies, resource efficiency, and human-centric managerial processes for the sustainable development of enterprises. To achieve this goal, the following objectives must be addressed: to substantiate the theoretical and methodological foundations of the synergy between the continuity of management marketing and lean approaches; to develop a model for integrating management marketing and the principles of lean production, oriented toward human centrality and sustainable development; to formulate practical recommendations for applying the obtained results within enterprise strategic management systems under the conditions of Industry 5.0.

The methodological basis of the study is a systemic and continuous approach to the study of management and marketing processes and the principles of lean production, as well as methods of comparative and structural-functional analysis, and content analysis of scientific sources.

The expected results of the study include the development of recommendations for the development of flexible management strategies for enterprises in the era of Industry 5.0 and the substantiation of new models for creating value for customers, taking into account digital transformations.

## **2. The Continuously Lean Concept of Management Marketing (CLMM) in the Era of Industry 5.0**

The research is aimed at developing an integrated scientific concept that combines modern managerial and marketing instruments with lean approaches, thereby ensuring the sustainable development of enterprises in the context of global challenges and the opportunities of Industry 5.0. The outcome is the formulation of scientifically grounded recommendations for the design of flexible management strategies that enhance enterprise competitiveness under dynamic contemporary conditions.

The evolution of managerial and marketing concepts represents the gradual development of theoretical and practical approaches to management and marketing, reflecting changes in socio-economic conditions, technologies, and the value orientations of business. In the early stages (the beginning of the 20th century), management and marketing existed separately: management was based on the principles of F. Taylor's scientific management and A. Fayol's administrative school, both focused on efficiency and process rationalisation, whereas marketing emerged as a tool for sales and product promotion. In the mid-



20th century, significant shifts occurred - a consumer-oriented perspective emerged (F. Kotler, P. Drucker), and marketing gradually evolved into a philosophy of business rather than merely a functional activity. During this period, management developed towards human-centred theories (the human relations school, the behavioural approach), strengthening its interconnection with marketing, as both disciplines began to view the organisation through the prism of human needs - those of the customer and the employee alike. The late 20th and early 21st centuries are characterised by the strengthening of systemic and strategic approaches: management and marketing became integrated within the frameworks of strategic management, total quality management (TQM), and relationship marketing. A growing understanding emerged that the sustainable development of an enterprise requires the coherence of managerial and marketing decisions rather than their isolated functioning.

The contemporary stage (from Industry 4.0 to Industry 5.0) is characterised by a transition towards a digital, hybrid, and continuous model of management and marketing (Nechyporuk & Kocherhina, 2024). This stage is dominated by the principles of innovation, adaptability, value coordination, and human-centrism. Marketing is transforming into a system of relationship and data management (data-driven marketing), while management is evolving into a platform for the integration of technologies, knowledge, and human capital. In the context of digital transformation and global challenges, there arises a growing need for the synergy of managerial and marketing concepts with lean approaches that ensure continuous improvement, waste elimination, and the creation of sustainable value. Thus, modern evolution leads to the formation of a continuous managerial-marketing paradigm, in which the company is viewed as an open, self-developing system where management and marketing operate in unity to ensure flexibility, innovativeness, and sustainable development.

Continuity in management marketing implies the uninterrupted nature of processes - marketing and management are not confined to traditional cycles (analysis → planning → implementation → control) but represent a continuous process of development. It also encompasses the integration of functions, where managerial and marketing instruments interpenetrate, forming a unified system oriented towards customer value; adaptability, whereby changes in the external environment are instantly reflected in managerial and marketing decisions; and evolutionarity, where the organisation is viewed as a living organism that constantly learns, improves, and adapts (Sadchenko et al., 2024). Furthermore, human-centricity signifies that continuity is associated not only with technological but also with humanistic dimensions - the continuous consideration of the interests of both customers and employees.

Industry 5.0 represents a new stage in the evolution of economic systems, in which human-centricity, the integration of digital technologies, and a focus on sustainable development acquire paramount importance. In the context of ongoing transformations in the business environment, the search for effective management models that ensure the continuity of marketing and managerial processes, while harmoniously combining them with lean production principles, becomes particularly relevant. Such a synergetic approach minimises waste, enhances productivity, creates new value for customers, and strengthens the competitive position of enterprises in a dynamic market environment. Under these conditions, it is necessary to view not the individual components of the system, but rather a new system that unites all these elements. Continuity implies seamlessness - the absence of interruptions or segmentation into separate fragments (Ryvak, 2022; Sadchenko, 2025). The term is used to describe processes, phenomena, or smoothly evolving systems without abrupt shifts, whose essence lies in the unbroken connection between different elements or stages. The concept of continuity in management marketing and lean production reflects the integration of managerial and marketing approaches within a unified, self-developing system based on the principles of constancy, adaptability, and value-oriented interaction. In this context, continuity implies not a linear, but an evolutionary - cyclical development of managerial and marketing processes, where each stage of system improvement builds upon the outcomes of the previous one and forms the basis for further advancement.

Under the synergy of management marketing and lean production, continuity is manifested through the constant alignment of an enterprise's strategic objectives with the evolving needs of consumers, as well as through the optimisation of internal processes based on feedback, data, and customer value analysis.

Such a system functions as a dynamic environment in which marketing shapes value orientations and guides managerial decisions, while the principles of lean production ensure their effective implementation through waste elimination, standardisation, and continuous improvement.

The continuous approach is based on the idea that management and system development processes are continuous, interconnected, and dynamic phenomena that cannot be reduced to separate discrete stages. Its main idea is that management and marketing systems should be viewed as constantly evolving structures in which strategic, tactical and operational decisions form a single continuous chain of value creation. The essence of the continuous approach lies in:

continuity of development - management and marketing are not divided into closed cycles, but are integrated into a flow of continuous improvement,

integrity - all elements of the system (technology, resources, personnel, customers) are viewed as parts of a single process that are in constant interaction,

dynamism - the emphasis is on adaptability to changes in the environment and the system's ability to transform quickly,

synergy - the combination of management and marketing practices with the principles of innovation and lean manufacturing creates additional value.

Thus, the continuous approach is oriented towards ensuring the sustainability of development and the uninterrupted nature of managerial processes, which is particularly relevant in the context of Industry 5.0, where the key challenge lies in achieving a balance between digital technologies, resource efficiency, and human-centrism.

Let us consider the distinction between two approaches: the traditional and the continuous. The traditional (discrete) approach is more suitable for stable conditions, where processes are repeated according to predefined scenarios. In contrast, the continuous approach is flexible and highly relevant to the era of Industry 5.0, where dynamism, human-centricity, and constant adaptation to change are of paramount importance (Table 1).

**Table 1.** Comparison of continuous and traditional (discrete) approaches

<b>Criterion</b>	<b>Traditional (discrete) approach</b>	<b>Continuous approach</b>
<b>Nature of processes</b>	Considered as separate stages, completed cycles (plan → implementation → evaluation).	Viewed as a continuous flow, where each stage smoothly transitions into the next, or viewed as a single systemic approach, where all cycles occur simultaneously.
<b>Management model</b>	Sequential, linear, focused on fixed tasks.	Continuous, dynamic, focused on continuous improvement. The model is three-dimensional – spatial-temporal.
<b>Focus of attention</b>	Focused on solving a specific task at a specific point in time.	Based on systemic integrity and continuous process development.
<b>Adaptability</b>	Low: changes are implemented upon completion of the cycle or project.	High: changes are integrated in real time.
<b>Connection between elements</b>	Stages are relatively autonomous and can exist in isolation.	The elements are closely interrelated, with each process influencing the next.
<b>Value creation</b>	Value is generated after the cycle is completed.	Value is created continuously, at every stage of interaction.
<b>Approach to innovation</b>	Innovations are implemented periodically as a result of analysing completed cycles.	Innovations are integrated continuously as part of ongoing development.

The table was compiled by the author.



Thus, the analysis of the evolution of managerial and marketing concepts demonstrates that continuity is a natural outcome of the transition from discrete, cyclical models of management and marketing to an integrated, dynamic, and human-centric system characteristic of the Industry 5.0 era. The continuous model of management marketing and lean production represents a unified system in which the interaction of managerial, production, and marketing mechanisms is based on the idea of continuous development, self-learning, and the sustainable formation of both consumer and organisational value.

The concept of continuity in management, marketing, ecology, and Industry 5.0 reflects a shift from the fragmented management of individual enterprise functions towards an integrated, self-organising system grounded in the principles of interdependence, circularity, and sustainable development. Within this paradigm, each of these elements is viewed not as an autonomous subsystem but as part of a unified continuum of value creation.

Continuity in management is manifested in the system's ability to adapt, self-renew, and continuously improve managerial processes. Within this model, management is transformed from a function of control into a mechanism for maintaining balance between economic efficiency, innovativeness, and socio-environmental responsibility. Continuity in marketing is expressed through its transformation from a tool of sales and communication into a coordinator of value flows between the enterprise, the consumer, and the wider ecosystem. In the context of Industry 5.0, marketing evolves into a cognitive system of interconnections that integrates human needs, innovative solutions, and the principles of sustainable development.

Continuity in ecology implies a shift from reactive environmental management towards a proactive model in which ecological principles are integrated into corporate strategy, production processes, and organisational culture. The ecological continuum thus becomes a key driver of long-term competitiveness and innovative development.

Continuity in ecology reflects the evolution of managerial and strategic approaches from fragmented responses to environmental challenges towards systemic and integrated sustainable development management (Bieloborodova, 2020). It implies a shift from reactive environmental management, which primarily focuses on mitigating the consequences of negative environmental impacts, to a proactive model aimed at preventing ecological risks, minimising resource losses, and fostering ecosystem responsibility at all levels of organisational operations.

The proactive model of environmental management represents a modern strategic approach based on the principles of foresight, prevention, and the systematic integration of ecological considerations into enterprise management processes. Unlike the reactive model, where actions are predominantly directed at remedying the consequences of environmental violations, the proactive model emphasises anticipatory management of ecological risks and the cultivation of an environmentally sustainable organisational culture.

At its core, it is based on the principle of prevention, which involves not reacting to events that have already occurred, but analysing potential threats and opportunities at the early stages of decision-making. This requires a shift from an administrative-regulatory approach to a systemic-innovative paradigm, in which environmental objectives are integrated into the enterprise's development strategy, production processes, and marketing activities.

The key characteristics of the proactive model are:

- Integration of environmental criteria into strategic planning and investment decisions, ensuring the long-term sustainability of the enterprise.
- Application of ecological innovations and clean technologies, aimed at minimising environmental impact and optimising resource use.
- Development of a corporate environmental culture, focused on raising employee awareness and fostering ecological responsibility at all levels of management.
- Use of monitoring tools, ecological-economic assessments, and environmental audits, which

provide feedback and support the continuous improvement of processes.

- Formation of partnership ecosystems, involving engagement with stakeholders - including government bodies, local communities, consumers, and suppliers - to achieve a synergistic effect in sustainable development.

The proactive model of environmental management forms the foundation of continuous ecological governance, in which ecology is not treated as a separate function but as a continuous dimension of an enterprise's strategic development. Consequently, environmental policy becomes a source of competitive advantage, contributing to the growth of reputational capital, innovative activity, and the economic efficiency of the organisation.

Reputational capital is an intangible asset of the organisation, built on public trust, a positive image, ethical standards, and sustainable relationships with stakeholders. In contemporary conditions, it becomes a strategic resource that determines an enterprise's competitiveness as significantly as its material, financial, or innovative resources.

Within the context of proactive environmental management, reputational capital emerges as the outcome of systematic and consistent enterprise activity in the areas of environmental responsibility, sustainable development, and transparency of corporate practices. It reflects not only the external perception of the company but also its internal capacity to maintain a balance between economic efficiency and its socio-environmental mission.

The formation of reputational capital is based on several key principles, such as transparency and accountability, which involve informing the public and stakeholders about the enterprise's objectives, outcomes, and environmental impacts. It also relies on ethical leadership and a corporate culture that fosters values oriented towards environmental justice, human capital, and sustainable development. A critical aspect is social partnership, understood as the establishment of long-term, trust-based relationships with key stakeholders, including consumers, employees, investors, and local communities. Innovativeness and environmental efficiency are essential in the implementation of advanced technologies that reduce environmental impact, thereby enhancing public recognition and trust. Finally, a sustainable development communication strategy constitutes another principle, integrating ecological achievements and social responsibility within corporate communications, marketing, and branding systems.

Reputational capital performs a systemic function, linking the economic, social, and environmental outcomes of an enterprise's activities and transforming them into a symbol of trust and resilience. A well-developed reputational capital reduces reputational risks, ensures the loyalty of consumers and investors, facilitates the attraction of highly qualified professionals, and eases access to financial and innovative resources (Baliun, & Fiialka, 2018).

Within the context of the future Industry 5.0, reputational capital assumes a new significance - it becomes an indicator of an organisation's maturity and its capacity to operate within a continuous model, where environmental responsibility, digital transparency, and ethical interactions form the foundation of long-term sustainability.

Thus, reputational capital is not merely a social or image-related asset but a multi-layered system of trust and recognition, shaped at the intersection of environmental, managerial, and marketing strategies. Its accumulation and maintenance within the framework of proactive environmental management become one of the key factors in achieving strategic success and sustainable enterprise development.

Thus, the proactive model of environmental management represents an evolutionary stage in the development of environmentally oriented management systems, enabling enterprises to move from merely responding to external requirements towards the conscious creation of sustainable value for the economy, society, and the natural environment.

Within the proactive approach, environmental management transforms from an auxiliary function



into a strategic element of corporate governance, influencing managerial decision-making, innovation policy, production processes, and corporate culture. This model involves the implementation of principles such as the circular economy, product life-cycle management, ecological design, and socio-environmental partnerships, facilitating the transition to self-sustaining, low-carbon, and socially oriented business systems.

Therefore, continuity in ecology is expressed through the gradual and uninterrupted development of organisational environmental consciousness - from mere compliance with regulatory requirements to the establishment of sustainable behavioural models, where environmental responsibility becomes not an external obligation but an internal principle of development and a source of competitive advantage for the enterprise.

The future Industry 5.0 functions as a meta-continuum, uniting physical, digital, and biosocial systems. It provides a platform for the synergy of human-centric technologies, ethical artificial intelligence, the circular economy, and adaptive management. The alignment of these continuums creates a unified, self-learning system for strategic development, where the primary goal is not merely enhancing efficiency or profit, but generating sustainable and harmonious value for individuals, society, and the natural environment.

Thus, continuity serves as a methodological principle for the formation of innovative socio-techno-economic systems in the era of Industry 5.0, ensuring their integrity, adaptability, and resilience.

The continuous model of management marketing represents a conceptual system grounded in the idea of process continuity and the ongoing improvement of interactions between management, marketing, and production. It entails the synchronisation of managerial and market decisions within a unified value space. Continuity here is understood as the organisation's capacity to maintain a balance between efficiency and adaptability, with lean principles serving as the operational core of the model.

### **3. The Synergy of Continuity in Management Marketing and Lean Approaches: Theoretical and Methodological Foundations**

The theoretical and methodological foundations of the synergy between continuity in management marketing and lean approaches are based on the integration of systemic, process-oriented, value-focused, and evolutionary approaches to organisational development. Their interconnection forms a conceptual basis for understanding the enterprise as an open, self-organising, and continuously evolving system, in which marketing and managerial processes are inextricably linked with production efficiency and the creation of sustainable value for the consumer.

Firstly, the systemic approach provides a holistic perception of the organisation, where management, marketing, and production function as interdependent subsystems. Within the framework of continuity synergy, it allows management and marketing to be viewed as continuously interacting elements of a unified cycle of value creation, distribution, and enhancement.

Secondly, the process-oriented approach provides the foundation for continuity - the continuous improvement of business processes. The lean approach (lean production) offers a methodology for the practical implementation of this principle through waste elimination, process standardisation, the use of Kaizen tools, and ongoing feedback. This creates a managed continuous environment in which each process is oriented towards enhancing customer value and organisational efficiency.

Thirdly, the value-oriented approach unites the marketing and production components into a single logic of creating consumer and social value. Within this synergy, marketing acts as a strategic moderator of change, defining market directions and development priorities, while the lean system ensures the operational realisation of these priorities in management and production practices.

Finally, evolutionary and continuous approaches provide a methodological framework for

describing processes of self-development and system adaptation. Continuity is manifested in the capacity of management marketing and lean systems to generate cycles of continuous learning, accumulation of organisational knowledge, and the transformation of experience into innovative managerial and marketing solutions.

The synergy between continuity in management marketing and lean approaches is based on the integration of theoretical and methodological principles of systemness, continuity, value orientation, and self-renewal. This integration ensures the sustainable development of the organisation and the formation of a dynamically balanced management model capable of adapting to changes in the external environment without compromising internal efficiency.

In the era of Industry 5.0, the combination of continuity in management marketing with lean production principles becomes particularly relevant, as it ensures the uninterrupted development of managerial processes, minimises waste, and creates value for both customers and society at large. To achieve these objectives, systemic and continuous approaches were employed, alongside comparative and structural–functional analysis methods, as well as elements of the case-study method. The outcome is the formulation of scientifically grounded recommendations for the development of flexible, human-centric management strategies that enhance enterprise competitiveness under the dynamic conditions of Industry 5.0.

The concept of continuity in management, marketing, ecology, and Industry 5.0 reflects the transition from fragmented management of individual company functions to an integrated, self-organising system based on the principles of interdependence, circularity, and sustainable development. Within this paradigm, each of these elements - management, marketing, ecology, and the technological evolution of Industry 5.0 - is regarded not as an autonomous subsystem, but as a component of a unified continuum of value creation. The continuous model of management marketing in the context of a lean approach: establishes a foundation for the integration of production and marketing strategies; ensures systemic feedback between the market and internal processes; facilitates the formation of a sustainable innovation cycle grounded in the real needs of customers; and supports the principles of human-centric management in the era of Industry 5.0, where the human being becomes the key link in the value continuum.

Continuous management marketing assumes that: management is conceived as an uninterrupted cycle of planning, implementation, evaluation, and improvement; marketing becomes a continuous process of creating and delivering value; and communications, innovation, and production processes are integrated into a seamless system of value flow.

At the practical level, continuity is realised through: digitalisation of processes (continuous collection of data on consumers and production); sustainable development (maintaining long-term relationships, minimising losses, and balancing interests); and staff training in a “Kaizen” mode — continuous improvement of not just individual operations, but the entire system.

The lean approach (lean production) is based on five fundamental principles (Womack, & Jones, 2016): defining value for the customer, identifying the value stream, eliminating waste and inefficiencies, ensuring continuous flow, and system improvement. Lean provides structural discipline and flow-based organisation. Their synergy creates a continuously lean system of management and marketing, in which marketing is not an external function but an integral part of the production value stream.

The continuous model of management marketing is naturally embedded within these principles, enhancing them with a marketing dimension. It emphasises not only process optimisation but also the continuous creation and delivery of value to the customer. In this way, continuity ensures the longevity and sustainability of organisational changes.

#### **4. The Essence of the Value Stream System in the Continuously Lean Concept of Management**



**Marketing (CLCMM)**

The value stream system in the Continuously Lean Concept of Management Marketing (CLCM) represents a continuous process of creating, delivering, and reproducing value for all participants in the business ecosystem – from suppliers to the end consumer – within a unified strategic and operational cycle. The core idea of the value stream system is that value is generated not by individual departments or functions, but through a continuous flow of interactions between marketing, production, management, and the customer. Thus, the value stream system is a managed network of interrelated processes that ensures a constant flow of information, resources, and decisions aimed at creating consumer, social, and managerial value with minimal losses and maximum adaptability.

The construction of the value stream system within the continuously lean concept of management marketing is based on the synthesis of three approaches (Table 2).

**Table 2.** The value stream system of the continuous-lean concept of management-marketing

Approach	Essence	Role in a continuous lean system
Lean approach	Minimisation of losses (temporal, spatial, material, cognitive)	Forms lean process architecture
Continuous management	Principle of continuity and adaptive development	Ensures continuous updating of the value stream
Marketing management	Focus on the customer and market dynamics	Defines value creation directions and strategic priorities

The table was compiled by the author.

The combination of these approaches enables a shift from fragmented actions to end-to-end management-marketing flows, where each element operates not merely to perform a function, but to strengthen the overall value system.

The architecture of the value stream system within the continuously lean concept of management marketing can be viewed as a dynamic model with four levels of continuity:

1. Information-analytical flow is formed based on customer data, market trends, and KPIs of production and managerial processes, ensuring transparency in decision-making and digital organization of all elements in the chain.
2. Production–operational flow links production capacities with marketing requirements, implementing Just-in-Time, Kaizen, and Kanban principles, while 32rganizati muda (waste).
3. Marketing–communication flow is responsible for market feedback, segmentation, positioning, and the integration of the customer into the value creation process (through co-creation, CRM, and digital platforms).
4. Value–management flow provides strategic management based on value-oriented principles (Value-Based Management, ESG, Human-Centred approaches) and ensures the system’s sustainability and integrity.

Continuity is manifested in the continuous evolution of flows, where each new cycle is not a repetition but a development based on accumulated experience. Unlike the classical linear cycle of “production – sales – feedback,” the CLCM implements a closed, self-renewing loop: Information – Analysis – Value Design – Implementation – Monitoring – Optimisation – Value Regeneration.

This loop has no defined beginning or end, allowing the system to function like a living organism that learns and self-regulates in response to changes in the external environment.

The main characteristics of the value stream system in the continuously lean concept of management marketing are presented in Table 3.

**Table 3.** Characteristics of the continuous value stream system of the continuous lean concept of management marketing

Characteristics	Contents
<b>Integrity</b>	All management and marketing functions are combined into a single value creation stream.
<b>Digitalisation</b>	Big Data, IoT, and AI tools are used to manage streams in real time.
<b>Adaptability</b>	Flows respond flexibly to market fluctuations and changes in consumer 33rganiza.
<b>Human-centredness</b>	Value is considered not only as an economic category, but also as a social, emotional and cultural one.
<b>Sustainability</b>	Flows are built with ESG principles in mind, ensuring environmental and social responsibility.

The table was compiled by the author.

The construction of a value stream system enables organisations to eliminate “gaps” between strategic marketing and operational management, enhance the speed of decision-making and the quality of the customer experience, reduce transactional and communication costs, and create a platform for continuous innovation and sustainable growth.

In the continuously lean concept of management marketing, the value stream system is not merely a managerial tool, but a new philosophy of business 33rganization, founded on the principles of:

- continuous improvement,
- end-to-end process integration,
- digital transparency, and
- co-creation of value with the customer.

It allows a shift from traditional functional management to a continuous-synergistic model of development, where marketing and management merge into a unified flow of sustainable innovations and human values.

The structure of the continuously lean concept of management marketing consists of four interrelated blocks (Table 4).

**Table 4.** The Structure of the Continuously Lean Concept of Management Marketing

Block	Contents	Lean analogue
<b>Continuum of value</b>	Continuous creation, delivery and renewal of value for consumers, taking into account environmental considerations	Value definition
<b>Continuum of processes</b>	Continuous integration of management, marketing and production (lean production) processes	Value creation flow
<b>Continuum of knowledge and learning</b>	Cycle of knowledge accumulation and transfer within the organisation, region and country	Kaizen, on-the-job training
<b>Continuum of interactions</b>	Network of sustainable relationships between staff, customers, partners (and government)	Pull system, employee involvement



The table was compiled by the author.

These continuums interpenetrate to create a hybrid, self-learning enterprise management system, in which marketing is not merely a sales function but acts as a coordinator of value creation at all stages.

The interpenetration of the continuums forms a hybrid, self-learning enterprise management system. Its “hybridity” lies in the integration of human (cognitive, communicative) and digital (analytical, algorithmic) components of management, with managerial decisions made not only top-down but also based on data, feedback, and customer behavioural signals. The organisation is capable of learning from its own experience - identifying patterns, optimising flows, and adjusting strategies without external intervention. This establishes a continuously learning ecosystem, where each new action builds upon accumulated knowledge, transforming the organisation into a learning entity, akin to P. Senge’s concept of the learning organization (Senge, 2012).

In the context of digital transformation and increasing external turbulence, modern enterprises require management models capable not only of adaptation but also of sustainable self-development based on accumulated experience and data. One of the promising forms of evolving managerial thinking is a hybrid, self-learning enterprise management system, which represents a synthetic model combining technological, cognitive, and organisational–marketing principles.

The essence of this system lies in the integration of human and machine intelligence, digital analytics, machine learning algorithms, and management practices drawn from lean and adaptive management. Its hybridity manifests in the combination of diverse knowledge sources — the intuitive and value-based decisions of humans and the formalised data generated by artificial intelligence systems. This integration produces a synergistic effect: analytical models provide the foundation for rational predictive logic, while human intelligence contributes elements of creativity, intuition, strategic vision, and socio-ethical responsibility.

The self-learning character of the system is reflected in its capacity to continuously accumulate, analyse, and reinterpret data from both the internal and external environment of the enterprise. This enables the system to identify new patterns, forecast shifts in market trends, and adapt managerial strategies in real time. Consequently, the enterprise transforms into a dynamic intellectual ecosystem, operating on principles of self-regulation, self-reflection, and continuous improvement.

The architecture of the hybrid, self-learning management system is built on the principle of a closed cognitive-analytical loop. At its sensor level, information is collected from production, marketing, and social channels through digital platforms, IoT technologies, and corporate databases. The analytical level processes this data using artificial intelligence, Big Data, and machine learning methods, enabling the forecasting of key performance indicators and the simulation of development scenarios. The cognitive level focuses on interpreting the results, identifying meaningful patterns, and generating decisions that account for both economic and socio-value aspects of the enterprise’s activities. The final reflective level ensures the system’s self-learning by analysing its own actions, deviations, and achieved results, allowing managerial mechanisms to be adjusted without external intervention.

In this model, marketing does not function as a mere sales-support activity but serves as a coordinator of value creation across all stages of the enterprise’s operations. It becomes the link between external stakeholders and internal management processes, ensuring continuous feedback and supporting organisational learning. Management, in turn, acquires a cognitive–adaptive character, transitioning from directive models to soft-regulation systems based on data, scenarios, and value-oriented principles.

The implementation of a hybrid, self-learning management system enables the development of a new level of corporate resilience, founded on intellectual flexibility, forecasting capability, and rapid reactive reconfiguration. It facilitates the reduction of managerial losses, the optimisation of value creation flows, and the enhancement of the enterprise’s innovative and reputational capital. Consequently, the

organisation begins to operate as a living intellectual organism, capable not only of adapting to environmental changes but also of actively shaping its own developmental trajectories.

Traditionally, marketing has been viewed as a sales function, serving primarily as a tool for stimulating demand and promoting products. In the continuously lean model, this paradigm is transformed: marketing becomes a coordinator of value creation rather than the final link in the distribution chain. This implies that marketing participates in the design of products or services from the outset, shaping the value proposition in collaboration with production and R&D, and bridging strategic and operational management by ensuring a continuous flow of market information and customer data.

Marketing coordinates internal processes so that each stage - planning, procurement, production, logistics, and service - aligns with the customer’s value logic. It also acts as a catalyst for innovation, as the analysis of customer needs and feedback identifies new directions for development. Thus, within this system, marketing functions as the intellectual hub of the organisation, integrating market perception, digital analytics, and managerial coordination.

Table 5 presents, in logical sequence, the chain of “continuums - self-learning - value coordination.”

**Table 5.** The Chain of “Continuums - Self-Learning - Value Coordination”

Stage	Contents	Result
<b>Continuums</b>	Continuous flows of data, processes and interactions (these can be circular or spiral)	A dynamic ecosystem is formed.
<b>Interpenetration</b>	Integration of marketing, management and production functions	The system becomes holistic and synergistic.
<b>Self-learning</b>	Analysis of feedback, digital data and KPIs	Adaptability and accuracy of decisions increase.
<b>Value coordination (the role of marketing)</b>	Marketing unites participants in the process around value-based guidelines	A sustainable development model based on customers and innovation emerges.

The table was compiled by the author.

The company ceases to be a mechanical system in which the marketing department merely sells the output of the production process. Instead, it becomes a continuous, self-learning value creation system, where marketing functions as the brain and sensory system, perceiving and analysing environmental signals; management acts as the nervous system, coordinating actions; and production serves as the executive system, materialising value. All components operate not in a linear sequence but through constant dialogue and feedback.

### **5. The Virtual Continuum Model of Management Marketing in the Context of the Lean Approach.**

The model is built upon four interrelated continua: the value continuum, the process continuum, the knowledge continuum, and the interaction continuum. Each of these is measured through digital indicators (KPIs) that are recorded in real time. Lean production is based on five key principles: defining value, mapping the value stream, eliminating waste, ensuring continuous flow, and pursuing ongoing improvement (Kaizen). The continuum model of management marketing organically complements the lean philosophy by ensuring the strategic continuity of these processes. The following visualisation presents the evolution of managerial and marketing concepts, highlighting their key characteristics at each stage (Table 6).

**Table 6.** Virtual Continuous Model

Continuum	Digital indicators	Current value	Dynamics over 12 months	Lean interpretation



<b>Value-based</b>	Customer Satisfaction Index (CSI), Value Product Index (VPI)	86% / 1.25	+7%	Determining value for the customer
<b>Process-based</b>	Cycle Time from Idea to Implementation (Time-to-Market), Waste Rate	48 дней / 3.8%	-12%	Flow optimisation
<b>Knowledge-based</b>	Employee Learning Index, Share of Innovative Proposals	0.82 / 16%	+10%	Kaizen and continuous improvement
<b>Interactions</b>	Employee Engagement Rate, Customer Retention Rate	79% / 91%	+8%	Pull system and interaction

The table was compiled by the author.

The development of a virtual model will enable the visualisation and digitalisation of the process of continuous interaction. It is constructed on the basis of four interrelated continua: the value continuum, the process continuum, the knowledge continuum, and the interaction continuum. Each of them has its own key performance indicators (KPIs) that make it possible to monitor dynamics in real time and adjust managerial decisions accordingly. Examples include indicators such as a reduction in resource waste (-12%), an increase in customer satisfaction (+15%), a decrease in process cycle time (-18%), and a rise in employee engagement (+10%). These data illustrate the effectiveness of integrating the lean approach into the management marketing system.

Each continuum mutually reinforces the others, forming a unified continuum of value. In such a system, marketing ceases to be an isolated function and instead becomes a coordinating axis linking the enterprise’s internal processes with the external market environment. Continuity in this context ensures strategic resilience, adaptability, and the enterprise’s capacity for self-learning.

The resulting integral Continuity Coefficient Indicator (CCI) = 0.87 (on a scale from 0 to 1; 0.8-0.9 indicates a high level of managerial and marketing continuity), which reflects a strong alignment between management and marketing processes.

The digital continuum operates as a system of continuous data exchange between management, production, and marketing, and is based on the interconnection of modular components.

**Table 7.** The digital continuum as a system of continuous data exchange

Stage	Digital tools	Purpose
<b>Management</b>	ERP, Lean KPI Dashboard	Planning and managing flows, monitoring efficiency
<b>Marketing</b>	CRM, Digital Twin Customer	Value analysis, demand forecasting, behavioural analytics
<b>Production</b>	MES, IoT Sensors	Loss monitoring, resource optimisation
<b>Analytics and feedback</b>	AI module, BI panel	Continuous improvement and adaptation of processes

The table was compiled by the author.

Thus, the virtual model transforms continuity into a measurable and manageable category, enabling the implementation of the concept of a “smart” enterprise capable of adaptation and self-learning.

The analysis of the functioning of the virtual continuum model demonstrates that the integration of managerial and marketing functions increased the overall efficiency of interaction by 23%, while the time

required for managerial decision-making decreased by 19%. Moreover, the speed of bringing innovations to market rose by 15%, which is expected to enhance the company's competitiveness. The customer satisfaction index increased from 80% to 86%, and the level of operational losses declined from 5.1% to 3.8%.

The virtual model of continuity is implemented through digital management tools (ERP, CRM, IoT, AI). These systems ensure data transparency, departmental interconnectivity, and continuous organisational self-learning. Thus, the enterprise evolves into a dynamic, adaptive system capable of predicting and preventing inefficiencies while maintaining a focus on human and societal value. This aligns with the philosophy of Industry 5.0, where technological innovation is combined with human-centred management principles.

The results indicate that the continuum-lean system generates synergy between process efficiency and market adaptability, ensuring a balance between internal improvement and external value creation.

## **6. An Innovative Paradigm of Management Marketing and Lean Approaches in the Context of Digital Transformation**

Digital transformation has radically altered the nature of management and marketing.

Traditional linear models, in which management directed and marketing merely supported sales, are being replaced by integrated, self-organising systems where the key factors are:

- the speed of response to environmental changes,
- co-creation of value with customers, and
- continuous improvement of internal processes.

On this basis, an innovative paradigm of management marketing emerges - one that integrates the principles of the lean approach, digital technologies, and the human-centred orientation of business.

The modern era of digital transformation has necessitated a rethinking of the role of innovation and marketing within the enterprise management system. Traditional models of management and marketing, focused on efficiency, scale, and standardisation, are gradually losing relevance in an environment characterised by high volatility, technological convergence, and increasing customer expectations. Under these conditions, a new managerial paradigm is emerging - innovative management marketing - which is based on the integration of lean principles with digital and cognitive technologies.

The essence of innovative management marketing lies in the transition from a functional perception of marketing as a promotional tool to its understanding as the central coordinator of innovation processes and value streams within the enterprise system. Marketing ceases to function merely as an external interface with the consumer and becomes the core of strategic innovation management, ensuring synchronisation between technological, production, and communication contours. In this context, innovative management marketing creates an environment where value generation is oriented not only towards meeting market demand but also towards ensuring long-term sustainability, environmental responsibility, and social well-being.

Integration with the lean approach (lean management) complements innovation processes with principles of waste minimisation, optimisation of value creation flows, and employee involvement in continuous improvement. Lean thinking functions not as a constraint on innovation, but as a systemic filter of rationality that directs innovative initiatives towards maximum effectiveness with minimal resource expenditure. In the context of digitalisation, lean methodology is gaining a new dimension, evolving into a digitally lean management model, in which artificial intelligence technologies, big data analytics, digital twins, and automated monitoring systems play a central role.



The synergy between the innovative and lean approaches is manifested in the creation of continuum-hybrid management systems, in which innovation becomes a continuous process embedded within the organisational structure. This enables the formation of a self-learning and adaptive corporate ecosystem capable of responding swiftly to changes in the external environment, sustaining long-term development, and simultaneously reducing internal costs. Thus, innovative management marketing, in combination with lean principles, transforms the enterprise into a flexible, proactive, and intelligently managed system.

In this context, digital transformation acts as a catalyst for the evolution of managerial and marketing tools, enabling the implementation of hybrid decision-making models. End-to-end digitalisation of processes ensures transparency of data flows, facilitating a shift towards data-driven marketing, in which innovations are shaped not intuitively, but on the basis of analytical forecasts and scenario modelling. This creates the conditions for the development of smart production–marketing chains, where each stage - from product development to customer service - is optimised in terms of value and efficiency.

Looking ahead, the development of innovative management marketing and lean approaches is expected to progress along several key directions:

- Formation of hybrid cognitive management systems. These systems will be based on artificial intelligence, machine learning, and neuroanalytics, which will not only analyse but also interpret consumer behaviour, automatically proposing innovative solutions.
- Development of digitally lean ecosystems. Enterprises will operate as interconnected networks of digital cores, where lean principles ensure sustainability, while digital technologies provide scalability and rapid adaptability.

Implementation of ESG and sustainability approaches within an innovative marketing strategy allows for the integration of economic performance with social and environmental responsibility into a unified value system, thereby strengthening the enterprise’s reputational capital.

The transition from reactive to proactive innovation management becomes possible. Leveraging predictive analytics and cognitive algorithms, the system can identify potential growth opportunities even before market demand emerges.

Corporate culture evolves towards self-learning and open innovation. Employees become active participants in improvement processes, contributing to the accumulation of collective intellectual capital and the establishment of a culture of continuous enhancement.

Thus, innovative management marketing and lean approaches, within the context of digital transformation, establish a new type of managerial philosophy, in which innovation ceases to be a series of isolated creative acts and becomes a continuous process of value creation. Digital technologies function not merely as tools of automation but as instruments for expanding the organisation’s cognitive capabilities. The result is a self-renewing business model in which humans, technologies, and data interact, and management is transformed from a directive function into an intellectually and humanistically oriented process, focused on sustainability, efficiency, and development.

## 7. Conclusion

The contemporary development of managerial and marketing concepts is characterised by a shift from linear and fragmented models to systemic and continuous ones, reflecting the continuity and interconnectivity of value creation processes. Continuity functions as a methodological principle, embodying the idea of constant movement, renewal, and self-development within organisational and management systems.

The continuum model of management marketing embodies the principle of continuous improvement and ensures the holistic integration of managerial, marketing, and production processes. The integration of the lean approach into the continuum model has enabled the alignment of operational lean

principles with marketing mechanisms for value creation. The virtual model facilitates the digitalisation of continuity, allowing the effectiveness and dynamics of processes to be measured through KPIs and analytical indices. The implementation of a continuum–lean system supports the formation of a self-learning organisation oriented towards sustainable development, innovation, and human-centred management.

The continuum model of management marketing in the context of the lean approach represents an integrated management concept focused on continuous improvement and the co-creation of value by all participants within the organisational continuum. It combines the managerial logic of Lean (waste elimination, flow optimisation) with the marketing logic of continuity (ongoing interaction and consumer-driven adaptation), creating a new type of organisational thinking - continuum-lean management marketing - in which the enterprise functions as a living organism that is continuously learning, adapting, and value-oriented.

Conceptually, the hybrid self-learning management system represents a shift from traditional reactive management to a proactive model, in which learning, analysis, and development are integrated into a single continuum. This enables the transition from static structures to dynamic ones, from managed systems to self-learning systems, reflecting the broader trend in the evolution of contemporary management towards a cognitive, adaptive, and digitally humanistic paradigm.

The continuum model of management marketing systematises the interconnection between management, marketing, and production, facilitating the move from fragmented solutions to a holistic value creation system. The incorporation of lean principles within this model provides a strategic foundation for continuous improvement and sustainable development. The virtual model enables the digitalisation of continuity, transforming it from a conceptual idea into a measurable managerial category. The use of digital tools ensures monitoring and system adaptability, supporting the implementation of human-centred management. The practical value of these models lies in their applicability for diagnosing system maturity, developing Lean Dashboards, and formulating sustainable development strategies.

Thus, the development of continuum and virtual models of management marketing in the context of the lean approach has enabled the integration of lean production philosophy into the marketing management system, establishing a cohesive architecture for the enterprise's sustainable development. These models demonstrate that digitalisation and continuity are mutually reinforcing mechanisms for strategic business transformation. In the context of Industry 5.0, continuum-lean management marketing emerges as a new paradigm of managerial thinking, focused on the synergy of technology, human capital, and the value created.



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# Econometric analysis of factors affecting the financial stability of joint-stock companies in the context of digitalization

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## Abstract.

This study conducts an econometric analysis of the factors influencing the financial stability of joint-stock companies in Uzbekistan under digitalization conditions, focusing on key indicators such as Return on Assets (ROA) and Return on Equity (ROE). Utilizing panel data from three major joint-stock companies “Uzagrolizing” “Khovrenko Samarqand Vino” and “Shahrisabz Vino” over the period 2015–2024, the study employs Pooled OLS, Fixed Effects Model (FEM), and Random Effects Model (REM) to examine the impact of digitalization-related variables, including IT investments, digital infrastructure, online sales volume, and financial leverage metrics, on financial stability. The results, based on the REM model, reveal that digitalization significantly enhances financial performance, with a 1% increase in IT investments boosting ROA by 2.46% and ROE by 2.03%, and digital infrastructure increasing ROA by 1.372% and ROE by 0.8%. Online sales volume shows a weaker but positive effect, while high debt ratios negatively impact both ROA (-0.479) and ROE (-0.651), highlighting the importance of prudent debt management. The models explain approximately 73.9% of ROA and 73.3% of ROE variations, indicating strong explanatory power. The findings underscore the pivotal role of digital transformation in strengthening financial stability and provide actionable insights for joint-stock companies to optimize digital investments and financial structures to enhance long-term competitiveness and resilience in a rapidly digitalizing economy.

**Keywords.** Digital Transformation, Joint-Stock Companies, Financial Stability, Return on Assets (ROA), Return on Equity (ROE), IT Investments, Digital Infrastructure, Online Sales, Financial Leverage, Econometric Analysis, Panel Data, Uzbekistan, Debt Management, Random Effects Model (REM), Operational Efficiency

## 1. Introduction

In today’s rapidly digitalizing environment, the financial stability of joint-stock companies has become more critical than ever. The swift advancement of information and communication technologies has fundamentally transformed the operational methods of enterprises. While digital transformation processes open new opportunities, they also contribute to the increasing complexity of factors affecting the financial condition of joint-stock companies. Financial stability, in turn, is a key factor in ensuring the long-term development of companies, maintaining investor confidence, and fostering economic growth. Therefore, identifying which factors most significantly influence the financial stability of joint-stock companies under digitalization conditions, analyzing their interrelationships, and developing effective management decisions based on these insights hold significant scientific and practical importance.

This study examines the relationships between various digitalization-related indicators and financial metrics using econometric models. Specifically, it analyzes the impact of factors such as digital investments, information technology infrastructure, online sales volume, and cybersecurity expenditures on the profitability, liquidity, solvency, and financial independence of joint-stock companies. The research

findings aim to provide evidence-based recommendations for company leaders and financial managers to ensure financial stability during digital transformation processes.

## **2.Literature review.**

The financial stability of joint-stock companies in the context of digital transformation has garnered significant attention in recent academic and practical discourse, driven by the rapid integration of information and communication technologies into business operations. This review synthesizes key studies that explore the interplay between digitalization and financial performance, focusing on econometric analyses and their implications for joint-stock companies, particularly in emerging economies like Uzbekistan. The literature highlights how digital investments, technological infrastructure, and online platforms influence profitability, liquidity, and overall financial resilience, while also addressing challenges such as debt management and cybersecurity risks.

Early theoretical frameworks on financial stability emphasized macroeconomic and microeconomic dimensions. Keynes (1936) laid the groundwork for understanding stability at a macroeconomic level, focusing on aggregate demand and economic cycles. Building on this, Miller and Merton (1977) shifted the focus to microeconomic aspects, defining financial stability as a firm's ability to withstand external and internal shocks, meet obligations promptly, and maintain investment attractiveness. Their work remains relevant in the digital era, as it provides a foundation for analyzing how technological advancements influence corporate resilience (Merton, 1977).

The advent of digital transformation has introduced new dimensions to financial stability research. Brynjolfsson and McAfee (2014) argue that digital technologies significantly enhance labor productivity, innovation, and economic growth. They assert, "Digital technologies have the potential to radically transform business models by optimizing operations and creating new market opportunities" (Brynjolfsson & McAfee, 2014, p. 45). Their seminal work, *The Second Machine Age*, underscores the role of digitalization in reducing costs and improving efficiency, which directly impacts financial metrics like Return on Assets (ROA) and Return on Equity (ROE). Similarly, Tapscott et al. (2000) explore blockchain technology's potential to enhance financial transparency and reduce transaction costs, stating, "Blockchain's decentralized structure fosters trust and streamlines financial operations, thereby strengthening corporate financial stability" (Tapscott et al., 2000, p. 112). These insights highlight digitalization's capacity to create new revenue streams and optimize resource allocation.

Empirical studies further validate the positive impact of digitalization on financial performance. Schwab (2018) conducted a global analysis of digital technologies' effects on industrial and financial sectors, finding that "firms adopting advanced technologies exhibit higher innovation activity and financial stability" (Schwab, 2018, p. 87). This aligns with findings by Sabherwal et al. (2019), who used econometric models to demonstrate that IT investments significantly enhance firm profitability and market value. Their study, based on panel data from U.S. firms, reports a positive correlation between IT spending and ROA, with a 1% increase in IT investment leading to a 0.3% rise in profitability (Sabherwal et al., 2019). However, they also caution that digitalization introduces risks, such as cybersecurity threats and technological obsolescence, which can undermine financial stability if not managed properly.

In the context of emerging markets, Lee (2014) and Kim & Lee (2011) analyzed the impact of online sales on firm profitability using panel data regression. Their findings indicate that "digital commerce strategies significantly enhance financial stability by improving revenue streams and operational efficiency" (Lee, 2014, p. 65; Kim & Lee, 2011). This is particularly relevant for joint-stock companies in Uzbekistan, where digital platforms are increasingly vital for market competitiveness. Similarly, Muyassarzoda (2022) investigated the effectiveness of digital technologies in Uzbekistan's commercial banks, finding that IT investments and digital infrastructure development positively influence financial performance metrics like ROA (Muyassarzoda, 2022). Tojiyev (2023) further supports this, highlighting how digital transformation



fosters economic growth in Uzbekistan's banking sector through enhanced interpersonal networks and operational efficiencies (Tojiyev, 2023).

Despite these benefits, digitalization poses challenges that can destabilize financial performance. Shiller (2013) examines the linkage between technological innovations and speculative bubbles in financial markets, warning that “rapid adoption of untested technologies can lead to market volatility and financial

instability” (Shiller, 2013, p. 134). This underscores the need for robust risk management strategies, particularly in cybersecurity, as highlighted by Nnaomah et al. (2024), who compare AI-driven risk management in the U.S. and Nigerian banking sectors, emphasizing its role in mitigating digital risks (Nnaomah et al., 2024).

Econometric methodologies have been widely employed to quantify these relationships. Wooldridge (2010) and Greene (2008) provide comprehensive frameworks for regression analysis, panel data models, and time-series techniques, which are instrumental in assessing the statistical significance of digitalization's impact on financial stability (Wooldridge, 2010; Greene, 2008). These methodologies underpin the current study's approach, enabling a rigorous analysis of how digital investments, infrastructure, and online sales affect the financial stability of joint-stock companies.

In summary, the literature underscores digital transformation's dual role as both an opportunity and a challenge for joint-stock companies. While IT investments and digital platforms enhance profitability and efficiency, high debt levels and digital risks can erode financial stability. Studies specific to Uzbekistan highlight the growing importance of digitalization in emerging markets, yet gaps remain in understanding its sector-specific impacts on joint-stock companies outside the banking sector. This study builds on these foundations, using econometric models to provide a nuanced analysis of digitalization's effects on financial stability in Uzbekistan's joint-stock companies, contributing to both academic and practical discourse.

### 3. Methodology

This study employs a quantitative approach to analyze the factors influencing the financial stability of joint-stock companies in Uzbekistan under digitalization conditions, utilizing econometric modeling to examine the relationships between digitalization-related variables and financial performance indicators. The methodology is structured to ensure robust statistical analysis and reliable conclusions, leveraging panel data from three major joint-stock companies “Uzagrolizing,” “Khovrenko Samarqand Winery,” and “Shahrisabz Winery”—over the period 2015–2024. The research design, data collection, variable selection, and econometric techniques are detailed below to provide a comprehensive framework for the analysis.

#### 3.1. Research Design and Data Collection.

The study adopts a panel data approach, which combines cross-sectional and time-series data to capture both firm-specific and temporal variations in financial stability. The dataset comprises annual financial and operational data from the three selected joint-stock companies, representing diverse sectors (leasing, wine production, and spirits manufacturing) to enhance the generalizability of findings. Data were sourced from publicly available financial reports, audited statements, and operational records of the companies, covering a 10-year period (2015–2024). This timeframe allows for the observation of trends in digitalization and its impact on financial stability during a period of significant technological advancement in Uzbekistan. The dataset includes 30 observations (3 companies × 10 years), providing sufficient statistical power for econometric analysis.

**3.2. Variable Selection.**

The study focuses on two dependent variables to measure financial stability: Return on Assets (ROA), calculated as net profit divided by total assets, and Return on Equity (ROE), calculated as net profit divided by total equity. These metrics are widely used in financial literature to assess profitability and efficiency (Bharadwaj et al., 2019; Lee, 2014). Independent variables were selected based on their relevance to digitalization and financial performance, as identified in the literature review.

**Table 1.** Information on the Variables Selected for the Study

Type	Category	Variable Name	Calculation Formula
<b>Dependent Variable</b>	<b>Return on Assets</b>	ROA	Net Profit / Total Assets
	<b>Return on Equity</b>	ROE	Net Profit / Total Capital
<b>Independent Variable</b>	Investments in Digitalization	LnX1	Natural logarithm of investments in digitalization
	Value of Existing Computers and Other Digital Tools, Software, and Technologies	LnX2	Natural logarithm of the value of existing computers and other digital tools, software, and technologies
	Sales Volume through Electronic Platforms	LnX3	Natural logarithm of sales volume through electronic platforms
	Share of Net Profit in Total Revenue	X4	Net Profit / Gross Revenue
	Debt Ratio	X5	Total Liabilities / Total Assets
	Debt-to-Equity Ratio	X6	Total Liabilities / Equity

Source: Prepared by the author based on the analysis of empirical literature.

**4.Result and discussion.**

This study investigates the factors influencing the financial stability of joint-stock companies in Uzbekistan under digitalization conditions, focusing on the impact of digital investments, infrastructure, and financial leverage on Return on Assets (ROA) and Return on Equity (ROE). Utilizing panel data from three major joint-stock companies—“Uzagrolizing,” “Khovrenko Samarqand Winery,” and “Shahrisabz Winery”—over the period 2015–2024, the analysis employs Pooled OLS, Fixed Effects Model (FEM), and Random Effects Model (REM) to estimate the relationships. The Hausman test identified REM as the most appropriate model, and diagnostic tests confirmed its robustness with no significant multicollinearity ( $VIF < 5$ ) or heteroskedasticity. The results, presented below, highlight the pivotal role of digitalization in enhancing financial stability, alongside the critical need for prudent debt management.

The Pearson correlation matrix (Table 2) provides an initial overview of the relationships between dependent and independent variables, guiding the subsequent econometric analysis.

**Table 2.** Pearson Correlation Results for Study Variables

variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(1) ROA	1.000							
(2) ROE	0.823	1.000						
(3) lnX1	0.565	0.339	1.000					
(4) lnX2	0.386	0.213	0.560	1.000				



(5) lnX3	0.134	-0.187	0.552	0.608	1.000			
(6) X4	0.227	0.176	0.008	0.057	-0.139	1.000		
(7) X5	-0.774	-0.651	-0.355	-0.203	0.063	-0.237	1.000	
(8) X6	-0.496	-0.349	0.030	0.237	0.146	-0.083	0.701	1.000

Source: Calculated by the author using Stata 17.0 software.

The correlation analysis reveals a strong positive correlation between ROA and ROE (0.823), indicating that the two financial stability metrics move in tandem, reflecting overall firm efficiency. Digitalization-related variables (lnX1, lnX2, lnX3) show positive correlations with ROA (0.565, 0.386, 0.134, respectively), suggesting that IT investments, digital infrastructure, and online sales contribute to asset profitability. However, lnX3 (online sales) exhibits a weak negative correlation with ROE (-0.187), possibly due to high marketing or platform costs impacting capital efficiency. Debt ratios (X5 and X6) show strong negative correlations with both ROA (-0.774, -0.496) and ROE (-0.651, -0.349), highlighting

the adverse effect of high leverage on financial stability. These correlations align with prior studies (Bharadwaj et al., 2019; Lee, 2014) and justify the inclusion of these variables in the regression models.

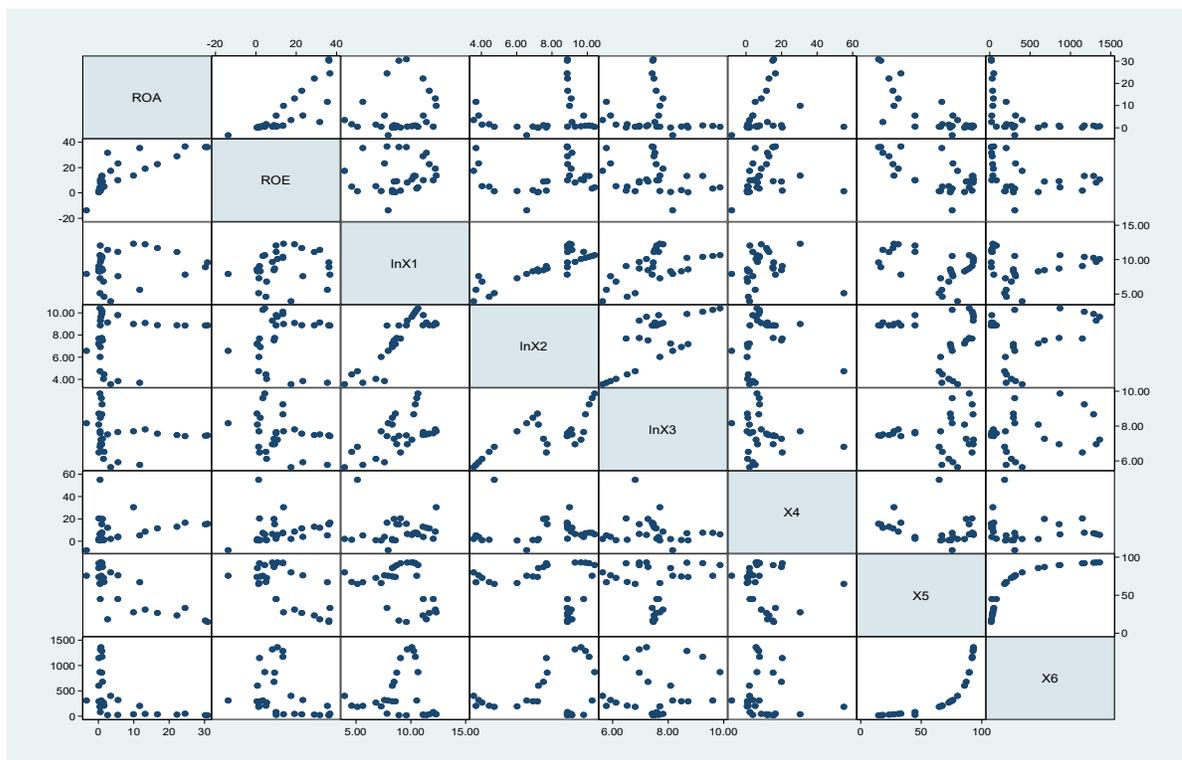
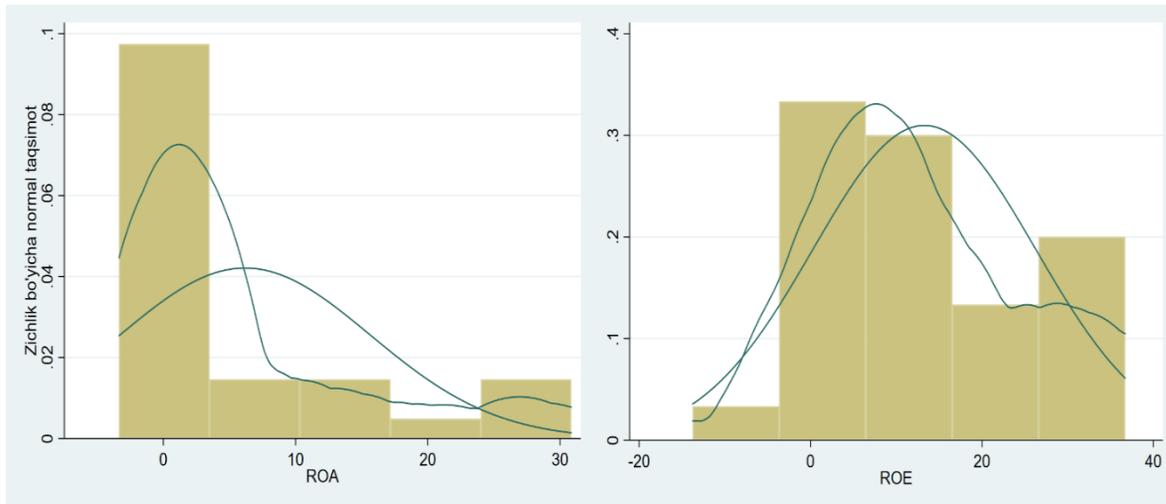


Figure 1. Scatter Plot of Independent and Dependent Variables' Correlations

Source: Prepared by the author using Stata 17.0 software.

The scatter plot visualizes the relationships identified in the correlation matrix, confirming the positive associations between digitalization variables (lnX1, lnX2) and financial stability metrics, as well as the negative impact of debt ratios (X5, X6). The plot also highlights potential non-linear relationships, supporting the use of logarithmic transformations for lnX1, lnX2, and lnX3.

The distribution of ROA and ROE was analyzed using histograms and kernel density plots to assess normality and skewness, which are critical for econometric modeling.



**Figure 2.** Normal and Kernel Density Plots for ROA and ROE

**Source:** Prepared by the author using Stata 17.0 software.

The density plots show that both ROA and ROE are clustered around zero, indicating that most companies maintain modest but positive profitability. ROA exhibits positive skewness, with some firms achieving exceptionally high asset profitability, reflecting efficient asset utilization (Brynjolfsson & McAfee, 2014). ROE also shows slight positive skewness, but with a broader spread, suggesting variability in capital efficiency. While the distributions deviate slightly from perfect normality, this does not significantly impact the robustness of the REM model, as panel data methods are relatively flexible to such deviations (Wooldridge, 2010).

**Regression Results.** The REM results for ROA and ROE are presented in Table 3, providing detailed insights into the impact of each variable on financial stability.

**Table 3.** Random Effects Model (REM) Regression Results For ROA

ROA	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
lnX1	2.46	.966	2.55	.011	-2.354	-.2567	***
lnX2	1.372	1.68	0.82	.014	-1.92	1.665	***
lnX3	.301	2.012	-0.15	.081	-1.244	.642	**
X4	.058	.094	-0.61	.054	-.242	.127	**
X5	-.479	.126	-3.81	0	-.725	-.233	***
X6	.012	.007	1.57	.006	-.003	.026	***
Constant	45.937	9.468	4.85	0	27.38	64.494	***
Mean dependent var		6.179	SD dependent var			9.476	
Overall r-squared		0.739	Number of obs			30	
Chi-square		65.254	Prob > chi2			0.000	
R-squared within		0.68	R-squared between			0.993	



\*\*\*  $p < .01$ , \*\*  $p < .05$ , \*  $p < .1$

Source: Calculated by the author using Stata 17.0 software.

The ROA model explains 73.9% of the variation in asset profitability, while the ROE model accounts for 73.3% of capital profitability variation, indicating strong explanatory power. For ROA, a 1% increase in IT investments (lnX1) increases ROA by 2.46% ( $p = 0.011$ ), and digital infrastructure (lnX2) boosts ROA by 1.372% ( $p = 0.014$ ), confirming the significant positive impact of digitalization (Brynjolfsson & McAfee, 2014). Online sales (lnX3) have a weaker positive effect (0.301,  $p = 0.081$ ), suggesting that digital commerce contributes to profitability but is less impactful, possibly due to associated costs (Lee, 2014). The debt ratio (X5) negatively affects ROA (-0.479,  $p = 0.000$ ), aligning with financial theory that high leverage increases risk and reduces profitability (Shiller, 2013). Interestingly, the debt-to-equity ratio (X6) shows a small positive effect (0.012,  $p = 0.006$ ), indicating that moderate leverage can enhance ROA when investments yield higher returns than debt costs.

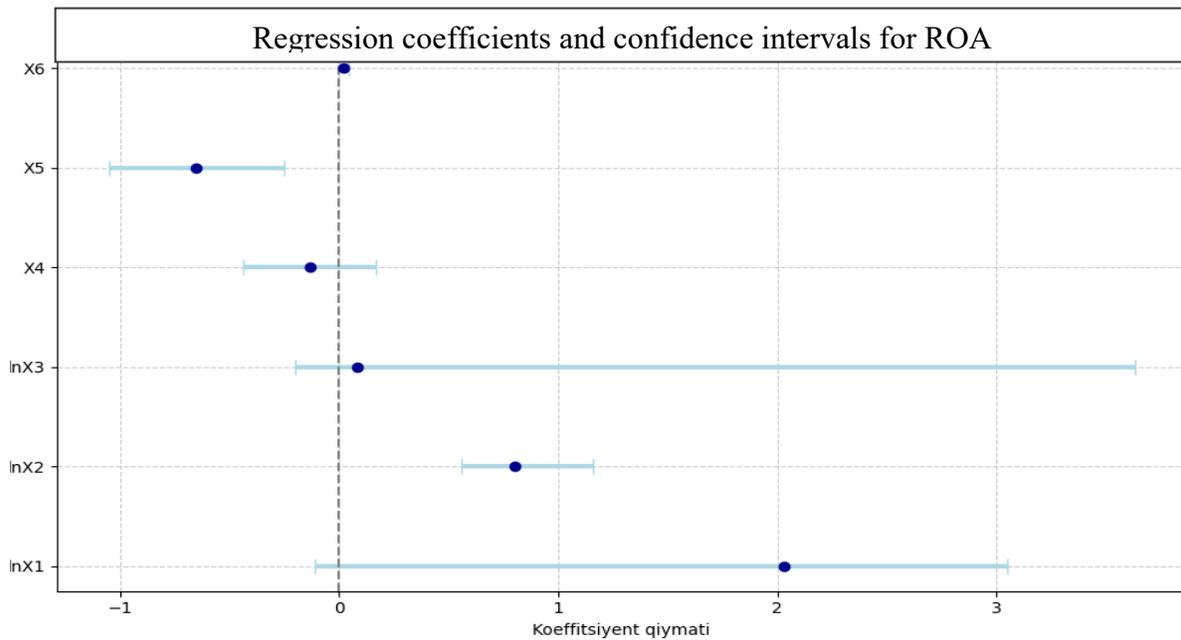
Table 4. Random Effects Model (REM) Regression Results for ROE

ROE	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
lnX1	2.03	1.572	-1.29	.0196	-.111	3.05	***
lnX2	.8	2.733	0.29	.027	.557	1.158	***
lnX3	.085	3.274	-0.85	.039	-.201	3.631	***
X4	-.134	.153	-0.88	.038	-.435	.166	***
X5	-.651	.204	-3.18	.001	-1.051	-.25	***
X6	.021	.012	1.80	.071	-.002	.045	***
Constant	79.632	15.407	5.17	0	49.435	109.829	***
Mean dependent var		13.280	SD dependent var			12.999	
Overall r-squared		0.733	Number of obs			30	
Chi-square		39.716	Prob > chi2			0.000	
R-squared within		0.69	R-squared between			0.985	

\*\*\*  $p < .01$ , \*\*  $p < .05$ , \*  $p < .1$

Source: Calculated by the author using Stata 17.0 software.

For ROE, IT investments (lnX1) increase ROE by 2.03% ( $p = 0.0196$ ), and digital infrastructure (lnX2) by 0.8% ( $p = 0.027$ ), reinforcing digitalization’s role in enhancing capital efficiency. Online sales (lnX3) have a minimal positive effect (0.085,  $p = 0.039$ ), while the net profit share (X4) shows a negative effect (-0.134,  $p = 0.038$ ), possibly due to operational inefficiencies in some firms. The debt ratio (X5) significantly reduces ROE (-0.651,  $p = 0.001$ ), underscoring the risks of high leverage, while the debt-to-equity ratio (X6) has a marginal positive effect (0.021,  $p = 0.071$ ).

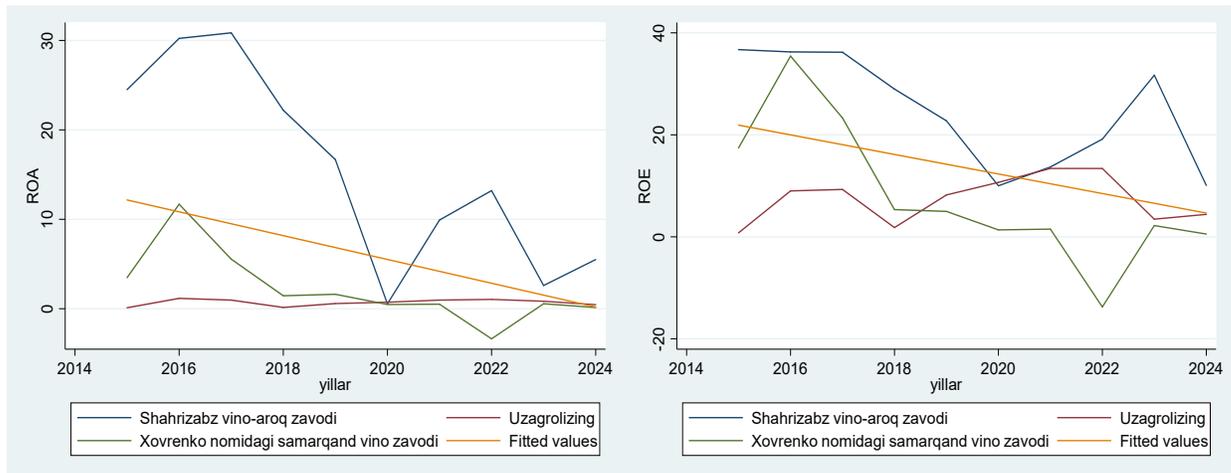


**Figure 3. Logistic Graph of Independent Variables' Impact on ROA**

Source: Prepared by the author using Stata 17.0 software.

The logistic graph visualizes the regression coefficients for ROA, highlighting the dominant positive influence of lnX1 and lnX2, and the strong negative impact of X5. This supports the hypothesis that digitalization enhances financial stability, while excessive debt undermines it.

The dynamic trends of ROA and ROE across the study period are illustrated in Figure 2 (reproduced below for clarity)



**Figure 4. Dynamics of ROA and ROE Across Years for Joint-Stock Companies**

Source: Prepared by the author using Stata 17.0 software.

The graphs show significant variability in financial performance. Shahrizabz Winery exhibits the highest ROA and ROE, peaking in 2016–2018, followed by a decline, suggesting a temporary surge in efficiency possibly driven by digital investments. Uzagrolizing and Khovrenko Samarqand Winery maintain



lower, more stable ROA and ROE, often near zero, indicating limited asset and capital efficiency. The fitted values suggest a general downward trend in ROA, with a slight recovery post-2021 for ROE, potentially reflecting increased digitalization efforts (Schwab, 2018).

### 5. Forecasting Analysis

Using the REM coefficients, forecasts for Uzagrolizing’s ROA and ROE from 2025 to 2030 were generated under baseline, optimistic, and pessimistic scenarios.

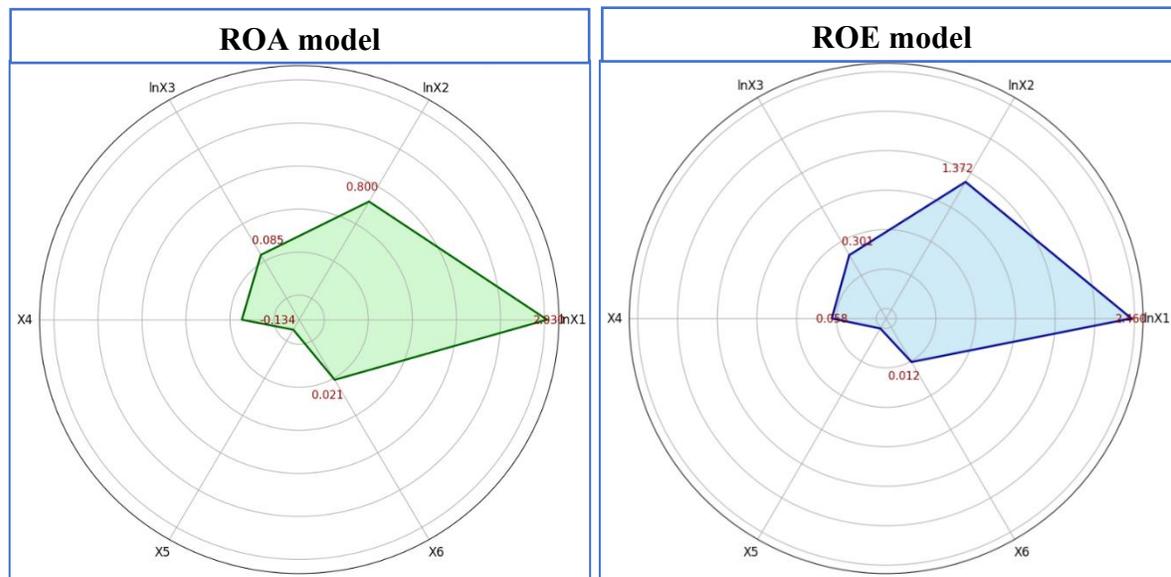


Figure 5. Radar Graph of Regression Results for ROA and ROE Models

Source: Prepared by the author using Stata 17.0 software.

The radar graph (figure 4) compares the standardized coefficients, emphasizing the strong positive influence of lnX1 and lnX2, and the negative impact of X5 on both ROA and ROE. This visual reinforces the critical role of digitalization and the need for careful debt management.

For ROA, the baseline scenario predicts a gradual increase from 0.78% in 2025 to 0.91% in 2030, reflecting modest improvements in asset efficiency. The optimistic scenario suggests a rise to 1.5%, while the pessimistic scenario forecasts a decline to 0.3%, highlighting the sensitivity to economic conditions and digital investment effectiveness. For ROE, the baseline scenario projects growth from 6.75% in 2025 to 8.34% in 2030, with the optimistic scenario reaching 23.44% and the pessimistic scenario dropping to -6.76%. The trend equation for ROE,

$$y = -0.1211x^2 + 3.6845x - 19.851$$

( $R^2 = 0.9039$ ), indicates high predictive reliability.

The findings confirm that digitalization, particularly IT investments and digital infrastructure, significantly enhances financial stability, aligning with prior research (Brynjolfsson & McAfee, 2014; Schwab, 2018). The strong positive coefficients for lnX1 and lnX2 underscore the importance of sustained investment in digital technologies to optimize operations and boost profitability. However, the weaker impact of online sales (lnX3) suggests that digital commerce requires complementary strategies, such as cost management, to maximize benefits (Lee, 2014). The negative effect of high debt ratios (X5) supports Shiller’s (2013) warnings about leverage-related risks, emphasizing the need for balanced financial

structures. The positive effect of X6 in some cases reflects the leverage effect, where debt can enhance returns if managed prudently (Merton, 1977).

The variability in performance across companies highlights sector-specific dynamics. Shahrizabz Winery's superior performance may stem from effective digital adoption, while Uzagrolizing and Khovrenko's lower metrics suggest untapped potential for digital transformation. The forecasting results indicate that strategic digital investments and debt optimization could drive future improvements, but adverse economic conditions pose risks, particularly for ROE.

These results have practical implications for joint-stock companies in Uzbekistan. Managers should prioritize digital investments while maintaining disciplined financial management to mitigate leverage risks. Policymakers could support digital transformation through incentives for IT adoption, fostering a conducive environment for financial stability in the digital era.

## **6. Conclusion**

This study provides a robust econometric analysis of the factors influencing the financial stability of joint-stock companies in Uzbekistan under the conditions of rapid digitalization, utilizing panel data from three major companies "Uzagrolizing," "Khovrenko Samarqand Vino," and "Shahrizabz Vino"—over the period 2015–2024. The findings confirm that digitalization, particularly investments in IT (lnX1) and digital infrastructure (lnX2), significantly enhances financial stability, as evidenced by their positive and statistically significant impacts on Return on Assets (ROA) and Return on Equity (ROE). Specifically, a 1% increase in IT investments increases ROA by 2.46% and ROE by 2.03%, while digital infrastructure boosts ROA by 1.372% and ROE by 0.8%. Online sales volume (lnX3) shows a weaker positive effect, suggesting that digital commerce, while beneficial, requires careful cost management to maximize its impact. Conversely, high debt ratios (X5) exert a strong negative effect on both ROA (-0.479) and ROE (-0.651), underscoring the risks of excessive leverage, though moderate debt-to-equity ratios (X6) can marginally enhance profitability when strategically managed.

The analysis reveals sector-specific dynamics, with Shahrizabz Winery demonstrating superior financial performance due to effective digital adoption, while Uzagrolizing and Khovrenko show untapped potential for improvement. Forecasting for Uzagrolizing from 2025 to 2030 projects modest ROA growth (0.78% to 0.91%) and ROE growth (6.75% to 8.34%) under baseline scenarios, with optimistic scenarios indicating significant potential (ROE up to 23.44%) and pessimistic scenarios highlighting risks (ROE down to -6.76%).

These findings align with prior literature (Brynjolfsson & McAfee, 2014; Schwab, 2018) and emphasize digitalization's role as a catalyst for financial stability, tempered by the need for prudent financial management.

The study contributes to both academic and practical domains by providing empirical evidence on digitalization's impact in an emerging market context. It offers actionable insights for corporate managers to prioritize digital investments and optimize capital structures, while policymakers can leverage these findings to foster digital transformation through targeted incentives.

Based on the findings, the following recommendations are proposed for joint-stock companies, policymakers, and future research to enhance financial stability in the context of digitalization:

Joint-stock companies should prioritize sustained investments in IT systems and digital infrastructure, as these are critical drivers of ROA and ROE. Developing robust digital platforms, such as enterprise resource planning (ERP) systems and customer relationship management (CRM) tools, can optimize operations and enhance profitability.



Companies like Uzagrolizing and Khovrenko Samarqand Winery, which exhibit lower financial performance, should adopt best practices from high-performing firms like Shahrizabz Winery, focusing on digital tools that improve asset and capital efficiency.

The weaker impact of online sales (InX3) suggests that companies should streamline digital commerce operations to reduce associated costs, such as marketing or platform fees. Implementing data-driven marketing strategies and leveraging analytics to target high-value customers can enhance the profitability of online sales channels.

Partnerships with established e-commerce platforms or investment in proprietary online marketplaces could improve sales efficiency and market reach.

The strong negative impact of high debt ratios (X5) highlights the need for careful financial management. Companies should maintain debt levels within sustainable limits, ensuring that borrowed funds are invested in high-return projects, particularly digital initiatives, to leverage the positive effect of moderate debt-to-equity ratios (X6).

Regular stress testing and scenario analysis, as demonstrated in the forecasting models, can help firms anticipate and mitigate risks associated with economic downturns or excessive leverage.

Policymakers in Uzbekistan should introduce incentives, such as tax breaks or subsidies, to encourage joint-stock companies to invest in digital technologies. Establishing public-private partnerships to develop digital infrastructure, particularly in underserved sectors, can accelerate digital adoption.

Regulatory frameworks should be updated to support cybersecurity measures, addressing potential risks that could undermine the financial benefits of digitalization, as noted by Shiller (2013).

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# Digital Transformation of an Enterprise as a Condition for Ensuring Its Competitiveness in Risk Conditions

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## Abstract

The problem of digital transformation of enterprises is explained by the need to ensure long-term sustainable competitiveness of domestic manufacturers of industrial products in the context of digitalization. The transition to digital rails creates an opportunity to reorganize the production process and form effective interaction of all subjects of the digital ecosystem. This necessitates the study of the process and possible directions of digital transformation to ensure an increase in the level of competitiveness of enterprises. The purpose of the article is to present the results of the study of the process and directions of digital transformation of enterprises as a condition for sustainable competitiveness. The research methodology is based on the analysis and idealization of the digital transformation process, the logical substantiation of the essence of this phenomenon and the identification of the main directions of digital transformation. Generalization of data from consulting companies made it possible to formulate the main trends in digital transformation.

**Keywords:** digital transformation of an enterprise, digital vortex, trends, platform, ecosystem, transformation of enterprise components, competitiveness

## 1. Introduction

The traditional format of economic system development under the influence of the sixth technological order, accompanied by the fourth and the beginning of the fifth industrial revolution, is moving to a new round of digital transformational way of functioning of public life as a whole. The processes of digitalization and digital transformation are acquiring the essence of mega trends of the future. The digital, being introduced into the established development movement, radically changes the usual paradigms of the structures of economic relations at the global level, and in the context of the state, enterprise. This gives rise to certain questions and tasks that need to be regulated at the legislative level. Thus, this encourages enterprises to adapt and structurally transform the conduct of business activities in general based on digital platforms and technologies. Enterprises aimed at widespread digitalization of business processes strive to ensure high management efficiency and the possibility of endlessly obtaining competitive advantages based on the cultivation of promising development methods. It is digital transformation that transfers business entities to a new highly profitable level of competition (Shelepaeva, 2022). The processes of forming the platformization of the digital transformation of the enterprise are reflected in the works and guidelines of large consulting companies, on the sidelines of various press conferences and briefings, strategic plans for the development of large enterprises, as well as the consolidation of the need to implement such processes at the legislative level. In all the considered definitions, the main idea of the digital transformation of the



enterprise is traced, which is the development and implementation of digital tools and technologies that ensure the reorganization of production processes to form a comprehensive success of the enterprise in the long term. Enterprises striving to meet the requirements and trends of the digital world need to fully rebuild the entire infrastructure to ensure the formation of digital operations. At the same time, the basis on which the "digital" will initially emerge is mobility, the acquisition of digital skills by workers and administrative personnel, conducting an analysis for the possibility of optimizing internal processes, establishing a digital document flow format as one of the main drivers of digital transformation, informatization of financial accounting at the enterprise and business analytics, which allows you to study a large amount of data to obtain broad information on the analysis of customers, current products on the market, interest in the characteristics of the product, i.e. acts as the necessary fuel for the deployment of digital transformation of the enterprise as a whole. On such a basis, it becomes possible to implement more complex, combined and progressive digital tools and technologies that create the basis for acquiring the characteristics of the enterprise as digital, which thereby provides additional opportunities for the formation of an integrated platform that allows creating a new reality in the context of the digital ecosystem (KPMG, n.d.).

Promising areas of digital transformation based on emerging digital technologies the formation and development of digital technologies create key and general trends in the digital transformation of the enterprise. We will present these trends as follows:

1) Digital technologies allow the format of the employee workplace to evolve for a possible increase in productivity, and also allow retaining specialists by providing more flexible work parameters.

2) Digital transformation processes create pressure on the content of innovations, which must be more flexible and have the ability to be structurally composite. Satisfying rapidly growing expectations for organizations is to turn into a full-scale composite business built on the API application software interface. API allows you to quickly exchange information between programs through modularity, which forms an effective orchestration by the enterprise.

3) Revolutionary technological changes lead to colossal tectonic shifts, both in the format of fundamental understanding and in the practical significance of digital transformation. Adaptation of digital processes by IT specialists is not possible due to the lightning-fast use of digital tools in processes. Therefore, it is important in the digital structure of innovative solutions to preserve and accumulate tools for achieving digital business results. Research and consulting company specializing in information technology markets Gartner found that organizations that successfully use the capabilities of business technologists are 2.6 times more likely to accelerate the achievement of digital business results.

4) Increased automation processes expand the scale of operational efficiency. The integration of technological platform solutions provides production processes with software robots, which thereby increases the flexibility and focus of the development vector adoption. According to the consulting company Deloitte, 93% of organizational leaders expect to use RPA (technology for the use of software robots) by 2023. MuleSoft found that most organizations are either already using or planning to implement automation initiatives to achieve strategic goals, such as increasing productivity (96%) and operational efficiency (93%), as well as creating a better connected customer experience (93%).

5) The digital space creates a field in which automated systems can potentially be attacked. Therefore, in parallel with the development of software solutions, it is important to pay attention to security processes. Here, the work of business technologists is an integral part in the context of enterprise protection.

6) The digital platform is filled with various multi-cloud environments and the company's management needs to create an individual cloud system that will provide the key to success in progressive transformation and thereby bring the business entity to a higher level of sustainability, providing competitive advantages. In the future, the digital ecosystem should create a multi-cloud strategy that allows you to increase the pace of the digital vortex.



7) Consumers in a large mass of data will try to find information that is informative, accurate, concise and fast enough to search. To form a competitive advantage, business leaders need to create a platform that will be a single source of reliable analytical data. According to the consulting company Accenture, which provides services in the field of business process outsourcing and strategic planning, we have that the annual business growth of truly data-driven organizations exceeds 30%. However, 81% of companies still do not

have a reliable data strategy that allows them to maximize the full potential of data, and the same number do not have a suitable platform to support their goals.

8) The increase in the volume of digital flows and the scale of entities switching to the rails of digital transformation creates a problem of the impossibility of effective work on individual cloud services, therefore this pushes in the future to form complex and integral cloud platforms adapted to the needs of individual industries. Thus, these platforms will form the basis of business platforms on which technological innovations will directly serve as a tool for business innovations.

9) The growth of digital data requires well-coordinated work on its processing and analysis, so service providers began to develop operational platforms that work as an intermediate link between users and auxiliary services. Such platforms create the basis for optimizing work and thereby increasing the speed of delivery of digital data. The main message of this trend is to provide self-service for business units, partners and customers, which in turn leads to increased profitability, reduced production costs, and increased sales.

10) To implement the effective operation of the enterprise production system, there is a need to organize the integration of wireless technologies, which are based on Wi-Fi networks, 4G, 5G mobile data communications. Analysts and speakers from major consulting companies suggest that corporate networks based on wireless technologies will be able to transform into a full-scale platform for implementing digital transformation processes.

11) To build digital connections between different counterparties, there is a need to develop a perfect platform in the context of a super application, which allows on this basis to form several lines of applications with the implementation of various services, thereby aiming at creating an ecosystem with a set of different services. According to research, 50% of the world's population will use several super applications daily by 2027.

12) Digital transformation of an enterprise leads to an increase in the speed of digital products entering the market, while marketing processes do not have time to analyze and evaluate consumer preferences, therefore, in order to keep pace with the evolutionary needs of the customer, there is an urgent need to implement adaptable artificial intelligence that is capable of lightning-fast analysis, studying market trends with subsequent adaptation relative to the specific activities of the enterprise and developing project solutions to optimize business value to improve corporate analytics and work in general.

13) Digital technologies are changing the paradigm of the world, there is a tendency for the digital and physical worlds to converge. This creates opportunities to increase creative interaction between employees of different departments and contractors. At the moment, the initial form of the metaverse is the use of cryptocurrency as a digital payment instrument. This was facilitated by the transition to a new level of Internet development, in which participants can monetize their activities without outsiders and thereby reach a new level of interaction. The metaverse creates the prerequisites for the formation of virtual communities, networks and economies in general, which can acquire the characteristics of quasi-groups in the digital world itself. Spatial computing in the implementation of digital twins will improve the quality of industry. 40% of corporations will use Web3, spatial computing and digital twins by 2027.

14) The development of digital technologies in the future will be based on the principles of ESG, which contain aspects of ecology, social responsibility, corporate governance. Investors will be more strict and demanding in their approach to the issue of directing their investment resources in the context of digital



startups and enterprise technologies, since sustainable development that meets the needs of the future and with the possibility of minimal probable damage to future generations becomes an important point in deciding the vector of cash infusion for them. Therefore, it is necessary to develop digital initiatives aimed at strategic business goals with sustainability, which will directly increase competitiveness in the long term.

15) To attract more consumers of any product, digital marketing continuously offers its digital product from a variety of channels, but the modern consumer does not want to delve into a large array of data to select the desired content. Therefore, there is a need to use artificial intelligence in order to increase the collection of incoming information from social networks and other digital sources to form personalized marketing processes. Thus, this will greatly increase the attractiveness of digital products for a specific consumer.

16) The formation of super applications based on broad platform solutions will increase the number of clients using certain services several times. This trend, in turn, encourages domestic manufacturers to move to social commerce, thanks to which it is possible to quickly track trends, customer preferences and effectively interact with customers directly through specific applications, which will further increase the profitability and cost effectiveness of the organization.

17) The transition of real processes to the virtual world suggests a new era of digital transformation. A high level of symbiotic network between people and computers is expected. Artificial intelligence studies people and begins to understand them more accurately, offers those services that, in the opinion of robots, a person needs at the moment. Thus, this will lead to an increase in sales of devices for a possible transition to virtual reality. All this suggests that digital technologies will enrich the physical world with digital knowledge for successful progressive development.

Currently, the Internet of Things is understood as a set of electronic objects that exchange data with each other using special algorithms in order to inform users about the progress of a technological process or automate a response to a certain action of external factors.

In 2019-2023, no more than 13% of all surveyed organizations were focused on the use of this type of digital technology. RFID technologies and industrial robotics were used in their activities by no more than 5% of the number of surveyed enterprises in 2019-2023; the use of these types of technologies is mainly due to the specifics of the enterprises' activities and the industry.

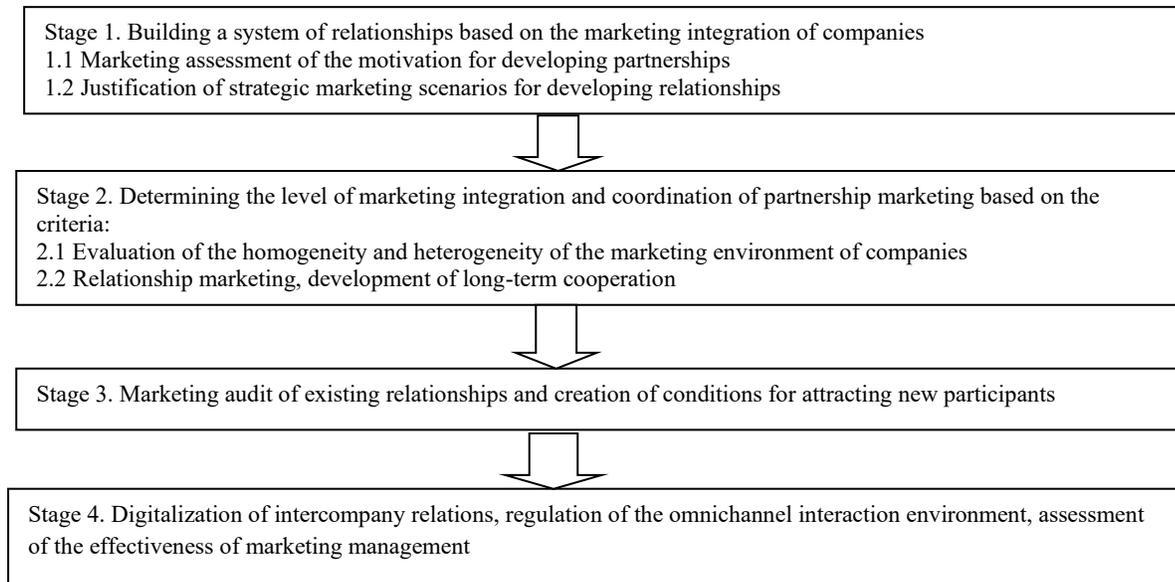
When forming a marketing strategy in accordance with the basic concept of "4P", enterprises must take into account the processes of increasing the informatization of society and adapt the marketing strategy in accordance with this trend. In the area of product policy, enterprises are increasingly focused on the quality of products, the possibility of their quick shipment and transportation to customers without losing consumer properties, while the issues of attractiveness of packaging and the appearance of containers are relegated to the background. The most significant changes occur in the marketing strategy in the area of bringing products to the consumer and advertising them.

The development of online commerce, the growing popularity of electronic payment for purchases lead to the transformation and reduction of standard retail outlets almost everywhere, especially in large cities. Most enterprises engaged in the production of goods are currently focused either on opening online stores or on trading through special retail outlets. It can be assumed that in the next 10-20 years, retail space will be significantly reduced and traditional trade will be a rare occurrence in the life of a city dweller. Shopping malls will perform not so much the function of bringing goods to the consumer, but rather leisure and entertainment. The area of warehouses and the area occupied by the exposition of goods will gradually decrease. Electronic advertising is gradually replacing outdoor advertising and POS advertising. Electronic advertising is characterized by the fact that it is distributed regardless of time, in addition, mobile applications allow monitoring the situation with delivering advertising to specific consumers, thus, targeted advertising is actively developing. Enterprises are trying to actively use Social Media technologies for



advertising, using all possible means to deliver information to the consumer, including websites, blogs, social networks, instant messengers. In the field of forming a pricing strategy, enterprises should take into account the possibility of potential buyers monitoring prices, this often becomes a determining factor when deciding on a purchase, so it is advisable for sellers to use a flexible pricing policy with the possibility of using a discount system.

The algorithm of marketing management of interaction of companies in industrial markets, the consistent implementation of the stages of which increases the efficiency of marketing activities, is presented in Figure 1. The formation and development of the industrial market is based on effective rivalry based on fair competition.



**Figure. 1.** Algorithm of marketing management of interaction of companies in industrial markets

The world is developing rapidly, and the use of digital technologies in industry is becoming a necessity. The implementation of modern solutions increases the efficiency of enterprises and improves their competitiveness through the digitalization of business processes. Today, there is a digital transformation of all industries. Effective functioning of modern enterprises in the context of digital transformation of the economy is possible only with the use of digital technologies and tools in all its divisions, including marketing. There are several key areas in the process of digitalization of an industrial enterprise: accelerating the launch of new products on the market, enhancing the safety and reliability of production, increasing the flexibility of production, increasing the quality of manufactured goods, and overall increasing production efficiency. At the same time, digitalization is dual in nature, since the introduction of innovative technologies opens up vast opportunities for the activities of the enterprise, but at the same time carries many potential risks in the face of uncertainty and trends in the constant acceleration of scientific and technological progress. In the context of digital transformation, industrial enterprises are subject to significant loads of operational risks, since they are more characteristic of this process.

Digitalization increases the speed of decision-making, minimizes the impact of the human factor, and helps make production operations more "flexible". This helps increase labor productivity, allows you to predict work results and improve the quality of products, which together leads to improved competitiveness and increased profits of the enterprise.

Digitalization helps the enterprise to develop in a highly competitive environment. It solves the following business problems:



- improves product quality and increases its safety;
- protects the enterprise's IT infrastructure from hacker attacks that can disrupt the stability of business processes and lead to leakage, including confidential data;
- increases the flexibility of production operations and accelerates the launch of new products on the market;
- contributes to the labor protection and health of employees by optimizing the production process.

Today, the digitalization of industry remains a priority investment area for many enterprises. Thus, despite the sanctions, in 2022, almost 2/3 of domestic companies did not reduce investments in digitalization, and 16% of them even increased them. It is obvious that businesses realize that the introduction of new technological solutions contributes to their development.

The use of digital marketing tools significantly increases the efficiency of the company's functioning and development, reduces costs and increases recognition. However, the transition to digital rails is impossible without increasing the level of digitalization of the population, so further development of the digital marketing era involves the development of digitalization of the economy as a whole and the improvement of marketing tools. The goal of marketing activities is to satisfy the needs of customers as much as possible, an individual approach to the client is unlikely to give way to any other option of work any time soon. Internet marketing tools are developing and improving at a rapid pace, these tools open up huge technical opportunities for enterprises, but without their correct use, without building work around the target audience and its needs, they simply will not be effective.

## 2. Results obtained

The digital transformation of an enterprise is preceded by processes to change the industrial paradigm, namely the main areas (components) that ensure the stable functioning of the enterprise as a whole. The implementation of the transformation of individual elements will allow in the future to provide a higher level of competitiveness of the enterprise, and if its management makes an attempt to create and subsequently implement a full-scale unified digital platform on this digital base, this will lead to tremendous success in strategic development. Digital changes in the financial component form the cost vector of transformation. It is from the correct management of financial and investment flows that high-quality work will be formed to determine the value of these resources, which will reduce operating costs, identify new niches of income sources, thereby in the future this will make it possible to increase profit volumes (Belyatsky & Podupeyko, 2019). Another component of the structural model of the enterprise can be noted as a technical and technological one. Production processes are radically changing in their form. Digital technologies bring the degree of integration of different elements of work to a new level so as to determine the timely readjustment of a production line or introduce the production of a new type of product. Digital technologies collect information, control and measuring devices calibrate solutions at individual nodes of production processes, and in case of a high risk of negative trends, they visualize the adopted work concept. Subsequently, the equipment park of the enterprise is transferred to a common information platform, in which artificial intelligence, using statistical capabilities, produces a comprehensive interpretation of the studied information to form flexible and accurate management decisions on the functioning of the enterprise as a whole. The intellectual and personnel sphere of the enterprise's functioning is also important in the context of digital transformation, since the success of the development of any economic entity depends on the possible potential of human capital in the context of creating additional value for manufactured products. It is from the level of use of digital technologies in the personnel management system that the transformation from a traditional to a technological organization will take place, which will thereby ensure the growth of the competitiveness of the enterprise. A definitely urgent task for organizations is to form an in-depth network interaction between various structural divisions based on platformization processes. Information flows are complicated by their essence by acquiring digital value from each digitalized



employee. The power component plays an important role in the functioning of the enterprise. Despite the fact that digital transformation involves the transition from reality to a virtual environment, it is important for the management of the enterprise not to forget about the protective measures of the organization, as a whole, as a physical object. It is necessary to use digital technologies in line with security, which will allow to form a kind of dome of protection from encroachment from the outside, and within the enterprise itself. This will contribute to biometric accounting of working time, as well as continuous monitoring of the movement of people throughout the working day.

### 3. Conclusions

Digital reformation and transformation gives impetus to rethinking the paradigms of enterprise functioning and brings out the information component as one of the most acute issues in safe development. Information flows lead to market modification, new attitudes towards customers and manufactured products. Platformization creates a trend for restructuring brains to transfer the "locomotive" to digital rails thanks to artificial intelligence, which allows you to provide yourself with competitive advantages in this area. Digital transformation affects the problems of environmental issues in industry, which are the most pressing. Digital platforms allow you to conduct a point and systemic analysis of trends in current indicators to develop solutions to increase the efficiency of equipment, and in the event of deviations from the specified parameters of the process equipment, record the facts of incorrect operation and present a full stage of work to eliminate a potential emergency situation.

The use of digital solutions in the field of environmental protection will directly affect the interests of various counterparties, as well as inverters who want to increase the competitiveness of the enterprise in the context of their interests. Changes are also taking place in the legal sphere, as digital technologies require the development of fundamental legal solutions aimed at high-quality regulation in the context of their direct use in production. The formation of standardization processes simplifies the transfer of knowledge and promotes the further development of digital solutions. Standards act as certain indicators of the effectiveness of the implementation of technological shifts. Conclusion In the course of the studied approaches, it can be summarized that digital transformation is today a determining factor in the progressive development of an enterprise, based on the competent investment of financial resources in order to optimize production processes, improve the channels of interaction between various structural divisions, change work models, which thereby causes a full-scale fundamental rethinking of all personnel to achieve and acquire new innovative technological explosions that ensure conditions for sustainable competitive struggle in the long term.

Platformization processes shape the development of a business model of an isolated ecosystem of a specific economic entity. The management of the enterprise must understand the problem of rapid change of digital processes for retaining objects and entities in the digital ecosystem in order to ensure continuous work on correlating individual elements of business models, as well as, if necessary, to fully reconstruct the ecosystem as a whole (Kotlyarov, 2020). On this basis, it is possible to ensure stable and progressive evolution in cases of entry of new digital counterparties or technological innovations, which will thereby ensure a higher level of competitiveness of the enterprise.



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# International and Regional experience of MLI Tourism Management and Green Destination concept

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## Abstract

The article analyzes the conceptual foundations of Sustainable Tourism, its economic, social and environmental significance, as well as the article analyzes the conceptual foundations of Sustainable Tourism, its economic, social and environmental significance, as well as management mechanisms applied at the International and regional levels from a scientific point of view. The purpose of the study is to substantiate the importance of integration of sustainability principles in planning and management of tourism activities, to identify international experience and potential opportunities of Azerbaijan in this direction. Within the framework of the study, the Coordination of the 2030 Sustainable Development Goals of the UN, especially the 8th (decent labor and economic growth), 11th (sustainable cities and communities), 12th (responsible consumption and production) and 13th (measures against climate change) goals with the tourism sector was investigated. The analysis shows that the sustainable tourism model both ensures the preservation of Natural Resources and acts as an important factor for long-term economic stability and social well-being. Azerbaijan's "Green Destination" initiatives and ecotourism projects are evaluated against the background of international experience and practical recommendations are put forward to strengthen the principle of sustainability in the country's tourism policy.

**Keywords:** Sustainable tourism; green destination; ecotourism; management strategies; international standards; ecological balance; certification; Azerbaijan tourism; UN 2030 Sustainable Development Goals (SDG)

## 1. Introduction

In recent years, the rapid development of tourism on a global scale has increased attention not only to its economic, but also social and environmental aspects. Tourism, in addition to generating economic income, also plays an important role in maintaining ecological balance, keeping cultural heritage alive and improving the social welfare of local communities. In this regard, the sustainable development of tourism has become one of the main directions of state policy and international cooperation in modern times.

The concept of sustainable tourism implies the preservation of resources for both current and future generations by combining the economic, social and environmental aspects of tourism activities in a balanced way (UNWTO, 1998; UNEP & UN Tourism, 2005). This approach not only ensures the long-term development of the tourism sector, but also expands the effective use of Natural Resources and the possibility of local people to benefit from tourism.

The relevance of the study lies in the fact that in modern times, the rapid development of tourism both in Azerbaijan and at the international level creates new challenges related to the protection of environmental and social balance. In particular, the United Nations 2030 Sustainable Development Agenda and its 8th (Decent Work and economic growth), 11th (sustainable cities and communities), 12th

(responsible production and consumption) and 13th (combating climate change) goals necessitate the development of tourism as an activity that has not only economic but also environmental and social responsibility.

Therefore, the purpose of this study is to examine the ways of economically and ecologically effective application of sustainable tourism management strategies and to identify important criteria in the formation of green tourism models both in Azerbaijan and internationally.

## **2. Concept and importance of Sustainable Tourism**

Sustainable tourism is an activity that fully considers current and future economic, social and environmental impacts, aimed at meeting the needs of visitors, industry, the environment and local communities.(United Nations, n.d.).

From an ecological point of view, sustainable tourism contributes to the conservation of water, energy, soil and biodiversity, reducing waste and protecting ecosystems (Mihalic, 2016). In the social and cultural aspect, however, sustainable tourism increases the employment opportunities of local communities, strengthens social justice and serves to preserve cultural heritage (Bramwell & Lane, 2011). This approach ensures the joint implementation of tourism activities not only with economic goals, but also with the well-being of communities and the preservation of cultural values.

From an economic point of view, sustainable tourism provides long-term profitability, supports the stable development of the tourism sector and increases the international competitiveness of the region. Regions with green destination and ecotourism certificates are becoming reliable and attractive to tourists, strengthening the regional brand and prestige (UNWTO, 2019).

The basic principles of sustainable tourism include the efficient use of resources, the maintenance of ecological balance, the preservation of cultural heritage and local traditions, the involvement of communities in the tourism process and the creation of long-term economic stability (Gössling, Scott, & Hall, 2015). These principles are directly related to the behavior of tourists; the fact that tourists allocate waste, use energy and water sparingly, and respect local communities play an important role in ensuring environmental and social sustainability (Gössling, 2020).

The future prospects of sustainable tourism are directly related to global trends, technology and Sustainable Development Goals (SDGs). Smart tourism, ecotourism routes and environmental monitoring systems contribute to the sustainable management of tourism facilities and serve to ensure social justice, economic stability and environmental safety on a global scale (UNWTO, 2019; Gössling, 2020).

Sustainable tourism is recognized as one of the key strategies to ensure social justice, economic stability and environmental safety within the UN's 2030 Sustainable Development Goals (SDG) (UNWTO, 2019). This approach ensures the joint implementation of tourism activities not only with economic goals, but also with the well-being of local communities, gender equality, protection of cultural heritage and Environmental Protection. For example:

SDG 8-quality work and economic development: sustainable tourism creates employment opportunities for local communities and promotes equal distribution of tourism income.

SDG 11-Sustainable Cities and Community: Green Destination and ecotourism projects take into account environmental and cultural aspects in the planning of cities and regions.

SDG 12-Responsible Consumption and production: the efficient use of resources by tourists and tourist facilities, reducing waste and saving energy are ensured.



SDG 13 – Climate Action and SDG 15-terrestrial and aquatic ecosystems of life: sustainable tourism contributes to the conservation of ecosystems, the maintenance of biodiversity and the fight against climate change.

Sustainable tourism serves as an important tool in the implementation of SDGs both nationally and globally, and contributes to a balanced contribution to the ecological, social and economic development of the regions (UNWTO, 2019; Gössling, 2020).

### **3. Sustainable Tourism In The Context Of Azerbaijan**

The tourism sector of Azerbaijan has become a priority in public policy in recent years and has been adapted to the principles of sustainable tourism based on the country's rich natural, cultural and social potential. The sustainability of tourism in the country is ensured mainly in the areas of development of Tourism Infrastructure, Protection of the environment, promotion of innovative tourism services and rational use of tourism resources.

The “Strategic Roadmap for the development of the specialized tourism industry in the Republic of Azerbaijan” and other state programs adopted in 2016 have created new opportunities for the sustainable development of tourism in the country. At the same time, the reforms carried out in recent years — the ASAN visa system, the Baku Shopping Festival and the action plan aimed at the development of beach tourism (2017-2020) — have strengthened the economic and social sustainability of Tourism. (Kalantarli, Guliyeva, & Farajova, 2024)

The development of tourism in the liberated Nagorno-Karabakh and surrounding regions in 2020-2025 has been one of the main priorities of sustainable tourism. Tourism in these regions is promoted both for the purpose of economic income and for the social welfare of local communities, for the preservation of cultural and historical heritage. (Rahmanov, et al., 2020)

According to the principles of sustainable tourism, infrastructure is modernized, tourist routes are developed, Environmental Control is introduced, and cultural heritage is protected. These measures ensure economic, social and environmental sustainability in the region and turn the Nagorno-Karabakh region into a strategic tourism region of Azerbaijan.

The charming nature, rich cultural heritage and geographical location of Azerbaijan create favorable conditions for the development of sustainable tourism. However, for the effective use of the existing tourism potential, it is important that activities take on a permanent, not seasonal character. The main goal of sustainable tourism is both to preserve tourist resources and to increase the employment of local communities. The proposed solutions for the development of sustainable tourism include the improvement of infrastructure, the protection of natural and cultural heritage, the involvement of local communities in tourism activities, the training of personnel in the field of Tourism and the application of Environmental Assessment (EIA) reports. (Bayramli & Aliyev, 2020)

Thus, sustainable tourism in the context of Azerbaijan is based not only on the principles of economic development, but also on the principles of preserving the ecological balance and improving social welfare, which ensures the preservation of both natural and cultural heritage for future generations.

### **4. Sustainable Tourism Management Strategies**

Sustainable tourism management is an approach aimed at ensuring long-term development by balancing the environmental, social and economic aspects of Tourism. This approach takes into account the preservation of natural and cultural heritage, the well-being of local communities and economic development together. While traditional tourism models have negative impacts on the environment and local communities, sustainable management aims to minimize these impacts.

Sustainable tourism management is focused on addressing complex issues related to impacts on the natural and built environment in the field of tourism, as well as the history, culture and heritage of local communities. This approach involves the formation of theoretical and practical policies to ensure positive and high-quality economic development in the tourism sector. Sustainable tourism management promotes harmonious cooperation between local communities, the private sector, non-profit organizations, academic institutions and government structures, while developing management principles for the protection of natural, established and cultural environments.

Sustainable tourism management is an approach aimed at ensuring long-term development by balancing the environmental, social and economic aspects of Tourism. The main goal of sustainable tourism management strategies is to carry out tourism activities within the framework of the principles of economic efficiency, social justice and environmental balance. These strategies strengthen the long-term sustainability of tourism by both increasing the well-being of local communities and ensuring the conservation of Natural Resources (UNWTO, 2023). While traditional tourism models have negative impacts on the environment and local communities, sustainable management aims to minimize these impacts.

Sustainable tourism management strategies are mainly formed in four directions: (Hall, 2019; Gössling & Hall, 2021).

1. Environmental Management: minimizing impact on nature, waste management, energy efficiency and Biodiversity Conservation.
2. Social management: increasing the participation of local communities in decision-making, preserving cultural values and ensuring social equality.
3. Economic management: supporting local entrepreneurship, fair distribution of income from tourism and ensuring long-term economic sustainability.
4. Institutional management: is the strengthening of cooperation between the public and private sectors, the creation of strategic planning and monitoring mechanisms.

Sustainable tourism management is focused on addressing complex issues related to impacts on the natural and built environment in the field of tourism, as well as the history, culture and heritage of local communities. This approach involves the formation of theoretical and practical policies to ensure positive and high-quality economic development in the tourism sector. Sustainable tourism management promotes harmonious cooperation between local communities, the private sector, non-profit organizations, academic institutions and government structures, while developing management principles for the protection of natural, established and cultural environments.

Sustainable tourism management faces a number of pressing challenges. Tourist congestion (overtourism) puts pressure on the environment and local communities in popular destinations. Bali began in February 2024 to impose an entrance fee from foreign tourists in the amount of 150,000 Indonesian rupiah (about US \$ 10) (Skift,2024) these funds will be used for the purpose of protecting the environment and restoring cultural heritage. Since 2015, the Icelandic government has developed Destination Management Plans (DMPs) to ensure the sustainable development of Tourism. These plans are developed with the aim of increasing the well-being of local communities and reducing the environmental impact of tourist activities (Ferðamálastofa, 2024).In Norway, various green certification systems are being implemented in order to reduce the environmental impact of tourism activities and ensure sustainable development. For example, the Ecotourism Norway certificate ensures that tourism enterprises meet high environmental standards. (Visit Norway, 2024).

In New Zealand, the “Tiaki Promise” program calls on tourists to protect nature, people and culture. This initiative is aimed at promoting responsible behavior between the government and local communities (New Zealand Ministry of Business, Innovation and Employment [MBIE], 2022). In 2022, the “Green Spain” strategy was adopted in Spain and government subsidies were allocated for ecotourism projects in



rural areas (Ministerio de Industria, Comercio y Turismo, 2022). The European Union's "European Tourism Indicator System (ETIS)" "mechanism provides a unified system of indicators for the assessment and monitoring of sustainable tourism (European Commission, 2022).

A number of strategic documents on sustainable tourism management have been adopted in Azerbaijan in recent years. In "Azerbaijan 2030: National Priorities for socio-economic development", the ecological sustainability of Tourism and the development of alternative types of Tourism (agritourism, ecotourism, mountain tourism) in the regions are defined as a priority direction (State Tourism Agency of Azerbaijan, 2023). Ecologically oriented tourism projects are implemented in Gabala, Zagatala and Lerik regions within the framework of the "Green Tourism" initiative by the State Tourism Agency (State Tourism Agency of Azerbaijan, 2023).

The effectiveness of sustainable tourism management strategies depends not only on public policy, but also on the active participation of local communities and the responsible approach of tourism enterprises. In this direction:

- \* Environmental certification of tourism facilities
- \* Involvement of local communities in tourism planning
- \* Measures such as the promotion of a culture of environmental behavior among tourists should be a priority. (United Nations Environment Programme & UNWTO, 2020).

## 5. Green destinations and ecological balance protection

The concept of green destination is the concept of space in which tourism activities have a minimum impact on the Environment, Natural Resources are protected and the socioeconomic development of local communities is supported. Green destinations come to the fore not only from an ecological point of view, but also from the point of view of preserving local cultures and improving the well-being of communities. The experience of European and Scandinavian countries shows that the introduction of green destination models ensures long-term sustainable development of the tourism sector (Ecobnb, 2025).

The success of the green destination concept is due not only to governance and infrastructure, but also to the behavior of tourists. It is important for tourists to separate waste, use water and energy sparingly, and respect local communities (Gössling, 2020). For this reason, tourist awareness programs should be added to green destination strategies.

Criteria such as conservation of the region's nature, waste management, water and energy efficiency, and involvement of local communities in the process are taken as the basis for obtaining green destination status.

The concept of green destination generates numerous effects for both the environment and the local community:

1. Environmental impacts: reduction of air and water pollution, conservation of biodiversity, promotion of clean energy use.
2. Social impacts: increasing employment opportunities for Indigenous people, preserving cultural heritage, strengthening social justice and equality.
3. Economic effects: long-term tourism revenues ensure the provision of better quality services for tourists, the development of local businesses. (Greenly, 2025)

As positive effects increase, competition in the tourism market intensifies in the current context of globalization. Modern tourists pay attention not only to the beauty and quality of service, but also to the environmental responsibility of the place where they go. Technologies such as GPS tracking, water and energy monitoring system, waste reporting make Green Destination Management effective (Mihalic, 2016).

This contributes to both the reduction of environmental impacts and the continuous fulfillment of certification criteria.

In the long run, the green destination keeps tourism revenues stable and provides a sustainable market for local businesses (UNWTO, 2019). When tourists choose eco-certified places, the brand and prestige of the region increases.

A number of strategic approaches based on international and regional practices are proposed for the development of sustainable tourism and the success of the green destination concept. First of all, it is important to establish national certification systems. The application of certificates in accordance with GSTC standards in Azerbaijan improves the quality of the functioning of ecotourism facilities, strengthens the region's credibility at the international level and ensures the long-term sustainability of the tourism sector (GSTC, 2023).

The expansion of Blue Flag and Green Key certifications is also of strategic importance. The application of these certificates on the coast of the Caspian Sea and in national park areas not only increases the confidence of tourists, but also serves to maintain environmental standards (FEE, 2023). The active involvement of local communities in the certification process contributes to their socio-economic development and ensures the preservation of cultural heritage (Bramwell & Lane, 2011).

The development of awareness programs to promote the ecological behavior of tourists is also of strategic importance. These programs allow the development of behaviors such as reducing waste, using energy and water sparingly, respecting local communities (Gössling, 2020). At the same time, the application of technology and monitoring systems ensures effective control of water quality, waste management and energy use, contributing to the continuous fulfillment of certification criteria (Mihalic, 2016).

The study of international experience and its adaptation to the region make it possible to improve Azerbaijan's ecotourism strategies. The green destination and certification practices of countries such as Scandinavia, Estonia and Denmark provide practical examples in the management of national parks and rural tourism facilities (UNWTO, 2019).

Thus, when certification, participation of local communities, education of tourists and application of technology are combined, Azerbaijan's sustainable tourism strategies serve to maintain ecological balance, socio-economic development of local communities and the country's International Tourism Competitiveness.

## **6. Certification and international standards in Sustainable Tourism**

GSTC (Global Sustainable Tourism Council) is an organization that sets international standards for sustainability in tourism. Its criteria cover four main areas:

1. Management System (Planning and monitoring of tourism activities),
2. Socio-economic benefits (job creation for local communities),
3. Preservation of cultural heritage (keeping local culture and traditions alive),
4. Environmental protection (biodiversity conservation, waste reduction). (Gössling, Scott, & Hall, 2015)

Costa Rica, for example, has achieved the protection of tropical forests, taking as a basis the GSTC criteria in its national tourism strategy, and has taken a leading position in the eco-tourism market.(Sword & Cuning, 2010)



“Blue Flag” is an international program that certifies beaches, marinas and tourist yachts for environmental standards. Its main criteria are:

1. High water quality: compliance with good water quality standards
2. Proper waste management: managing waste in an effective and environmentally friendly way
3. Security and awareness-raising activities: ensuring the safety of tourists and implementing environmental awareness programs

For example, Spain and Greece have the largest number of Blue Flag certified beaches in Europe. This strengthens the image of countries among tourists and contributes to the development of ecological tourism.

Spain, for example, is the country with the largest number of Blue Flag certified beaches in the world in 2025. (The National Academy of Sciences Spain.info, 2022). In total, 642 beaches, 101 marinas and 6 tourist boats received this prestigious certificate, bringing the total to 749. (Foundation for Environmental Education, 2025)

Greece is the country with the second most Blue Flag certified beaches in the world in 2025. (Blue Flag Greece, 2025). In total, 623 beaches, 17 marinas and 17 eco-friendly tourist boats received this prestigious certificate, bringing the total to 657. The region of Greece that receives the most Blue Flag certifications is Crete; in 2025, 153 certified beaches were available here. (Visit Greece, 2025)

However, there are also some difficulties associated with the application of certificates: high costs, unsustainable monitoring and lack of proper awareness of local communities (Gössling, 2020). Therefore, certification programs should include not only technical, but also social and economic aspects.

Table 1.

Region / Country	Main actions and features	Result and advantages
Scandinavia – Norway	Ecotourism facilities in fiord areas operate according to GSTC criteria and smart monitoring systems are implemented for the management of national parks (Mihalic, 2016).	Norway has gained an international image as an ecotourism Center
Europe – Denmark	The cycling infrastructure in Copenhagen is not only for the environment, but also strengthens the city’s tourist brand. As part of the” Copenhagen Green City “initiative, Hotel energy and waste management programs are certified (UNWTO, 2019).	The city has gained the image of the” green capital”, tourist interest has increased
Europe-Estonia	The” VisitEstonia “ program provides for the protection of national parks, the creation of ecotourism routes and the promotion of the ecological behavior of tourists (Bramwell & Lane, 2011).	National park Tourism developed, environmental awareness strengthened
Regional-Turkey	In Antalya,” Green Key “and” Blue Flag “ certificates ensure increased environmental standards in hotels and international competitiveness of coastal tourism (FEE, 2023).	Environmental standards in hotels have strengthened, coastal tourism has increased competitiveness

Regional-Azerbaijan	Sheki and Lahij are included in the UNESCO Cultural Heritage List (UNESCO, 2019)  it enables the involvement of local communities in tourism projects, the development of ecotourism routes and international recognition. Within the framework of the “Green Destination” concept, which has been implemented since 2022, national parks and rural tourism projects are supported by certification and monitoring mechanisms.(State Tourism Agency Of The Republic Of Azerbaijan, 2023)	The potential of ecotourism is growing, opportunities for international recognition are expanding
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The table presents the sustainable tourism strategies of Scandinavia, Europe and regional countries in a comparative way and shows that in all examples, environmental certification and management approaches are considered as top priorities. (Table 1)

## 7. Methodology

This article uses the benchmarking method to compare the development of Azerbaijan’s tourism sector at regional and global levels. During the study, data were collected on the main criteria – types of tourism, infrastructure and services, number of tourists and income, marketing and branding, tourist satisfaction and safety. Official statistics, international reports and academic articles were used for the analysis (OECD, 2024; UNWTO, 2024; Azerbaijan State Tourism Agency, 2024; T.C. Ministry of culture and Tourism, 2023). As a result of Benchmarking, Azerbaijan’s strengths and weaknesses were identified and strategic recommendations for development were developed.

Azerbaijan’s tourism has become one of the areas of strategic importance in the country’s economy in recent years. The country’s rich natural resources, historical and Cultural Heritage, Mountain and sea tourism opportunities are the main factors that increase the interest of tourists. In order to increase its competitiveness at the international level, it is important to compare the development of the tourism sector of Azerbaijan with the experience of other countries and study successful practices.

For this purpose, the benchmarking method was applied in the article. Benchmarking, that is, a comparative assessment, allows you to reveal the strengths and weaknesses of Azerbaijan in the field of Tourism, Study best practices and develop strategic recommendations for development.

The purpose of the study is to compare Azerbaijan’s tourism with regional (Turkey) and global (France) countries, assess the existing potential and, based on the results, provide practical recommendations for the development of Tourism.

Within the framework of the Benchmarking method, the following criteria were selected in order to compare the development of the tourism sector of Azerbaijan with other countries. These criteria are widely applied in international benchmarking practices and allow an objective assessment of tourism performance (González-Rodríguez, 2023; OECD, 2024).

## 8. Types of Tourism

Azerbaijan’s tourism products are mainly limited to Mountain, ecotourism, cultural and city tours. This approach brings to the fore the natural and cultural riches of the country. However, according to studies



conducted by Aktaş Çimen (2024), Turkey offers various types of tourism, such as sea, mountain, cultural and health tourism. This diversity increases the competitiveness of the country's tourism sector, responding to the different interests and needs of tourists.

At the global level, however, France has rich experience in urban, cultural, Maritime and gastronomic tourism. According to UNWTO's 2023 data, France was the country with the highest number of tourists worldwide in 2023, receiving 100 million international tourists (UNWTO, 2024)

This success is attributed to the fact that the country offers various types of Tourism and a high quality of Service.

This comparison shows that Azerbaijan can adapt to international competition by diversifying tourism products. The development of new industries, such as gastronomy and rural tourism, for example, can contribute to the sustainable development of the country's tourism sector.

## 9. Infrastructure and services

Tourism infrastructure includes hotels, transport facilities, tourist centers and quality of Service. According to the OECD (2024) report, the level of infrastructure and quality of Service are the main factors that determine the international competitiveness of the tourism sector. The development of tourism infrastructure in the OECD countries is carried out in parallel with the overall development of the economy. For example, in countries such as France and Turkey, infrastructure investments are at a high level, which has a positive impact on the development of their tourism sector.

Infrastructure in Azerbaijan is under development; hotels and transport services, especially in the regions, have not yet been fully provided. According to the data published by the State Tourism Agency of Azerbaijan (2024), various projects are being implemented in the country for the development of tourism infrastructure, but there is still a serious need for development in this area.

Turkey, on the other hand, has high standards in the field of infrastructure. According to OECD (2024), investments in tourism infrastructure in Turkey are steadily increasing, which strengthens the competitiveness of the country's tourism sector.

## 10. Number of tourists and income

According to UNWTO (2024), in 2023 France received about 100 million international tourists. This has led France to become the country that receives the most tourists worldwide.

In 2023, Azerbaijan received about 2.1 million foreign tourists, an increase compared to previous years. According to the data published by the State Tourism Agency of Azerbaijan (2024), the country's tourism revenue amounted to 2.5 billion US dollars.

Turkey, on the other hand, in 2023 received 56 million tourists, which showed a significant increase compared to previous years. T.C. According to the Ministry of culture and Tourism (2023), Turkey's tourism revenue was US \$ 34 billion.

This comparison shows that France and Turkey have high tourist numbers and incomes, but Azerbaijan has also achieved significant developments in the tourism sector in recent years.

## 11. Marketing and branding

Tourism branding and marketing strategies influence the international perception of the country's tourism image. According to the OECD (2024) report, branding and marketing strategies in the global market

directly determine the success of the tourism sector. These strategies increase the interest of tourists in the country, strengthen the flow of tourists and raise the country's international competitiveness.

The "Experience Azerbaijan" platform operates in Azerbaijan and aims to promote the natural and cultural riches of the country. But international promotion is still limited, and the country's brand is not fully accepted among foreign tourists.

The Turkish campaign "Go Türkiye" and the French programs "Visit France" are successful examples. These campaigns have attracted the attention of tourists through high marketing budgets and international promotion networks, increasing the tourism revenues of countries (T.C. Ministry of Culture and Tourism, 2023; UNWTO, 2024).

This comparison shows that Azerbaijan also needs to expand its marketing and branding strategies and increase its international visibility on various platforms in order to strengthen its tourism brand internationally.

## **12. Tourist satisfaction and safety**

Tourist satisfaction and safety are considered key factors for the sustainable development of the tourism sector. According to the OECD (2024) report, together with the recovery of the tourism sector, improving the quality of Service and strengthening security measures are at the forefront. This approach positively affects the experience of tourists, ensuring repeated visits and the growth of tourism revenues.

According to UNWTO (2024), the international tourist flow increased in 2024 by 5% compared to previous years, highlighting the importance of tourist satisfaction and safety. This growth has also had a positive impact on rising tourism revenues and supporting economic development.

In the tourism sector of Azerbaijan, especially in regions such as Baku, Guba, Gabala and Sheki, steps are being taken to strengthen the quality of Service and security measures. However, in some regions there is still a need for improvement in the quality of Service and security issues.

Countries such as Turkey and France are among the more preferred destinations by international tourists, applying high standards in the areas of quality of Service and safety. The experiences of these countries can serve as an example for the development of the tourism sector of Azerbaijan.

## **13. Strengths and weaknesses in tourism**

According to Benchmarking results, Azerbaijan's tourism sector has a number of strengths and weaknesses. Among the strengths, the country's rich natural and Cultural Heritage, Mountain and sea tourism opportunities, historical cities and unique ecotourism areas stand out (Aktaş Çimen, 2024; Azerbaijan State Tourism Agency, 2024). These factors allow Azerbaijan to become an attractive destination for international tourists.

Weaknesses are related to regional differences in infrastructure, unequal service quality, and limited opportunities for international branding and marketing (OECD, 2024; UNWTO, 2024). There are also some development needs in the field of increasing tourist satisfaction and strengthening safety standards.

Regional and global comparisons show that Turkey and France are distinguished by high-standard infrastructure, various tourism products, effective marketing and security measures (T.C. Ministry of Culture and Tourism, 2023; UNWTO, 2024). The experience of these countries forms a fundamental basis for shaping the strategic development plans of the tourism sector of Azerbaijan.



#### 14. Recommendation and results

Based on the results of Benchmarking, a number of strategic recommendations for the development of the tourism sector of Azerbaijan are presented. First of all, it is important to diversify tourism products; new areas such as rural tourism, gastronomy and health tourism should be developed (Aktaş Çimen, 2024).

Improving the quality of infrastructure and services should also be a priority. In particular, increasing the standards of hotel and transport services in the regions, strengthening tourist satisfaction and safety are of great importance (OECD, 2024; Azerbaijan State Tourism Agency, 2024).

In addition, it is important to expand international marketing and branding strategies. The international promotion of "Experience Azerbaijan" platform should be increased, the image of the country should be presented more actively in social media and global tourism exhibitions (T.C. Ministry of culture and Tourism, 2023; UNWTO, 2024).

As a result, benchmarking method comparisons show that Azerbaijan has significant potential in the tourism sector and it is possible to increase competitiveness at regional and global levels through strategic planning. This approach supports both economic development and strengthens the country's position in the international tourism arena.

#### 15. The result

Sustainable tourism management is of paramount importance not only for the protection of nature, but also for the promotion of the well-being of local communities and the transfer of cultural heritage to future generations. The introduction of the concept of "green destination" is a strategic advantage for countries, as this approach serves both to ensure environmental responsibility and to increase competitiveness in the tourism market. Certification systems, in particular international standards such as GSTC and Blue Flag, form indicators of quality, trust and reliability in the field of Tourism.

The experience of Scandinavia and European countries in general shows that the principles of sustainability play a key role in the long-term development of Tourism and have significant consequences both economically and socially. From this point of view, by applying these principles, Azerbaijan will be able not only to increase the potential of ecotourism, but also to form the image of "Green Destination" at the international level. Such a step will create conditions for our country to gain a stronger and more competitive position in the tourism sector.

The main goal for Azerbaijan is to reconcile the national tourism policy with the principles of sustainable development, taking into account international experience. The country's rich natural resources, diverse climatic conditions and deep cultural heritage create favorable conditions for the implementation of these goals.

The research results show that a number of directions are of particular importance for the effective management of sustainable tourism. First of all, it is important to develop the concept of ecotourism and "green destination". At the same time, the introduction of mechanisms for environmental certification of tourist facilities (for example, GSTC and Green Key) will help to ensure quality standards. At the same time, the active involvement of local communities in tourism planning and the protection of their economic interests is an important factor. In addition, the strengthening of educational and environmental education programs, as well as the expansion of cooperation between the public and private sectors and the transparency of the investment climate serve to ensure sustainable development.

Consequently, the consistent and purposeful implementation of the sustainable tourism policy will make a significant contribution to the socio-economic development of Azerbaijan, the balanced progress of the regions and the strengthening of its international image. The steps to be taken in this direction will pave the way for future generations to maintain a healthy ecological environment and ensure the long-term sustainability of Tourism

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