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Matrix for Selecting Methods of Forecasting Regional Socio-Economic Development: An Adaptive Taxonomy for Managerial Decision-Making

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ABSTRACT

The **purpose** of this study is to develop a matrix for selecting methods for forecasting the socio-economic development of regions. The **scientific novelty** of the research lies in the classification of existing approaches used to address this issue, the identification of their advantages and limitations, the specification of required data and resources, the consideration of uncertainty factors and forecast-specific tasks, and the determination of the planning horizon. The study employs such **methods** like a systems approach, as well as comparative and retrospective analyses. The **findings**, obtained through a review of publications on regional socio-economic development forecasting over the past twenty years, may be useful both to the academic community and to decision-makers involved in related policy and management processes.

Keywords: socio-economic development of regions; forecasting methods; selection matrix; adaptive taxonomy

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INTRODUCTION

In conditions of uncertainty associated with geopolitical conflicts, sanctions pressure, economic crises, and social challenges, the ability of regions to ensure sustainable socio-economic development directly depends on the quality of managerial decisions based on diverse forecasts and development scenarios. It is important to note that in the present study, the term “region” (due to the broadness of this concept) is used as a general designation for administrative-territorial entities — constituent entities of the Russian Federation. Methods for forecasting regional socio-economic development are constantly being updated and transformed, which creates significant barriers to their practical implementation due to fragmentation and the lack of a unified integrated approach. Moreover, some approaches remain purely theoretical due to their impracticality caused by resource constraints in regions, the unavailability or complexity of obtaining analytical data, and other factors.

In this regard, there is a need for a comprehensive analysis of existing methods for forecasting regional socio-economic development, their classification in order to determine their applicability in practice, taking into account available data and resource potential.

The adaptability of the proposed taxonomy lies not only in the classification of these methods, but also in their subsequent linkage to specific managerial contexts through a developed selection matrix. This enables the decision-maker (DM) to understand under which conditions a method will be most effective in terms of resources, planning horizon, and level of uncertainty.

It should be noted that forecasting of regional socio-economic development has undergone a significant transformation over the past two decades — from the use of linear extrapolation models to the application of complex adaptive systems, which may be attributed to three main factors: the development of digitalisation, the accumulation of experience in overcoming crisis situations, and a shift in the management paradigm.

In the 2000s, classical econometric methods based on regression analysis of data predominated. Their theoretical foundation was laid in the works of J. Box and G. Jenkins [1], who established the methodology of time series analysis; P. Schwartz [2], the founder of scenario planning; O. Helmer and N. Dalkey [3], who applied the Delphi method; and J. Forrester [4], whose works are based on system dynamics and simulation modelling.

The effectiveness of classical methods under stable conditions (where forecast error did not exceed 5–7%) was demonstrated in the works of A.P. Yanukyan [5] and V.Z. Petrosyants [6]; however, the 2008 financial crisis revealed their key limitation, namely the inability to account for significant changes in data structure.

A turning point in the development of methods for forecasting regional socio-economic development occurred in the 2010s with the spread of digitalisation and simulation tools. For example, in the study by O.I. Babina [7], it was shown that regional “digital twins” make it possible to test scenarios in real time, take into account nonlinear relationships among more than fifty parameters, and visualise the consequences of decisions.

The COVID-19 pandemic became a catalyst for the integration of artificial intelligence (AI) into the solution of this problem. For instance, the results of neural network models by A.R. Dmitrieva [8], which have the unique ability to process heterogeneous data (from environmental indicators to population mobility), proved significantly more accurate than demographic forecasts obtained via regression analysis. At the same time, the role of the scenario approach, considered in particular by A.V. Voloshin [9], has increased.

EVOLUTION AND CLASSIFICATION OF METHODS FOR FORECASTING THE SOCIO-ECONOMIC DEVELOPMENT OF REGIONS

The contemporary paradigm of forecasting regional socio-economic development is characterised by: the hybridisation of methods (for example, the simultaneous use of artificial in-

Econometric and Regression Methods	<p>Key characteristics:</p> <ul style="list-style-type: none"> - use of systems of interrelated equations; - reliance on historical statistical data; - scenario-based variation of control parameters <p>A.P. Yanukyan [5], V.Z. Petrosyanc [6], D.V. Bateikin [10]</p>
Scenario Forecasting Methods	<p>Key characteristics:</p> <ul style="list-style-type: none"> - development of alternative development trajectories (e.g., baseline, innovative, crisis scenarios); - consideration of external uncertainty; - incorporation of strategic regulatory and policy documents <p>D.D. Vavilova [11], S.Yu. Zelentsova [12], Haiyan Hao [13], Yuriy Zhukovskiy [14]</p>
Simulation Modeling Methods	<p>Key characteristics:</p> <ul style="list-style-type: none"> - creation of digital twins of regions; - consideration of nonlinear dynamic processes; - testing of managerial decisions <p>O.I. Babina [7], A.G. Korneev [15], Simon Elias Bibri [16]</p>
Artificial Intelligence and Neural Network Methods	<p>Key characteristics:</p> <ul style="list-style-type: none"> - processing of nonlinear relationships and adaptive learning; - forecasting of multi-parameter systems <p>F.S. Fayzullin [17], Weidong Xu [18], N.I. Lomakin [19], Xinyuan Wang [20]</p>
Integrated Methods	<p>Key characteristics:</p> <ul style="list-style-type: none"> - synthesis of economic and social parameters and indicators; - application of mathematical tools and techniques; - use of rating and ranking assessments <p>O.B. Ponomarev [21], P.E. Tugarool [22], O.S. Zvyagintseva [23]</p>
Expert-Analytical Methods	<p>Key characteristics:</p> <ul style="list-style-type: none"> - qualitative assessments; - SWOT/PEST analysis and related approaches; - normative frameworks <p>R.A. Shibzukhova [24], N.I. Cherkharova [25], Yu.E. Vechtomova [26]</p>
Trend-Statistical Methods	<p>Key characteristics:</p> <ul style="list-style-type: none"> - extrapolation of historical trends; - time series smoothing; - comparative analysis <p>N.N. Gagiev [27], N.S. Komleva [28], A.M. Kipkeeva [29]</p>

Fig. 1. Classification of Methods for Forecasting the Socio-Economic Development of Regions

Source: compiled by the author based on the theoretical analysis of the works by Russian and international scholars, published over the past 20 years.

telligence capabilities, scenario approaches, and macroeconomic tools); their adaptability through feedback mechanisms; and a focus on uncertainty as a constant of development. At the same time, it is important to note that, due to the diversity and complexity of methods, their tools are not always applicable in practice because of various constraints (lack of data, as well as regional resource limitations [financial, human, material, time, etc.]). In addition, each region has its own specific features, and it is precisely its needs that should be taken into account when selecting a method for managerial decision-making. For these purposes, it is first necessary to classify existing approaches to forecasting regional socio-economic development, identifying their limitations and advantages (Fig. 1).

The data in Fig. 1 reflect the diversity and fragmentation of existing methods, which can be grouped according to forecasting horizons: short-term (1–3 years) — focused on operational indicators of regional development (unemployment, inflation, demographic indicators, etc.); medium-term (3–7 years) — primarily focused on strategic planning and development programmes; long-term (over 7 years), where elements of scenario modelling are used.

The following trends in the evolution of methods for forecasting regional socio-economic development can be identified:

- a shift towards hybrid models that take into account a wide range of parameters and tools;

- increasing adaptability of methods and the incorporation of mechanisms for forecast adjustment;

- emphasis on uncertainty and sudden risks (for example, sanctions, pandemics, geopolitics, etc.);

- integration of ESG criteria, i.e. consideration of environmental indicators and parameters of regional development (Fig. 2).

At the same time, all analysed approaches (regardless of the evolution of their development) have a number of advantages and disadvantages (Table 1).

The data presented in Table 1 are further explained below.

1. Econometric and regression methods.

Advantages:

- High accuracy under stable conditions means that the method produces minimal error in the absence of structural changes in the economy and when historical patterns remain stable;

- Transparency of calculations is ensured by the interpretability of the coefficients used in forecasting, which makes it possible to justify managerial decisions;

- Statistical verification enables the practical testing of existing theoretical assumptions using statistical methods.

Disadvantages:

- Require extensive historical data — robust regression models typically require statistical information covering 15 years or more, which is not

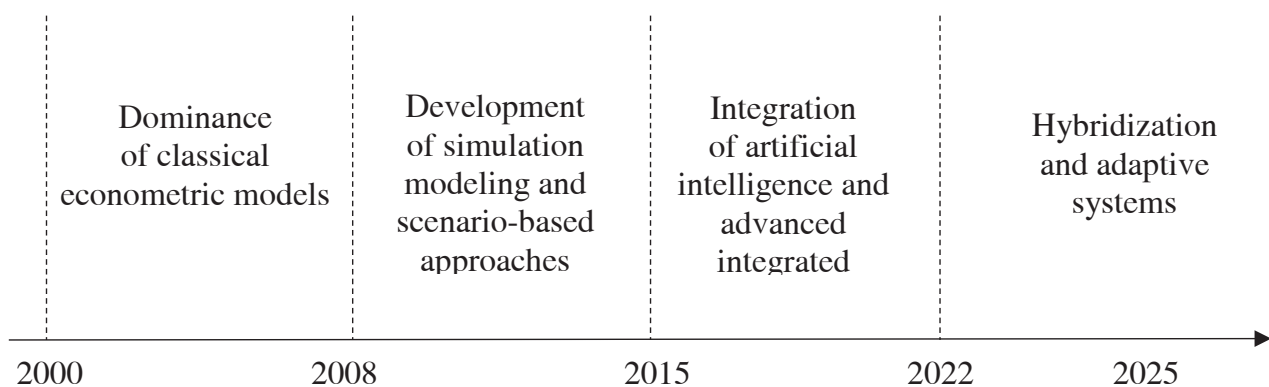


Fig. 2. Evolution of Methods for Forecasting the Socio-Economic Development of Regions

Source: compiled by the author.

available, for example, for newly formed regions of the Russian Federation or in cases where calculation methodologies have changed;

- Do not account for nonlinear shocks — the models fail to predict crises, as they are based on linear extrapolation;
- Risk of multicollinearity is explained by strong correlations between variables (for example, investment and GRP), which may distort forecasting results.

2. Scenario forecasting methods.

Advantages:

- Consideration of uncertainty allows assessment of the consequences of unpredictable events (sanctions, crises) through the construction of alternative scenarios;
- Flexibility of strategic planning is explained by the active use of planning documents, which facilitates the adaptation of forecasts to changing development priorities;
- Visual clarity is achieved through graphs and other visualisation tools.

Disadvantages:

- Subjectivity of scenarios arises from the fact that the selection of scenario variants always depends on experts' individual judgments, reducing the objectivity of forecasts;
- Labour-intensive development is associated with the need to account for a large number of parameters and to incorporate qualitative assessments from multiple experts, etc.;
- Difficulty of quantitative assessment is determined by the largely subjective nature of assigning probabilities to scenarios in the absence of statistical justification.

3. Simulation modelling methods.

Advantages:

- Testing managerial decisions enables the application of developed forecasts without real-world costs;
- Accounting for complex interdependencies in system dynamics makes it possible to model feedback loops;
- Result visualisation makes forecasts more understandable, including for non-specialists.

Disadvantages:

- High data requirements — the application of this method requires several dozen indicators (with time-series dynamics) for at least 10 years;
- Computational intensity is explained by the first limitation;
- Calibration complexity — an error in weighting relationships between indicators may increase forecast error by up to 25%.

4. Artificial intelligence and neural network methods.

Advantages:

- High accuracy is driven by the ability of neural networks and AI to simultaneously analyse interdependencies among dozens of factors;
- Adaptability to new data is explained by the capacity of neural networks and AI for re-training;
- Forecast automation is ensured by the ability to generate results without manual calculations or adjustments.

Disadvantages:

- “Black box” nature is determined by the specifics of neural networks and AI, as internal processes are not transparent to users, which complicates the interpretation of decision-making processes;
- Risk of overfitting is a known issue in the application of neural networks and AI. It occurs when the model learns training data too well during machine learning and loses its ability to generalise new information;
- High computational requirements are necessary to ensure stable operation of neural networks and AI.

5. Integrated methods.

Advantages:

- Holistic perspective is typically formed through the use of composite indicators that include various aspects of regional development;
- Comparability across regions enables ranking and the development of specialised rating systems (e.g., welfare, competitiveness, quality of life, etc.).

Disadvantages:

- Subjectivity of weighting coefficients due to the use of expert methods for their determination;
- Limited practical applicability due to the inability to adapt certain tools used for one region to forecasting in another.

6. Expert-analytical methods.*Advantages:*

- Consideration of non-formalised factors, i.e. those belonging to the category of “qualitative” variables;
- Low data requirements are explained by the widespread use of qualitative information that does not require full statistical analysis.

Disadvantages:

- Subjectivity of assessments of development prospects based on expert judgement, as well as their potential dispersion;

- Dependence on expert competence (the lower the qualification level, the higher the probability of forecasting errors);

- Limited scalability of assessments across multiple regions, due to their qualitative nature.

7. Trend-statistical methods.*Advantages:*

- Simplicity of implementation using standard tools that do not require additional costs (e.g., Excel);
- No need for specialised software or programming skills;
- Clarity of results due to the use of graphs and other visualisation tools.

Disadvantages:

- Inapplicability under structural breaks (due to reliance mainly on linear extrapolation in forecasting);

Table 1

**Comparative Characteristics of the Advantages and Limitation of Methods
for Forecasting the Socio-Economic Development of Regions**

Method	Advantages	Disadvantages
Econometric and regression methods	- high accuracy under stable conditions; - transparency of calculations; - statistical verification	- require extensive historical data; - do not account for nonlinear shocks (crises); - risk of multicollinearity
Scenario forecasting methods	- account for uncertainty; - flexibility of strategic planning; - visual clarity	- subjectivity of scenarios; - labour-intensive development; - difficulty in quantifying probabilities
Simulation modelling methods	- testing managerial decisions; - accounting for complex interdependencies; - result visualisation	- high data requirements; - computationally intensive; - model calibration complexity
Artificial intelligence and neural network methods	- high accuracy in complex relationships; - adaptability to new data; - automation of forecasting	- “black box” nature, interpretability issues; - risk of overfitting; - require significant computational resources
Integrated methods	- holistic assessment of development; - interregional comparability	- subjectivity of weighting coefficients; - limited practical applicability
Expert-analytical methods	- consideration of non-formalised factors; - low data requirements	- subjectivity of assessments; - dependence on expert competence; - low reproducibility and scalability
Trend-statistical methods	- simplicity of implementation; - minimal resource requirements; - clarity of results	- inapplicability under structural breaks; - low long-term accuracy; - neglect of qualitative factors

Source: compiled by the author.

Table 2

Matrix for Selecting Methods of Forecasting Regional Socio-Economic Development

Criterion	Methods							
	Econometric and regression	Scenario forecasting	Simulation modelling	Artificial intelligence and neural network	Integrated	Expert-analytical	Trend-statistical	
	Data							
Rich (>15 years)	●	○	●	●	●	○	○	
Moderate (10 – 15 years)	●	●	○	○	●	●	●	
Limited (<10 years)	∅	●	∅	∅	○	●	●	
	Planning horizon							
Short-term (1 – 3 years)	●	○	○	●	∅	○	●	
Medium-term (3 – 7 years)	●	●	●	●	●	●	○	
Long-term (>7 years)	○	●	●	○	●	●	∅	
	Uncertainty							
Low	●	∅	○	●	○	∅	●	
Medium	●	●	●	●	●	●	○	
High	∅	●	●	○	○	●	∅	
	Resources							
Limited	∅	○	∅	∅	∅	●	●	
Sufficient	●	●	●	●	●	○	○	
	Special tasks							
Testing decisions	∅	○	●	○	∅	∅	∅	
Balance assessment	∅	∅	∅	∅	●	○	∅	
Interregional comparison	●	∅	∅	∅	●	∅	∅	

Source: compiled by the author.

Notes: ● – use of the method/methods is recommended; ○ – use of the method/methods is conditionally recommended; ∅ – use of the method/methods is not recommended.

- Low long-term accuracy (resulting from the first limitation);
- Neglect of qualitative factors, as forecasting is primarily based on statistical data and trend construction.

ADAPTIVE TAXONOMY FOR MANAGERIAL DECISION-MAKING IN THE SELECTION OF METHODS FOR FORECASTING THE SOCIO-ECONOMIC DEVELOPMENT OF REGIONS

In the context of this study, adaptive taxonomy is understood as a classification system of forecasting methods that enables flexible adjustment of the selection process to changing regional conditions and managerial tasks. Taking into account the advantages and disadvantages of the methods described above, it should be noted that forecasting effectiveness critically depends on the degree of alignment between the method and the specific characteristics of the region, the availability of necessary data and resources for their processing, as well as the planning horizon, the presence of uncertainty, and the specific objectives embedded in the forecast. Based on *Table 1*, a decision matrix for selecting forecasting methods is constructed to support their identification and effective practical application (*Table 2*).

The logic for assigning values (“recommended”, “conditionally recommended”, and “not recommended”) to each cell of the matrix is as follows.

Data criterion. Methods that directly depend on large volumes of retrospective information (econometric, AI-based, and simulation methods) are not recommended under conditions of data scarcity. Conversely, when data requirements are less strict (expert-based, trend-statistical methods), such methods are classified as “recommended” under the same conditions.

Planning horizon criterion. Long-term methods (scenario-based, simulation methods) are classified as “recommended”, whereas short-term methods (trend-based methods) are marked as “not recommended” for such horizons.

Uncertainty criterion. Methods designed for uncertain environments (scenario-based, expert-based methods) are marked as “not recommended” under conditions of high uncertainty. Deterministic methods (econometric, trend-based methods) are also classified as “not recommended” under these conditions.

Resource criterion. Resource-intensive methods (AI-based, simulation methods) are not recommended under conditions of limited resources.

Special-task criterion. Recommendations are based on the method’s ability to solve a specific task (for example, simulation modelling is recommended for testing managerial decisions).

Depending on the specific situation in a given region, combinations of methods can be constructed on the basis of the obtained matrix. The step-by-step procedure for its application by the decision-maker (DM) is as follows:

1. Diagnosis of forecasting parameters. The DM assesses the current situation in the region according to all matrix criteria: volume and quality of data, planning horizon, level of uncertainty, available resources, and specific tasks.

2. Selection of the core method. At the intersection of the identified parameters in the matrix, corresponding recommendations are found. Methods marked with ● form the core for constructing the forecast.

3. Formation of a hybrid approach. The DM analyses the possibility of combining methods. For example, under high uncertainty (● for scenario methods) and availability of large datasets (○ for AI), it is possible to create a hybrid model in which AI calculates quantitative parameters for each qualitative scenario.

4. Verification of the selection. The final choice of method must be checked for compliance with resource constraints and the specific characteristics of the region.

The presented matrix demonstrates that, for example, scenario methods are the most universal under contemporary conditions of un-

certainty, while neural network-based methods provide maximum accuracy when Big Data is available. For regions with data scarcity, expert-analytical approaches are recommended, supported by enhanced result verification, whereas for stable environments, econometric and regression methods are more appropriate.

CONCLUSIONS

The diversity of methods for forecasting the socio-economic development of regions can be divided into the following groups: econometric and regression methods; scenario forecasting methods; simulation modelling methods; methods using artificial intelligence and neural networks; integrated methods; expert-analytical methods; and trend-statistical methods. Over time, this classification may be subject to adjustment.

For the effective application of the listed methods, it is important to take into account

specific criteria, namely: the characteristics of the region, the set of required data and resources for their processing, the planning horizon, the presence of uncertainty elements, and the specific tasks embedded in the forecast.

Thus, the developed matrix is a reliable analytical tool. Its practical application will serve as a basis for optimising managerial decision-making in the field of forecasting regional socio-economic development.

The theoretical contribution of the study lies in the development of an adaptive taxonomy of forecasting methods that integrates a classification dimension with managerial selection criteria. The practical value of the work consists in the creation of a decision-making tool – a selection matrix that provides the decision-maker (DM) with a structured and transparent algorithm for choosing a forecasting method adapted to the specific conditions of a region.

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ORIGINAL PAPER



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Main Directions and Methods of Public Administration in Agriculture under Contemporary Russian Conditions

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ABSTRACT

The purpose of this study is to analyse current challenges in the development of domestic agriculture and to identify key methods for addressing them effectively within the framework of public administration. The author proposes a modification of the program-target approach, involving its division into two analytical domains: factors that promote sectoral development and those that constrain growth, followed by their further specification as individual target factors. These target factors were subjected to situational analysis in order to determine the most appropriate intervention mechanisms for modernising the agricultural sector. The study identifies five principal factors shaping sectoral development. For each of these, a set of policy measures aimed at progressive growth is proposed, including financial support for agriculture, export promotion, land reclamation infrastructure development, production intensification, continuation and expansion of import substitution programmes, and rural territorial development as an indirect mechanism of agricultural support. The empirical basis of the research consists of statistical data from Rosstat related to sectoral performance, innovation dynamics in the economy, and indicators of rural territorial development. The concluding part of the article presents an assessment of development factors within the Russian agricultural sector and evaluates the current operating conditions of agricultural production. The findings and conclusions of the study are expected to be of interest to specialists engaged in the governance and strategic development of the agro-industrial complex.

Keywords: agriculture; public administration; agricultural policy; innovation activity of agricultural enterprises; agricultural production; import substitution

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INTRODUCTION

The development concept of Russia emphasizes the self-regulation of economic sectors while minimizing state interference in intra-industry matters [1]. However, due to the high strategic and social significance of agriculture and the agro-industrial complex (AIC), active state participation in the functioning of this system-forming sector becomes inevitable, as it directly affects national security and the quality of life of citizens. The key motivations behind such involvement include increasing agricultural output; ensuring support for the sustainable economic condition of enterprises within the sector and preserving territorial development; reducing dependence on imports; and maintaining stable social conditions in rural areas. The combination of these objectives determines the principal directions of state governance in the agricultural sector. This study is devoted to the analysis of the main approaches and instruments applied within this process and also contains the authors' proposals.

The issues related to the objectives and methods of public administration in the agro-industrial complex have been examined in numerous academic publications. Particular attention should be paid to the works on agricultural development and innovation management by such authors as V.I. Abramov [2], M.N. Dudin [3], L.V. Popova [4], and A.N. Semin [5], as well as to the studies by A.A. Dubovitsky [6] and A.P. Tsypin [7] addressing the problems of rational land use. In terms of international experience in agricultural governance, the works of I.L. Kovalev [8] and A.V. Khotkin [9] are of considerable interest. The articles by V.A. Ovsyannikov [10], M.A. Solomakhin [11], A.E. Suglobov [12], E.A. Shamin [13], D. Panakaje [14], and D. Warjri [15] are particularly valuable from the perspective of rural development prospects. It is also important to mention the studies by I.A. Bareeva [16], G.N. Zvereva [17], V.A. Mironchuk [18], M.S. Oborin [19], O.A. Sagina [20], O.I. Khairullina [21], M. Barbosa [22], and R. Virianita [23], which examine the general

instruments and outcomes of public governance in the sector.

The article presents the scientific conclusions of the above-mentioned authors, along with their comments regarding the feasibility of further policy measures and management actions.

RESEARCH METHODOLOGY

An analysis of studies [1–23] revealed that among the factors influencing the development of agriculture in Russia and abroad — both positive and negative — five of the most significant can be identified (*Table 1*). Their significance decreases from top to bottom (from one to five).

As can be seen from the presented data, the positive factors are associated with economic stability, exports, production intensification, import substitution, and territorial development. These are contrasted with negative factors that hinder the modernization of the agricultural sector.

The study is primarily based on the generalization of existing and potential directions of state influence on these factors. The novelty of the research lies in the systemic analysis of the latter, as well as in the examination of the general development trends of the industry and the statistical analysis (including correlation and regression analysis) of indicators characterizing their individual aspects.

RESEARCH RESULTS

1. The Economic Factor

The globalization of world economic relations creates a highly competitive environment in both external and domestic markets, including the agricultural sector. Thus, the agro-industrial complexes of foreign countries, supported by increased subsidies, are able to pursue active economic expansion into external agricultural markets, which may pose a threat to domestic producers in other states.

State financial support for agriculture constitutes a complex system of numerous major and auxiliary federal and regional programs. In a broader sense, the most significant indicator

Table 1

Factors Facilitating and Constraining the Development of the Russian Agricultural Sector

Nº	Positive factors facilitating the development of the industry	Negative factors constraining the development of the industry
1	Stability of the economic condition of agricultural enterprises; financial support for agricultural producers	Volatility of agricultural product prices; lack of stability in long-term price planning
2	Export of competitive agricultural products	Low level of innovation activity; insufficient use of advanced (digital) technologies
3	Intensification of agricultural production	Insufficient technical equipment; labor shortages
4	Production of import-substituting products	Significant imports of critically important products and technologies.
5	Indirect methods of supporting the rural population in rural areas, infrastructure development, and financial incentives for specialists	Insufficient development of rural areas leading to population outflow; reduction in cultivated land and livestock numbers in a number of regions

Source: compiled by the author.

is the share of subsidies in the total income of agricultural enterprises, expressed in relative terms, as this facilitates cross-country comparisons based on this parameter.

In the international statistics of the Organisation for Economic Co-operation and Development (OECD), this indicator is referred to as the “Producer Support Estimate (PSE), % of gross farm receipts” [24]. A more detailed examination of this issue shows that there is also consumer support, i.e., the subsidization of food prices. However, for Russia this indicator amounts to an insignificant –0.7% of consumer expenditures. Thus, rather than support, there is, on the contrary, increased taxation of agricultural products, albeit to a very limited extent.

According to the overall OECD country ranking in 2021, Russia (based on the data presented by A.V. Loseva [24]) ranked only 22nd in terms of the level of agricultural producer subsidies, with support amounting to 3.7% of producers’ income, placing it between Costa Rica and Brazil. By comparison, this indicator reached 17.6% in EU countries, 23.4% in the United Kingdom, 16.2% in China, and 10.5% in the United States.

The above findings indicate that the level of agricultural support in Russia is comparatively low. On the one hand, this reflects the relatively high efficiency of the sector; on the other hand, it points to its underfunding in terms of ensuring equal conditions of global competition. According to Rosstat data for 2023, this indicator amounted to only 2.1% of gross agricultural output (*Fig. 1*). Its peak was recorded in 2009 (20.2%), after which it has been declining almost continuously.

Figure 1 illustrates the enormous disparity in the level of state support even among Russian regions located within the same federal district: from 0.2% of agricultural producers’ income in the Jewish Autonomous Oblast to 71.9% in the Chukotka Autonomous Okrug. It should be noted that, in general, the volume of subsidies decreases from north to south and from east to west as agroclimatic conditions improve. Moreover, almost all territories situated south of the conditional line “Smolensk–Moscow–Kazan–Yekaterinburg–Tyumen–Novosibirsk–Irkutsk” (i.e., the principal population zone of Russia) belong to areas with the lowest budgetary subsidy component in agricultural production.

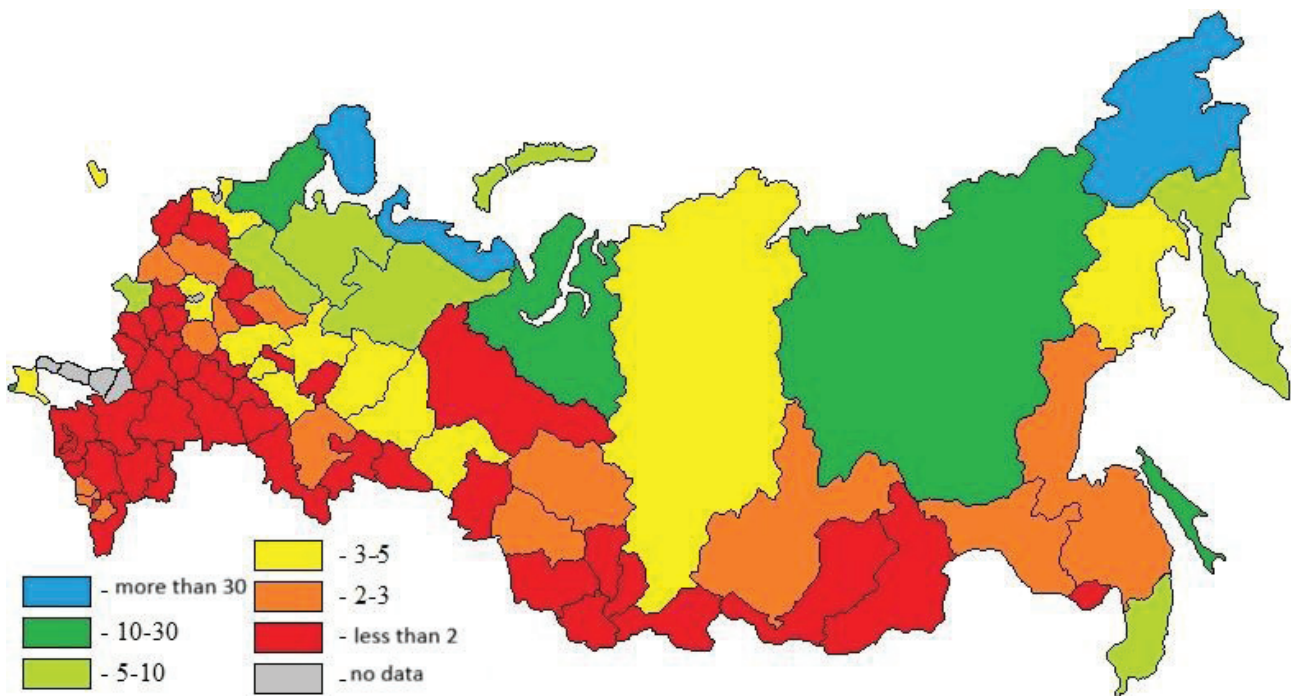


Fig. 1. Level of State Support by Regions of Russia in 2023, % of Gross Agricultural Production

Source: compiled by the author.

At present, the key direction of state policy is to increase the relative volume of subsidies as agroclimatic conditions deteriorate in order to prevent the depopulation of rural territories and preserve production in the Non-Black Earth Region, the North, and the Far East. From a purely economic perspective, such expenditures may appear unjustified. However, the social importance of maintaining inhabited territories and employment across most of the country outweighs the potential short-term economic benefits that could result from reducing such support.

As noted by A.V. Khotkin, the cornerstone of the agricultural policy of any state is the regulation of pricing within the sector [9]. Therefore, the most effective approach would be to ensure stable long-term economic conditions for producers by establishing prices in the system of state procurement that are not lower than the minimum profitability threshold, as well as by providing price subsidies in certain years (also ensuring profitability across all regions of the country). In this context, the quota benchmark should be the

average yield of a particular crop or the average production volume of a livestock product over a specified preceding period. Otherwise, such measures may lead to uncontrolled growth in domestic supply and a crisis of overproduction, as well as provoke undesirable consequences in the form of disputes within the framework of the WTO. These actions should therefore be coordinated with decoupled producer support measures and evaluated from the standpoint of preserving, rather than expanding, commodity production volumes. If such measures are properly quota-regulated, negative reactions from WTO members and accusations of unfair competition practices can be avoided. At the same time, this would guarantee producers economic stability, thereby positively affecting the socio-economic conditions of rural territories.

In conclusion to this section, it should be noted that the regression analysis of the level of subsidies (as a percentage of output value) and agricultural production across regions in 2023 did not reveal any significant effect of subsidy

volumes on output growth. The correlation coefficient was only 0.14, and the significance level was 0.18, which indicates that the “subsidies–output” regression model is statistically unreliable overall. Therefore, it can be argued that current sectoral financing is not aimed at expanding production volumes, although for certain subsectors it remains a critical condition shaping their operation.

2. The role of exports and global market competition.

The export factor is crucial for a number of segments of the domestic agricultural sector. For example, in vegetable oil production in 2021 (with more detailed data for 2022 and 2023 not publicly available), the export share amounted to 54.5%, while in grain production it was 35.3%. It should be noted that these are the most important areas of crop farming: according to Rosstat, grain sales accounted for 26.1% of producers’ revenues in 2021, while oilseeds accounted for 14.1%. Thus, two subsectors generating 40% of total revenue are export-oriented. Maintaining stable export supplies is therefore essential to avoid negative consequences not only in terms of the country’s reputation as a global food supplier, but also in terms of broader socio-economic effects, both at the level of individual enterprises or regions and for agriculture as a whole. Consequently, enhancing the global competitiveness of the domestic agro-industrial complex — primarily crop production, whose output is largely demanded on the world market — represents an important strategic objective of sectoral planning and public administration.

I.L. Kovalev, drawing on international experience, argues that the key direction in the development of modern global agriculture is digitalization [8]. In the context of globalization and increasingly open markets, high technologies serve as a crucial competitive advantage, enabling the intensification of agricultural production through knowledge transfer from the scientific sphere. The formation of the sixth technological

paradigm is naturally extending to all sectors of the economy, and the agro-industrial complex is no exception [2, 4].

However, according to statistical data, the sector’s current level of innovation-driven development remains low (*Table 2*).

As can be seen from the presented data, the indicators of innovation activity among agricultural enterprises have lagged significantly behind the economy-wide average in recent years — being approximately one and a half times lower, while the share of innovative goods is almost twice as low. Only the share of expenditure on innovation as a whole is broadly comparable to the average across all enterprises.

The adoption of digital technologies in agriculture is virtually negligible against the backdrop of Russia’s overall digital development. Thus, expenditure on the implementation and maintenance of advanced technologies in the agricultural sector amounted to only 10.1 billion RUB in 2023 (or 0.2% of total expenditures across all sectors of the economy)—a critically low figure at the national scale. This represents a significant long-term risk for the development of the sector. Therefore, one of the priorities of public policy should be the implementation of measures aimed at integrating agriculture into the sixth technological paradigm.

Naturally, to a large extent, the issue of digital modernization in the domestic agro-industrial complex is related to insufficient technical equipment and a high dependence on imports, the disruption of which that emerged in 2022 has still not been fully mitigated due to low levels of financing. Production intensification — which is the subject of the following section of this study — is in turn determined by the availability of adequate machinery and the overall level of energy endowment in the sector.

3. Intensification of agricultural production.

Adverse demographic trends in the long term will lead to labour shortages in the agricultural sector. In addition, there has been a significant reduc-

Table 2

Innovation Development and Use of Digital Technologies in Russian Agriculture in 2022–2023

Indicator		2022	2023
Level of innovation activity of organizations, %	Total in the economy	11.0	11.3
	Agriculture	7.0	8.8
Share of expenditures on innovation activities in total shipped goods, %	Total in the economy	2.1	2.5
	Agriculture	3.2	2.0
Share of innovative goods, %	Total in the economy	5.1	6,0
	Agriculture	2.6	3.1
Expenditure on the implementation of digital technologies, billion RUB .	Total in the economy	3740	4049
	Agriculture	9.8	10.1
Number of organizations using digital technologies, units Total economy	Total in the economy	247888	248522
	Agriculture	5696	5738
including geographic information systems	Total in the economy	40550	37844
	Agriculture	1208	1221
big data	Total in the economy	...	47314
	Agriculture	...	891
artificial intelligence	Total in the economy	20599	15320
	Agriculture	366	184
RFID	Total in the economy	29799	28105
	Agriculture	730	798
“Digital twin” technologies	Total in the economy	3937	4534
	Agriculture	75	96

Source: compiled by the author.

tion in sown areas [7] and a decline in the overall level of technical equipment. Given the high-risk nature of agriculture across much of the country's territory and its dependence on prevailing weather conditions, the sector's overall “buffer capacity” appears to be insufficient.

All else being equal, countries with more technologically advanced agriculture enjoy competitive advantages in the form of higher productivity, lower dependence on labour shortages, and reduced vulnerability to weather instability. A key indicator in this regard is energy endowment,

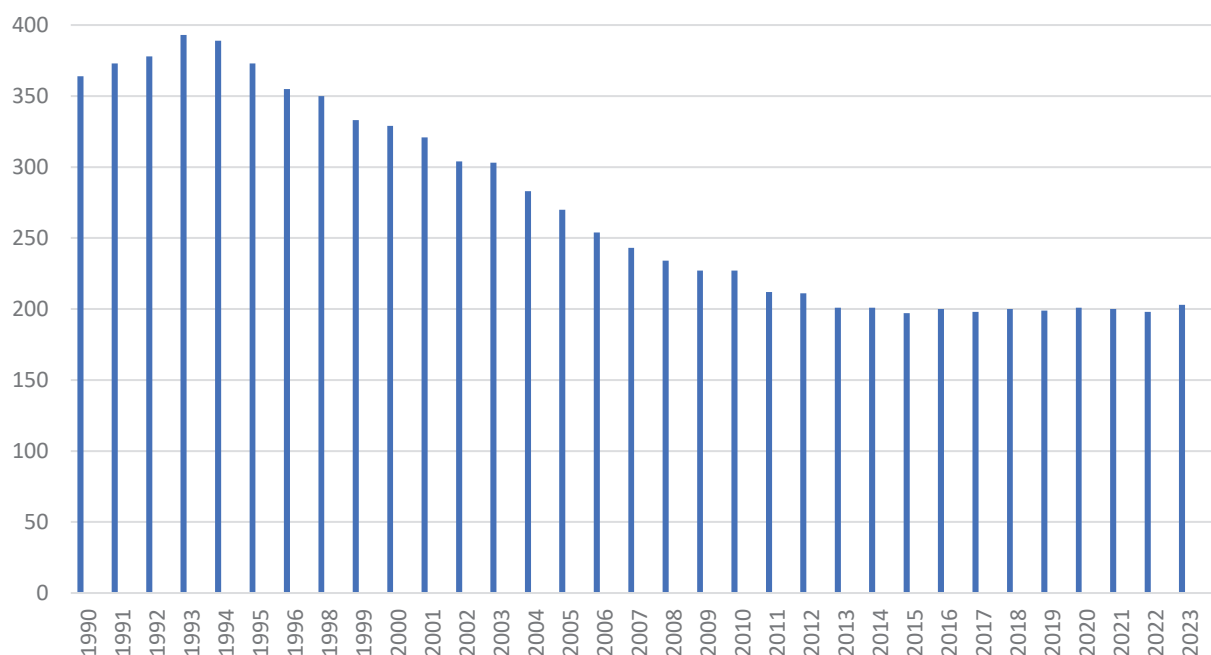


Fig. 2. Dynamics of Energy Capacity in Russia Agriculture, 2000–2023, hp/ha

Source: compiled by the author.

measured as the total engine power per 100 hectares of sown area. In the EU countries, it is approximately 500 hp/ha, in the United States 850 hp/ha, and in Belarus 300 hp/ha. The dynamics of this indicator for Russia from 1990 to 2023 are shown in *Figure 2*.

As can be seen from *Figure 2*, at the beginning of the period the level of energy endowment in Russian agriculture exceeded that of Belarus and was close to the levels typical of European Union countries. However, the decline in energy endowment that began in 1994 and continued until 2013 has resulted in a situation where the current gap with EU countries is approximately 2.5 times, and more than fourfold compared to the United States. Many scholars, for example E.A. Shamin [13], consider the technological factor to be a key reason for the higher crop yields observed in these countries compared to Russia, and this view is difficult to dispute.

The situation with key types of agricultural machinery is presented in *Table 3*.

This information reflects a long-term process of deterioration in the technical provision of agricultural enterprises, which accelerated in the

1990s-2000s, then slowed noticeably, but nevertheless has continued up to the present day. Therefore, an important task of public administration is to halt the decline in machinery load indicators and to ensure an increase in the sector's level of technical provision.

Naturally, the set of policy instruments is not limited to financing machinery purchases alone. It is also necessary to work with enterprises producing agricultural machinery and equipment in terms of expanding product range, improving quality, and increasing productivity.

In order to intensify production, long-term strategic planning of measures related to land reclamation and irrigation is also required.

The data presented in *Table 4* illustrate a decline in the scale of land reclamation works from 1990 to 2005. This was followed by a period of growth, which continues to the present day, although pre-1990 levels have not yet been fully restored. This indicates the limited potential for increasing agricultural output across the sector as a whole, rather than only in selected export-oriented segments (primarily grain and oilseed production). As shown in *Table 4*, the volumes

Table 3

Availability of Selected Types of Machinery in Russian Agricultural Organisations, 1990–2023

Name	1990	2000	2005	2010	2015	2020	2023
Arable land load per tractor, hectares	95	135	181	236	308	349	369
Load per harvester, hectares							
Grain harvester	152	198	253	327	422	451	454
Corn harvester	80	120	215	817	2008	2974	2418
Potato harvester	41	22	31	62	67	66	72
Flax harvester	46	31	46	42	70	114	75
Load per sugar beet harvester, hectares	61	62	93	278	396	431	490

Source: compiled by the author.

Table 4

Land Reclamation Activities in Russian Agriculture, 1990–2023

Name	1990	2000	2005	2010	2015	2020	2023	2023 by 1990	2023 by 2010
Application of mineral fertilizers, kg/ha	88	19	25	38	42	69	76	86	200
Share of fertilized areas, %	66	27	32	42	48	67	72	109	171
Application of organic fertilizers, t/ha	3.5	0.9	0.9	1.1	1.3	1.6	1.6	46	145
Share of fertilized areas, %	7.4	2.2	3.4	7.5	8.4	9.4	9.3	126	124
Liming of acidic soils, million ha	4.7	0.4	0.3	0.2	0.2	0.4	0.3	6	132
Land improvement works, thousand ha:									
•irrigation of land;	105	4.7	0.5	20.5	3.9	38.4	99.7	95	486
•drainage of land;	162	14.2	5.8	2.5	13.0	4.2	1.5	1	58
•land reclamation (agricultural land improvement measures)	865	57.8	25.6	9.8	–	–	–	–	–

Source: compiled by the author.

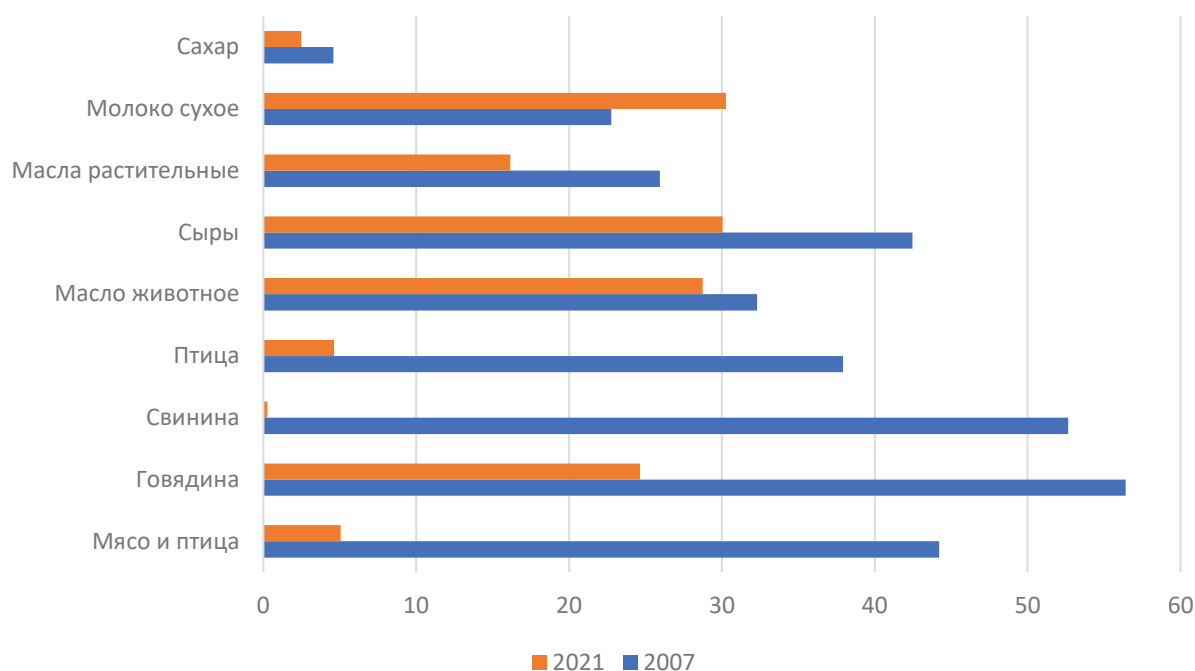


Fig. 3. The Share of Imports in Commodity Resources of Selected Goods in 2007 and 2021, %

Source: compiled by the author.

of mineral fertilizer application have nearly returned to levels observed 30 years ago; the scale of irrigation works has also been largely restored. However, liming, drainage, and other land improvement measures — predominantly relevant to the Non-Black Earth Zone, Siberia, and the Far East — remain at an extremely low level. This reflects the preferential development of agriculturally specialized regions (mainly in the southern part of the country), while in most other territories no significant intensification of agricultural production is observed.

Naturally, import substitution objectives in several areas (milk and dairy products, beef, wool) can only be achieved in a comprehensive manner, taking into account, among other factors, the need to improve soil fertility through land reclamation methods, since the main livestock production zones are located in non-chernozem regions characterized by risky agriculture.

4. Import substitution.

Import substitution processes, initiated back in the 2000s, have had a positive impact on

a number of segments of Russian agriculture (Figure 3*), in particular

Over the past 15 years, near self-sufficiency has been achieved in poultry and pork production, whereas in the mid-2000s this indicator stood at 40–50%. Only in beef consumption does a relatively modest level of imports remain — around one quarter. This has had a positive effect on the socio-economic situation of rural areas, which had been gradually declining following the collapse of the socialist economic system. The intensification of the livestock sector has enabled the domestic agro-industrial complex to reach a new level of development and successfully compete with foreign suppliers in the domestic market. The sanctions imposed by so-called unfriendly countries have also played a role, as European countries were the main competitors of national producers. It should be noted that the counter-sanctions effect is likely to persist in the foreseeable future, as there are currently

* Commodity resource balance statistics for 2022 onward have not been published.

Table 5
Share of Imports in Consumption of Selected Products
Critical for Agricultural Development, 2021, %

Name	%
Amino acids	100
Sugar beet	97
Breeding broiler stock	95
Breeding broiler eggs	90
Sunflower	73
Incubators	70
Feed protein	70
Potatoes	65
Maize (corn)	55
Spring rapeseed	49
Soy beans	45
Plant protection products	41
Seed material	40
Breeding cattle (bovine livestock)	36
Spring barley	22
Spring wheat	16
Winter wheat	3

Source: compiled by the author.

no prerequisites for restoring trade relations to the pre-2014 level.

As for the dairy industry, despite noticeable positive changes, the share of imported products remains high, particularly in powdered milk and cheese (around 30%). This is due to limited capacity in cattle breeding, which affects both milk and dairy production as well as beef output. The solution to this problem lies primarily in the financial domain: in 2022, profitability in crop production amounted to 34.9%, whereas in live-

stock production it was only 11.5%. Therefore, addressing import substitution challenges in the dairy and beef sectors is only possible through increased subsidization.

It should be noted that in 2005 the profitability structure was reversed (9.5% in livestock production and 6.4% in crop production). However, as mentioned above, over the past 15 years, policy priorities have been primarily focused on import substitution and export expansion in crop production, which has led to the emergence of export-oriented subsectors (oilseed and grain production). A similar trajectory may also emerge in other areas, particularly in cattle breeding.

In addition, an important issue is the significant dependence on imported inputs, including seed material, breeding livestock, livestock equipment, plant protection products, feed additives, and others [25] (Table 5).

From Table 5 it can be seen that progress in the sugar industry, the fat-and-oil sector, poultry farming, and livestock production has largely been ensured by technological imports, and this dependence needs to be reduced. This necessity is driven by the fact that food security objectives cannot be fully achieved without reaching a certain threshold in both imported food consumption and the use of foreign technologies through which such products are produced. It is also important that technological imports have been largely provided (and continue to be provided) by unfriendly countries.

Thus, in order to ensure import substitution, first, agricultural production should be increased, as imported products currently account for a significant share of total consumption. Second, measures are required to reduce the share of technological imports in agriculture.

5. Development of rural territories.

The development of rural territories — as an indirect method of supporting the agricultural sector — is particularly important from a WTO perspective, as it is subject to the least criticism

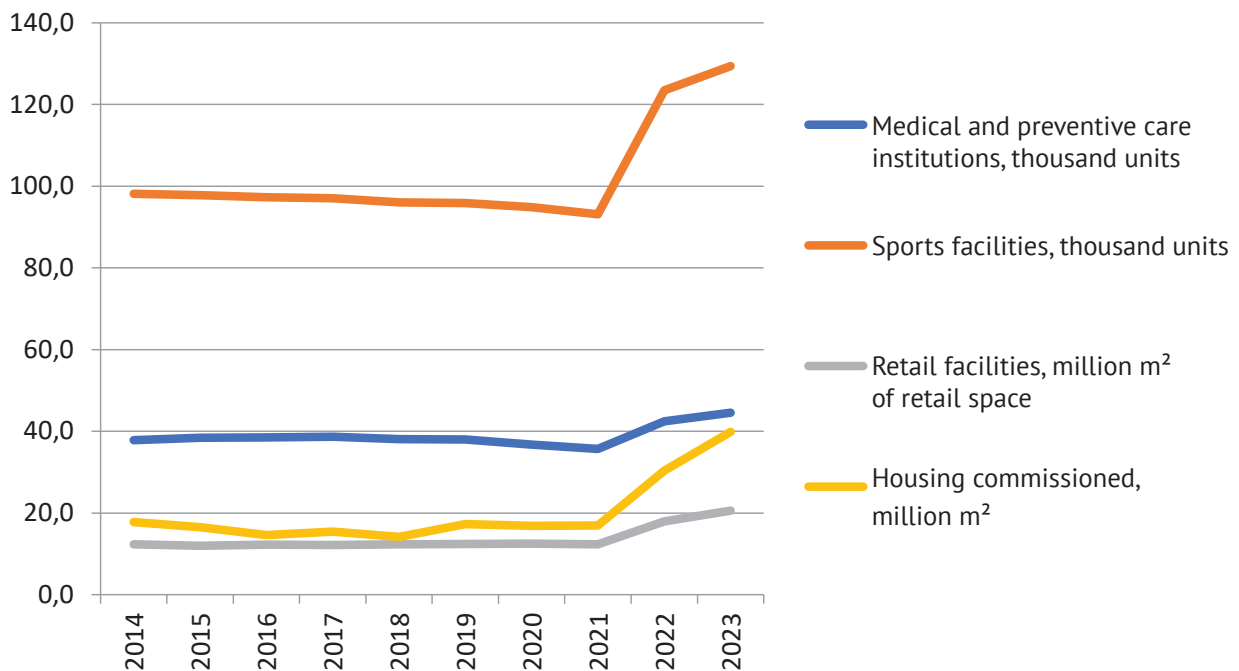


Fig. 4. Availability of Selected Infrastructure Facilities in Rural Areas 2014–2023

Source: compiled by the author.

from member states due to its limited use of distorting, non-market support mechanisms.

The general direction of public policy in this area should include the development of infrastructure (transport, utilities, and communications), tourism, construction, as well as the maintenance of sports and cultural institutions and, above all, education and healthcare services. This would help alleviate labour shortages, improve the quality of life in rural areas, and relieve agricultural enterprises of infrastructure-related costs, thereby providing an additional form of indirect support.

The above applies not only to rural areas but also – under the expanded interpretation of the term “rural territories” – to small towns, which also play an important role in supplying the agro-industrial complex with labour resources, as a significant share of its facilities is located there. The main indicators of infrastructure provision in Russia’s rural territories are presented in *Figure 4*. According to these data, in 2022 there was a significant improvement in the dynamics of key indicators,

particularly in healthcare, sports, retail, and housing construction.

This constitutes a favourable factor for the overall development of the sector, as it helps reduce the gap in living standards between urban and rural areas and increases the attractiveness of employment in rural regions.

DISCUSSION OF RESULTS

Strictly speaking, it is virtually impossible to establish a correlation between indicators of state support and the growth of any specific segment or of overall agricultural output, since it is influenced by a wide range of multidirectional factors. These include climatic and weather conditions, infrastructure development, socio-economic conditions, protectionist policies, and others, which cannot be meaningfully integrated into a single or even several simple mathematical models. *Figure 1* demonstrates that regions with the highest shares of support in Russia are by no means the leading agricultural producers, while the share of state support in gross agricultural output steadily increases from the southern to the northern

regions of the country. In other words, geography is the determining factor behind the relative level of subsidies.

In the international context, it can be observed that the countries with the highest relative level of state support in producers' income are those with the least favourable conditions for agricultural production, although the geographical factor is not as pronounced as in Russia. This is due to characteristics that are less typical for Russia, such as high population density combined with mountainous terrain or limited availability of arable land. The global leaders in terms of the producer support estimate (PSE) include Norway, Switzerland, and Iceland. The first and third are located in clearly high-risk agricultural zones, while Switzerland is characterised by mountainous conditions. They are followed by South Korea and Japan, where limited land availability necessitates high levels of support, as well as the Philippines and the EU (17%), where population pressure and land scarcity also play a significant role.

Thus, in the case of Russia, economic support across regions is primarily required to mitigate differences in climatic conditions, whereas at the international level, additional factors such as population density and limited availability of agricultural land become decisive.

When planning the expansion of Russian agricultural products into global markets, it is necessary to take into account the level of support provided by competing producers in other countries. Target market niches are likely to require a higher level of public financing than might initially be expected. For the development of import-dependent sectors, it is also advisable to consider the effectiveness of protectionist measures, which, for example, had a positive impact on the dairy and meat industries following the counter-sanctions introduced in 2014–2015.

Since 2022, there has been a significant increase in state attention to the infrastructure provision of rural territories, which indicates the implementation of a multidimensional

Table 6

Main Directions and Methods of Public Administration, Based on Development Objectives of Domestic Agriculture under Contemporary Conditions

№	Direction and methods of agricultural management based on the analysis of sector development factors
1	Ensuring state support at a sufficient level to maintain the competitiveness of regional agro-industrial complexes. Increasing support for agricultural producers to the level of the largest global competitors through pricing policy (subsidising costs up to a target profitability level within regional quota frameworks).
2	Stimulating innovative activity and expanding the use of digital technologies in the sector, with a primary focus on geographic information systems, digital twins, radio-frequency identification (RFID), etc.
3	Maximising the development of domestic production of agricultural machinery, improving the technical level of equipment provision. Co-financing of land reclamation measures and implementation of state programmes for melioration at regional and macro-regional levels.
4	Expanding import substitution and localisation programmes. Encouraging import substitution in technologies and critically important agricultural products.
5	Increasing the level of agricultural subsidies in regions in line with worsening agro-climatic conditions in order to prevent depopulation of rural areas in the Non-Chernozem zone, the North, and the Far East.

Source: compiled by the author.

approach to the development of the agricultural sector as a socio-economic complex. The gradual implementation of import substitution programmes, the strengthening of protectionist measures, the expansion of agricultural exports, and the development of the digital economy (including ensuring internet access in small settlements) all constitute a coherent state policy aimed at developing the country's agricultural sector.

CONCLUSION

The theoretical contribution of this study lies in the systemic analysis of the factors shaping the development of the Russian agro-industrial complex (AIC) and the assessment of current economic conditions, which has made it possible to identify the main directions and instruments of public administration (Table 6).

Overall, the general trends can be described as ensuring financing conditions comparable to international standards; reducing intra-regional disparities in support while taking into account differences in climatic conditions; stimulating innovation and the adoption of digital technologies; supporting technological sovereignty; intensifying production through increased energy provision and energy endowment; continuing and expanding import substitution programmes; and supporting rural infrastructure development.

From the perspective of the practical findings of the study, it can be noted that although correlation and regression analysis did not confirm a direct relationship between gross agricultural output and the level of sector financing, a clear geographical pattern was identified in the regional distribution of subsidies relative to gross output.

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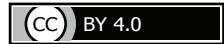
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The Evolution of the Non-Profit Sector in Russia: Regional Ranking Experience and Development Trends of the Third Sector

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ABSTRACT

The article presents a comprehensive analysis of the transformation of the non-profit sector (NPS) across the regions of the Russian Federation based on the Region–NPO ranking (2020–2025). The aim of the study is to identify, through this analytical instrument, key changes in the development of socially oriented non-profit organizations (SONPOs), major trends in the formation of the third sector, and the factors influencing these processes. Drawing on eight ranking criteria and 54 indicators, the paper examines structural transformations within the non-profit sector, the evolving interaction between SONPOs and key stakeholders, changes in support mechanisms, and the specific features of regional third-sector ecosystems. Particular attention is paid to the reduction of interregional disparities and the formation of sustainable development models. The study explores the principal trends in the development of sectoral infrastructure, financial sustainability, and citizen engagement in non-profit activities, as well as the dynamics in the number of organizations. The findings make it possible to identify promising directions for governmental and civic support, as well as to determine success factors and regional typologies of development. **Keywords:** non-profit sector; socially oriented non-profit organizations; regional ranking; third-sector development dynamics; interregional disparities; civil society; efficiency of the non-profit sector

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INTRODUCTION

In recent years, the development of the Russian non-profit sector (NPS) has demonstrated stable positive dynamics, while conditions conducive to the further systemic strengthening and expansion of opportunities for non-profit organizations¹ (NPOs) in the regions have been taking shape. The year 2025 became a key milestone marked by significant achievements related to the infrastructure of the non-profit sector, funding mechanisms, transparency of operations, civic engagement, and information openness.

These positive developments constitute an important indicator of the maturity of civil society and the effectiveness of the state's social policy. Over recent decades, Russia has witnessed the active formation and institutionalization of the non-profit

sector, which has become a significant component of both the economy and the social sphere. In order to assess its condition and development dynamics, a special monitoring instrument – the “Region–NPO²” ranking – was established in 2020 by the Public Chamber of the Russian Federation in partnership with the rating agency RAEX Analytics.

The relevance of the “Region–NPO” ranking is determined not only by the theoretical interest in the subject under consideration [1–4], but also by the practical significance of the identified patterns for shaping effective public policy toward the non-profit sector [5, 6]. The ranking, whose database has by now become substantial, makes it possible to trace significant changes in the non-profit sectors of the constituent entities of the Russian Federation

¹ NGOs (non-profit organizations), including socially oriented NGOs (SO NGOs), constitute the non-profit sector (NPS), also referred to as the third sector

² A new “Region–NGO” ranking has been published. Journal of Charity. URL: <https://givingjournal.ru/2025/11/01/opublikovan-novyj-rejting-region-nko/> (date of access: 08.11.2025).

and to identify stable development trends, thereby contributing to the improvement of the effectiveness of socially oriented non-profit organizations (SO NPOs) themselves [7–9]. The successive stages of ranking third-sector organizations since 2020 — including the publication of the fifth anniversary edition of the ranking in 2024³, as well as the current sixth edition⁴ — provide a unique opportunity for analyzing dynamic processes within the non-profit sector across Russia's regions.

RESEARCH METHODOLOGY

Evolution of the Methodology of the “Region-NPO” Ranking

Before proceeding to the analysis of changes within the non-profit sector, it is necessary to address the evolution of the measurement instrument itself — the methodology of the “Region-NPO” ranking. Over the years of its existence, the methodology has undergone a number of transformations reflecting both the evolving understanding of the nature of the non-profit sector and the aspiration to improve the accuracy and objectivity of assessment.

The pilot edition of the ranking in 2020 included 39 indicators. In 2021, their number increased to 70, which was associated with the expansion of data sources and the intention to incorporate the maximum possible range of aspects characterizing the functioning of the non-profit sector. In subsequent editions, the model was optimized: 58 indicators were used in both 2022 and 2023, while the 2024 edition included 54 indicators. At the same time, the number of analyzed metrics (primary data points) increased to 170, indicating an improvement in the quality of analysis despite the reduction in the number of indicators.

It is important to emphasize that the refinement of the methodology does not disrupt data continuity, since the fundamental structure of the ranking and its key assessment factors have remained

unchanged [10]. This makes it possible to conduct valid comparisons of results across different years and to identify stable trends in the development of the non-profit sector.

Structure of the Rating Model

The 2024 version⁵ of the “Region-NPO” rating model comprises eight key factors, each reflecting a particular aspect of the functioning of the non-profit sector:

1. Economic significance of the non-profit sector in the region (weight: 15%) — assesses the scale and economic contribution of socially oriented non-profit organizations (SO NPOs) to the regional economy.
2. Sustainability of the non-profit sector in the region (weight: 5%) — characterizes the stability of SO NPO operations and their capacity for long-term functioning.
3. Activity level of the non-profit sector in the region (weight: 15%) — reflects the intensity of SO NPO activities and their ability to attract resources.
4. Level of state support for SO NPOs (weight: 15%) — evaluates the volume and diversity of forms of government support provided to SO NPOs.
5. Online accessibility of information on support for SO NPOs in the regions of the Russian Federation (weight: 15%) — characterizes the informational openness and accessibility of support mechanisms for SO NPOs.
6. Media activity of regional SO NPOs (weight: 10%) — assesses the representation of SO NPOs within the information space and media environment.
7. Results of the expert survey on the development of the non-profit sector (weight: 10%) — reflects expert evaluations of the condition of the third sector.
8. Social significance of the non-profit sector in the region (weight: 15%) — characterizes the social impact generated by the activities of SO NPOs.

³ PA RAEX (official website). URL: <https://raex-rr.com/NKO/Region-nko/Region-nko/2024/analytics/> (date of access: 08.11.2025).

⁴ Ibid. URL: <https://raex-rr.com/NKO/Region-nko/Region-nko/2025/analytics/> (date of access: 08.11.2025).

⁵ Maltsev, E. A. Methodology of the Regional Rating of the Third Sector “Region-NGO”. Civic Chamber of the Russian Federation, RAEX (RAEX-Analytics). URL: https://raex-rr.com/files/methods/Region-NKO_methodology_2024.pdf (date of access: 08.11.2025).

Data Sources

The ranking is based on 23 sources of objective information, including data provided by: the Ministry of Justice of the Russian Federation on the number and activities of socially oriented non-profit organizations (SO NPOs); SPARK-Interfax (financial indicators of SO NPOs); SCAN-Interfax (citation rates and media presence); the Federal State Statistics Service (Rosstat), the Ministry of Economic Development of the Russian Federation, and the Ministry of Labour and Social Protection of the Russian Federation; the Federal Tax Service regarding social tax deductions for charitable donations; the Presidential Grants Foundation, the Presidential Foundation for Cultural Initiatives, Rosmolodezh; the analytical platform Similarweb; and other sources.

Of particular value are the results of the 2024 expert survey, which involved 3,506 specialists from 87 constituent entities of the Russian Federation (for comparison, the first survey conducted in 2021 involved 1,881 experts).

ANALYSIS OF CHANGES IN THE NON-PROFIT SECTOR

Dynamics of Key Development Indicators

An examination of the data presented in the “Region-NPO” ranking makes it possible to identify a number of significant changes in the development of the non-profit sector.

Increased Transparency and Formalization of SO NPO Activities

One of the key indicators of the institutional development of the non-profit sector is the share of socially oriented non-profit organizations (SO NPOs) submitting non-zero financial statements. This indicator reflects the degree of transparency in organizational activities and their integration into formal institutional frameworks. Between 2020 and 2023, its steady increase from 50.0% to 55.0% indicates the gradual professionalization of the third sector and improvements in the quality of administrative management within SO NPOs. This constitutes an important institutional transformation, since operational transparency is a necessary condition for building trust in the non-

profit sector among all stakeholders — the state, business, and society.

Growth in Civic Philanthropy

The most remarkable change within the non-profit sector during the period under review was the substantial increase — more than twofold — in charitable donations made by citizens. In 2024, charitable tax deductions were claimed by 20.4 thousand individuals, compared to only 9.9 thousand in 2020.

The growth in the total amount of donations is also noteworthy: from RUB 3.9 billion in 2020 to RUB 7.3 billion in 2024. These figures likewise indicate the legalization of charitable practices and their transition into the formal legal framework.

Such dynamics may be explained by several factors, including: increased financial and tax literacy among the population; improved public awareness regarding the possibility of obtaining tax deductions; the development of digital platforms for charitable donations that simplify the donation process; and strengthened public trust in the activities of SO NPOs and charitable foundations.

Development of the Support System for SO NPOs

During the first five years of the ranking’s operation, substantial changes were observed in the support system for socially oriented non-profit organizations (SO NPOs). Whereas in 2020 Russian regions differed significantly in terms of the level and quality of support provided to the non-profit sector, by 2024 a trend toward the equalization of these indicators had become evident. This is confirmed by the decline in the Gini index⁶ across a number of criteria related to support for SO NPOs, particularly through the development of infrastructure.

Thus, in the majority of constituent entities of the Russian Federation, resource centers have been established and are actively operating, providing non-profit organizations with informational, consulting, educational, and other forms of assistance. Over the five-year period, the number of such centers increased by more than 30%.

⁶ The Gini index (coefficient) is a statistical measure of the degree of inequality within a country or region across a selected variable. It is used to assess economic inequality.

Qualitative changes also occurred in the structure of support for SO NPOs. In addition to financial support, which predominated in 2020, by 2024 property-related, informational, consulting, legal, and educational forms of support had become increasingly developed. This indicates the emergence of a comprehensive approach to the development of the non-profit sector.

Reduction of Interregional Disparities

One of the most important findings of the “Region-NPO” ranking is the existence of significant disparities between regions across individual indicators of non-profit sector development, despite the relative homogeneity of the overall integral ranking⁷.

The greatest disparities — those most directly affecting both the population and non-profit organizations themselves — relate to the following indicators (2023 data):

1. Compensation to NPOs for social services from regional budgets⁸ — Gini index: 56.5%.
2. Total revenues of regional resource centers relative to the total revenues of all SO NPOs — Gini index: 56.2%.
3. Support for SO NPO infrastructure — Gini index: 51.3%.
4. Trend in charitable tax deductions — Gini index: 48.4%.
5. Aggregate social media audience of operating resource centers — Gini index: 42.2%.

At the same time, the most balanced indicators include the share of resource centers submitting non-zero financial statements (Gini index: 7.0%); workforce dynamics (Gini index: 12.4%); and evaluations of interaction between SO NPOs, the media, other SO NPOs, and public authorities (Gini indices ranging from 12.7% to 15.7%).

One of the most significant developments observed between 2020 and 2024 was the reduction of interregional disparities in the development of the non-profit sector. According to data from the

“Region-NPO” ranking, regional differences across a number of key indicators decreased substantially. For example, in 2020 the Gini index for the criterion “Support for SO NPO Infrastructure” amounted to 62.5%, indicating a highly uneven distribution of support among the constituent entities of the Russian Federation. By 2024, this indicator had declined to 58.2%, pointing to a tendency toward greater equalization in the level of infrastructural support for SO NPOs across the country.

A similar trend can be observed for other criteria as well. For instance, the Gini index for the indicator “Total Revenues of SO NPOs Relative to Regional Budgets” decreased from 52.1% in 2020 to 46.2% in 2024, indicating a more even distribution of the financial resources of the non-profit sector relative to the budgetary capacities of the constituent entities of the Russian Federation.

CASES OF SUCCESSFUL REGIONS

An analysis of the ranking data makes it possible to identify territories demonstrating the most significant progress in the development of the non-profit sector. Between 2020 and 2024, 28 regions consistently implemented measures aimed at improving the conditions for non-profit sector activities, and the positions of many constituent entities of the Russian Federation in the ranking strengthened considerably: the maximum increase over the five-year period amounted to 55 positions (with an average improvement of more than 10 positions).

Among the leading regions, particular attention should be given to the Belgorod Oblast (+55 positions over four years), Leningrad Oblast (+39), Smolensk Oblast (+33), Arkhangelsk Oblast (+31), Kirov Oblast (+30), and Kursk Oblast (+29).

An examination of their experience makes it possible to identify several key success factors in the development of the non-profit sector:

Systemic support for SO NPO infrastructure. For example, in Leningrad Oblast the volume of such support increased by 128% (from RUB 1.2 billion to RUB 2.6 billion).

Development of mechanisms for socially beneficial services. In Astrakhan Oblast the number of

⁷ Leaders outperform lagging regions by 2.5 times..

⁸ Federal Law “On the Fundamentals of Social Services for Citizens in the Russian Federation” dated 28.12.2013 No. 442-FZ (latest amendment). URL: https://www.consultant.ru/document/cons_doc_LAW_156558/

service providers operating within this framework increased by 55% (from 11 to 17).

Financial sustainability and legal protection of NPOs. In Astrakhan Oblast the total amount of unresolved legal claims involving NPOs as defendants decreased by 87% (from RUB 20.2 million to RUB 2.5 million).

Active participation in federal competitions and programs. In Orenburg Oblast the total number of projects submitted to the “#WEARETOGETHER” competition increased by 64% (from 14 to 23).

Development of media activity and information openness. In Orenburg Oblast the number of publications concerning SO NPOs, according to the Zircon Research Group, increased by 73% (from 26 to 45).

Growth in the economic significance of the sector. In the Republic of Bashkortostan the total revenues of regional NPOs increased by 41% (from RUB 29.4 billion to RUB 41.4 billion).

GENERAL INDICATORS AND KEY TRENDS OF 2025

Infrastructure for Supporting Non-Profit Organizations

In 2025, more than 150 resource and support centers for non-profit organizations were operating across the country, which is nearly 1.5 times higher than the number recorded in 2024.

At the level of the constituent entities of the Russian Federation, the most developed support infrastructures are observed in Moscow, Saint Petersburg, Belgorod Oblast, Leningrad Oblast, Arkhangelsk Oblast, Novosibirsk Oblast, and Krasnodar Krai.

The development of an effective infrastructure for supporting non-profit organizations represents a key factor in enhancing their sustainability, professionalization, and social effectiveness. The following section examines the current trends in this sphere as of 2025, with particular attention to quantitative indicators, structural transformations, and regional characteristics.

Overview of Current Trends

As previously noted, more than 150 resource and support centers for NPOs are currently operating in Russia as of 2025.

The nearly 1.5-fold increase compared to 2024 reflects targeted governmental and private-sector initiatives aimed at strengthening the ecosystem of civil society organizations.

The number of digital platforms is also increasing: between 2024 and 2025, their number grew by more than one third. The expansion of online resources contributes to transparent communication, simplifies access to grants and consulting support, facilitates the organization of educational programs, and promotes the exchange of experience. As a result, conditions are being created for more effective interaction between sector participants, public authorities, businesses, and civil society.

Regional Features of Infrastructure Development

Among the constituent entities of the Russian Federation, the leading regions in terms of NPO support infrastructure include:

Moscow and Saint Petersburg — the largest metropolitan areas, characterized by extensive networks of resource centers and digital platforms. Their infrastructure is distinguished by a high degree of automation, a broad range of services, and frequent integration with both national and international platforms.

Belgorod Oblast and Leningrad Oblast — regions actively implementing support programs for the sector and developing regional portals and educational platforms that contribute to the formation of sustainable and professional non-profit organizations.

Arkhangelsk Oblast, Novosibirsk Oblast, and Krasnodar Krai demonstrate substantial progress in improving basic support resources, thereby creating conditions for the emergence of local initiatives, the expansion of support mechanisms, and increased public trust in the sector.

These regions stand out due to the high level of integration of infrastructural elements and the active utilization of local capacities, which contributes to improving the effectiveness of the non-profit sector.

Analytical Perspective

The increase in the number of support centers and digital platforms has been accompanied by growing levels of professionalization and transparency

within the activities of non-profit organizations. This trend contributes to lowering entry barriers for new participants and improving the quality of projects implemented within the sector. Overall, infrastructure development constitutes a strategic objective that enables the systematic growth of the non-profit sector, particularly in the context of contemporary social and economic challenges.

The successful implementation of infrastructure development initiatives demonstrates the expanding capacity of the non-profit sector to carry out socially significant projects and contributes to the strengthening of civil society.

Financial Support for the Sector

The total volume of charitable donations exceeded RUB 500 billion by the end of 2024⁹. The volume of state grant funding and subsidization of the non-profit sector amounted to approximately RUB 18 billion, representing an 11% increase compared to the previous year. This trend has been driven by increasing civic engagement and the expansion of tax deduction mechanisms. Charitable platforms are actively adopting new instruments, including online payment systems, mobile applications, and crowdfunding services.

Professionalization and Transparency

The share of non-profit organizations submitting non-zero financial statements reached 55% by the end of 2023, significantly increasing public and governmental trust in the sector. The implementation of automated reporting systems, national registries, and transparent digital platforms has helped reduce the bureaucratic burden placed on organizations. The level of competence among NPO staff and managers is also increasing, primarily through training programs, certification initiatives, and participation in professional associations.

Civic Engagement and Charitable Activity

According to recent studies, citizen participation in charitable campaigns and community initiatives has increased more than threefold, with approximately 3 million individuals claiming charitable tax deduc-

tions. The total volume of charitable donations exceeded RUB 7 billion.

Media Activity and Information Openness

Compared to 2024, the number of thematic publications, reports, and news materials increased by 17%. Particular attention should be paid to the development of platforms for the public presentation of non-profit activities, including the creation of interactive maps, online reporting systems, video blogs, and podcasts. At the same time, regional authorities are directly involved in promoting the activities of non-profit organizations through internet platforms and mass media channels.

Regional Dimension and Rankings

The top ten constituent entities of the Russian Federation in terms of the development of socially oriented non-profit organizations (SO NPOs) in 2025 included: Moscow, Vologda Oblast, Samara Oblast, Chelyabinsk Oblast, Nizhny Novgorod Oblast, Republic of Tatarstan, Khanty-Mansi Autonomous Okrug – Yugra, Leningrad Oblast, Belgorod Oblast, and Krasnoyarsk Krai.

Table 1 presents the characteristic features of the non-profit sector infrastructure demonstrating high growth rates across a number of regions.

However, despite the positive trends observed in the development of the non-profit sector across Russia, a substantial gap persists between regions with well-developed infrastructure, high levels of information activity, and significant funding opportunities, and those where civic initiatives continue to face serious barriers. The principal characteristics of the existing lagging regions include the following:

6. A small number of NGOs and their low level of activity: their operations are often concentrated primarily on local initiatives without broad media and communication support.

7. Limited infrastructure: a lack of specialized venues, support centers, and resources necessary for organizing events, educational programs, and consulting activities.

8. Low levels of public awareness and media activity: the absence or insufficient development of platforms for public reporting and the dissemination of information about sectoral activities.

⁹ Frank RG. URL: https://frankrg.com/wp-content/uploads/public-files/Sber_PB_Frank_RG_Charity_2025.pdf (date of access: 08.11.2025).

Table 1

Regions with High Growth Rates of Socially Oriented Non-Profit Organizations (2025)

Region	Commentary
Belgorod region	Systemic support and the creation of NGO clusters
Leningrad region	Expansion of infrastructure projects
Arkhangelsk region	Active development in the field of social services
Novosibirsk region	Growth of regional support and initiatives
Krasnodar region	Infrastructure development, tourism, and the eco-sector
Kaliningrad region	Innovative projects and interregional cooperation
Republic of Tatarstan	Active participation of business and government
Moscow region	Continuous growth in support and project integration

Source: compiled by the author.

9. Funding shortages caused by the lack of internal revenue sources, insufficient large-scale federal or regional support, and a limited number of grant funding and subsidy programs.

10. Geographic and socio-economic factors: such regions are typically located in remote areas and are characterized by low household incomes and underdeveloped social infrastructure.

Examples of lagging regions are presented in Table 2.

The principal reasons for the weak development of the non-profit sector in these territories include the following:

1. Economic factors. In regions with weak economic performance and high unemployment rates, the decline in support for civic initiatives is primarily associated with the limited financial capacities of both the population and organizations.

2. Political and administrative factors. In a number of regions, there is an insufficient level of political commitment or limited resource capacity for supporting the sector, which is reflected in weak infrastructure, the absence of grant programs, and inadequate support for civic initiatives.

3. Cultural and social characteristics. Traditions associated with skepticism toward civic initiatives may create barriers to the development of the sector.

Infrastructure deficiencies. These include an underdeveloped network of organizations, a weak media environment, and the absence of information platforms for covering NGO activities.

The major challenges associated with the above-mentioned issues include the following:

1. The problem of information isolation and the resulting limited opportunities for attracting public attention to NGO initiatives.

2. Insufficient internal funding. The lack of federal and regional support programs hinders the development of non-profit infrastructure.

3. Geographic isolation and low mobility. These factors create difficulties in experience sharing, training, and establishing partnerships with more developed sectors.

Lagging territories require special attention from both federal and regional authorities.

In order to address the identified problems, the following support measures appear particularly promising: the introduction of targeted financing programs and grant projects in regions with low civic activity; the creation of regional platforms and media services to promote NGO activities; the implementation of educational and training programs for sector leaders and active participants; and the strengthening of interregional experience exchange and partnership networks.

RESULTS AND DISCUSSION

The analysis of the changes identified on the basis of the Region-NGO ranking for 2020–2025 is grounded in a comparison of the ranking indicators, including the number of registered organizations, activity indicators (the number of implemented projects and

Table 2

Regions with a Low Level of Non-Profit Sector Development (2025)

Region	The main reasons	Specificities	Media resources and support
Republic of Ingushetia	High political and economic instability; low engagement of the civic sector	Small population size and limited civic initiatives	Absence of regional platforms and media outlets covering NGO activities
Republic of Dagestan	Economic difficulties and weak civil society development	Low public awareness and insufficiently developed sectoral infrastructure a	Almost complete absence of platforms for reporting and informational support
Karachay-Cherkess Republic	Traditionally oriented toward large businesses and state projects	Low activity of non-governmental initiatives	Underdeveloped network of information resources
Yamalo-Nenets Autonomous Okrug	Geographic remoteness and harsh climatic conditions	Constraints on the development of local NGOs and a low level of media culture	Weak local information activity
Republic of Kalmykia	Economic dependence and irregular support from federal authorities	Low level of information transparency	Lack of developed systems for publishing NGO activities
Tuva Republic	High level of isolation and weak infrastructure	Small population size and underdeveloped sector	Limited opportunities for reporting and public communication

Source: compiled by the author.

the level of public engagement), funding indicators (the volume of grants, state support, and other funding sources), as well as infrastructure-related factors (the presence of regional support centers and development programs¹⁰).

Growth in the Number of Organizations and Structural Transformation of the Sector

According to the ranking data, the period from 2020 to 2025 was characterized by a steady increase in the number of registered NGOs. The average annual growth rate amounted to approximately 7%, indicating the continued development of civic initiative-based society. The most significant progress was recorded in regions with extensive government support (for example, Republic of Tatarstan and Saint Petersburg), and was accompanied by demographic and structural transformations, including an increasing share of professional organizations and the emergence of new forms of activity such

¹⁰ As a result of systematizing regional characteristics of third-sector development, key factors influencing its dynamics were identified. Correlation analysis and clustering methods were used to distinguish typological groups of regions based on the level of development and the sector's dynamics..

as online initiatives and social entrepreneurship.

Financial Sustainability and Sources of Funding

The ranking indicators demonstrate both an increase in the volume of attracted financial resources (including grant funding and private donations) and the diversification of funding sources, as well as the formation of sustainable financing models for active NGOs. However, regional disparities persist: unlike major urban centers, smaller territories continue to face a shortage of resources.

Development of Infrastructure and Regional Support Programs

The infrastructure of the non-profit sector has strengthened considerably, as reflected in the establishment of regional support centers, the expansion of mentoring programs, educational platforms, and coordination structures. According to the ranking data, the effectiveness of these measures is evidenced by increased levels of civic engagement, the expansion of project geography, and stronger intersectoral cooperation.

Regional Development Patterns and Typologies

Cluster analysis identified three principal regional typologies: major metropolitan regions, developing

regions, and stagnating regions. The leading positions are occupied by Moscow, Saint Petersburg, and Yekaterinburg, which demonstrate the highest growth dynamics across the majority of indicators. Developing regions are characterized by moderate growth and the active implementation of state support programs, whereas stagnating regions are represented by federal subjects with low levels of NGO activity and organizational density caused by insufficient infrastructure and limited resources. These typologies are shaped by the specific features of territorial policy, economic conditions, and the level of civic culture.

The Impact of External Factors and Challenges

The COVID-19 pandemic had a destabilizing effect on the sector, while simultaneously stimulating the transition to remote forms of operation and fostering the development of new channels of communication and audience engagement. At the same time, economic constraints continue to hinder the emergence of new initiatives in lagging regions¹¹.

CONCLUSION

The analysis of non-profit sector rankings for the period 2020–2025 indicates several important trends in the development of the non-profit sector across Russian regions. Russian NGOs demonstrate steady growth across all key indicators. Infrastructure and financial support mechanisms continue to expand, contributing to higher levels of professionalism and increased public trust. Territorial disparities and regional imbalances are gradually decreasing due to the implementation of systemic programs and federal initiatives. The scale

¹¹ The implementation of recommendations aimed at strengthening infrastructure in lagging regions and enhancing systemic support programs will help ensure a more balanced development of the sector and increase its social effectiveness.

of civic participation is also increasing significantly, as evidenced by the steady growth in the number of donors and, consequently, in the volume of tax deductions for charitable contributions.

Under these conditions, new platforms for service provision, support, and interaction are being actively developed.

The results of the analysis of the Region–NGO ranking data for 2020–2025 make it possible to draw several important conclusions regarding the current state and future prospects of Russia’s national non-profit sector. The sector remains characterized by substantial disparities, reflecting not only differences in the economic potential of regions but also variations in local authorities’ approaches to NGO activities. Despite the progress achieved, several federal subjects still demonstrate low levels of support and weak infrastructure. There also remains a need to improve the quality of organizational performance, reporting standards, and transparency.

In this regard, the following areas appear particularly promising:

- strengthening network-based and digital platforms;
- expanding financial support mechanisms through the introduction of new capitalization instruments;
- increasing professionalism through training and certification programs;
- intensifying interregional exchange of experience and best practices;
- deepening the integration of NGOs with government institutions and business structures.

Overall, future efforts should focus on reducing regional disparities, developing innovative support mechanisms, and ensuring the full integration of the non-profit sector into the country’s social and economic policy framework.

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The Process Model of Digital Transformation of a Resource-Supplying Organization

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ABSTRACT

The digital transformation of resource-supplying organizations in Russia is becoming a key element in ensuring the sustainable development of the public utilities sector. In the context of increasing demand for energy efficiency, automation, and transparency of business processes, companies are progressively implementing advanced technologies ranging from smart metering systems and remote monitoring to big data analytics and artificial intelligence. These solutions enable organizations to optimize operating costs, reduce resource losses, improve forecasting accuracy, and enhance the quality of customer service. The **objective** of this study is to develop a process-based model of digital transformation for a resource-supplying organization. The **relevance** of the research is determined, on the one hand, by the need to ensure both the sustainable development of public utility enterprises and the accessibility of their services to the population, and, on the other hand, by the necessity to align with national regulatory priorities and state policy. In particular, this includes achieving the objectives of the national project “Digital Economy” and the ministerial project “Smart City” implemented by the Ministry of Construction of the Russian Federation. The article presents an analysis of the impact of methodological and practical approaches to the implementation of innovative technologies, modern services, and digital platforms on managerial decision-making processes. The study employs such research methods as comparative and logical analysis, including a review of academic literature. The **findings** may be of practical relevance to resource-supplying organizations and to the academic community in the development of effective approaches to managing public utility infrastructure.

Keywords: public utility infrastructure; digitalization; smart housing and utilities; innovative technologies; digital solutions

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INTRODUCTION

In recent years, the utilities sector — particularly water supply, district heating, and other municipal services — has witnessed active implementation of digital technologies. A notable example is the “Digital Water Utility” project developed by Rosatom Infrastructure Solutions (RIS JSC¹), implemented in Glazov (Udmurt Republic). Digitalization in this case enabled a reduction in network losses by 11%, a decrease in electricity consumption by 20%, and a 60% increase in labor productivity. These results demonstrate the significant potential of such technological solutions for improving operational efficiency and reducing costs. Another relevant case is the digital transformation experience of Nizhny Novgorod Vodokanal.

Government support for the digitalization of the housing and utilities sector has further contributed to its development. Within the framework of the national projects “Digital Economy” and “Housing and Urban Environment,” the “Smart City²” initiative was launched, with federal budget funding exceeding 800 million RUB in 2019–2024. Large-scale digitalization of urban infrastructure has included methodological support for the development and implementation of standards and solutions, as well as the creation of a repository of best practices.³

However, despite the positive outcomes achieved, the level of digitalization expenditure among resource-supplying organizations (RSOs) remains relatively low. According to a study conducted by researchers at the Higher School of Economics (HSE), telecommunications companies, the financial sector, and manufacturing industries rank highest in terms of digital technology spending. Energy supply organizations occupy 11th place, while water supply

and wastewater management organizations rank only 18th.⁴ The primary reason for this situation is the lack of sufficient financial resources for infrastructure maintenance and renewal, driven by high asset depreciation, payment collection issues, and tariff regulation constraints. As a result, automation is not a strategic priority for these organizations.

In the context of limited resources, it is essential to understand the specifics of digital solution implementation in RSOs in order to ensure an optimal balance between costs and achieved outcomes.

GENERAL MODEL FOR IMPLEMENTING INNOVATIVE TECHNOLOGIES IN ORGANIZATIONS

At present, the academic literature extensively addresses innovation management. Among the diversity of approaches to innovation adoption, a universal model can be identified, which includes the following key stages of the innovation process⁵ [1]:

- defining objectives and generating an idea;
- developing an innovation program and its feasibility study;
- allocating responsibilities and making decisions on the innovation program among all participating stakeholders;
- implementing the innovation program;
- monitoring the execution of the innovation program;
- analyzing and evaluating the effectiveness of the innovation program;
- adjusting the innovation program.

Any innovation process — whether process optimization, the development of a new product, or service quality improvement — begins with setting objectives that reflect the strategic priorities of the organization.

An idea is then generated, drawing on both internal sources (employees, management) and external stakeholders (customers, partners, com-

¹ JSC “Rosatom Infrastructure Solutions” (official website). URL: <https://www.rusatom-utilities.ru/activities/tsifrovye-tehnologii/dlya-goroda-i-regiona/smart/informatsionnaya-sistema-tsfrovoy-vodokanal-alternativnoe-nazvanie-programmnyy-kompleks-tsfrovoe-teo-detail/>

² Ministry of Construction of Russia (official website). URL: <https://minstroyrf.gov.ru/trades/gorodskaya-sreda/proekt-tsifrovizatsii-gorodskogo-khozyaystva-umnyy-gorod/>; “Smart City” Project. URL: <https://gorodskreda.ru/smartcity>

³ Ministry of Digital Development, Communications and Mass Media of the Russian Federation (official website). URL: <https://digital.gov.ru>

⁴ Expenditures on the Development of the Digital Economy in 2023. Institute for Statistical Studies and Economics of Knowledge, HSE University. URL <https://issek.hse.ru/news/984068213.html> (date of access: 03.06.2025).

⁵ Beynar I.A. Innovation Management. Study guide. Kursk: Universitetskaya Kniga; 2021. 80 p.

petitors). Analytical and creative methods are used for idea generation, including the MECE principle (Mutually Exclusive, Collectively Exhaustive) [2], which ensures logical completeness and the absence of overlap in decision-tree structuring. This tool enables a systematic approach to selecting innovation directions by evaluating alternatives in terms of benefits, costs, and probability of success.

Next, based on the idea, a structured implementation plan is developed — an innovation program.

In parallel, a feasibility study (techno-economic justification) [3] is conducted, during which the technological feasibility of the idea is assessed, required investment volumes are specified, risks are evaluated, and expected returns are forecasted. The feasibility study plays a critical role in the decision-making process regarding project initiation and the selection among alternative options.

For the successful implementation of an innovation program, changes in the organizational structure of resource-supplying organizations (RSOs) are required, along with the allocation of responsibilities among participants [4]. This involves the formation of a project team or working group, as well as the establishment of accountability systems, interaction mechanisms, and communication channels. At the same time, it is important to ensure a balance between centralized management and the involvement of all stakeholders — from top management to operational staff.

At the implementation stage of innovation, particular attention is paid to the management of timelines, budgets, and quality, as well as to the timely response to emerging changes [5]. In parallel, the execution of the program is monitored and key performance indicators are continuously tracked.

Following the pilot implementation of innovations, an evaluation of the achieved results is conducted in terms of:

- quantitative indicators (increase in profit, reduction in costs, productivity growth);
- qualitative effects (improvement of customer experience, increased organizational flexibility, development of an innovation-oriented culture);

- social and environmental factors (where applicable).

Within the assessment framework, the degree of achievement of the set objectives, the level of deviation from the original plan, and the efficiency of resource utilization are determined.

Based on the analysis of project effectiveness, one of the following decisions is made:

- refinement of the innovation;
- introduction of additional solutions (adjustment);
- scaling of successful practices to other departments or processes;
- closure of the project in case of low effectiveness.

The adjustment stage is a crucial feedback mechanism, enabling the transition from a one-time innovation project to a continuous organizational development process.

In contemporary conditions, among various directions of enterprise innovation, digital transformation (DT) is gaining particular importance. It not only meets the requirements of technological progress but also serves as a key factor in enhancing the sustainability, transparency, and efficiency of organizations, particularly in the resource supply sector.

EXISTING THEORETICAL AND PRACTICAL APPROACHES TO DIGITAL TRANSFORMATION OF A RESOURCE-SUPPLYING ORGANIZATION

As part of the analysis of practical approaches to the digital transformation (DT) of resource-supplying organizations (RSOs), this study examines the experience of Nizhny Novgorod Vodokanal and Rosatom Infrastructure Solutions.

Case Study: Nizhny Novgorod Vodokanal⁶

As the foundation for its digital transformation initiatives, the company adopted the domestic back-

⁶ How Digital Technologies Transformed Nizhny Novgorod Vodokanal. Delovoy Kvartal. 2023. URL: <https://nn.dk.ru/news/237186010>; URL: <https://vodanews.info/upravlenie-it-proektami-opyt-ao-nizhegorodskij-vodokanal/>

office personnel management system “Gandiva,” a software platform that provides functionality for communication management, user support (Service Desk), electronic document management, and project management.

The implementation of this system was initiated by the IT department, as its employees possess the highest level of competence in mastering and applying new digital tools. Moreover, effective interaction between IT specialists and other departments was identified as a key factor determining the success of the organization’s digital transformation.

The implementation of the “Gandiva” system followed several stages:

- approval of the decision to implement the information system through an executive order issued by top management;
- establishment of a digital transformation working group (Digital Transformation Office), which included representatives of all organizational units where business processes were subject to change. Within the Digital Transformation Office, technical specialists were tasked either with selecting appropriate solutions from other industries or with developing them independently. In practice, the first approach was applied, drawing on best practices from banking, IT companies, telecommunications operators, car dealerships, and other sectors;
- initial employee training and communication of the benefits of the innovation;
- system implementation;
- provision of user support and assistance in working with the new system.

The main objectives of automation and digitalization at Nizhny Novgorod Vodokanal included optimizing customer interaction processes, increasing transparency of business processes across all management levels, and improving the organization of production activities aimed at cost reduction.

A wide range of information systems was introduced at the enterprise, each implemented as a separate innovation project: 10 solutions in 2019, 12 in 2020, and 14 in both 2021 and 2022.

Tables 1 and 2 provide a brief description of the most significant digital systems and services.⁷

The key challenges of digital transformation faced by the enterprise are presented in Table 3.⁸

Overall, based on the analysis of the experience of Nizhny Novgorod Vodokanal, the following stages of digital transformation can be identified (Table 4⁹).

When implementing digital systems at Nizhny Novgorod Vodokanal, the following principles were applied:

- Systems approach: integration of all projects into a unified digital development strategy.
- Customer orientation: focus on improving interaction with customers and enhancing service quality.
- Information security: special attention to data protection and compliance with regulatory requirements.
- Training and professional development: improvement of employees’ digital literacy and training in new technologies.

Case Study: Rosatom Infrastructure Solutions

Rosatom Infrastructure Solutions is gradually implementing a platform-based hardware and software complex in small cities across its facilities to automate core business processes of resource-supplying organizations, known as the “Digital Water Utility” system.

The primary objective of this initiative is to create a unified information environment for:

- resource management based on big data;
- digital monitoring of measurable performance indicators;
- improving the efficiency and transparency of processes;
- establishing high-tech workplaces with increased productivity.

⁷ How Digital Technologies Transformed Nizhny Novgorod Vodokanal. Delovoy Kvartal. 2023. <https://nn.dk.ru/news/237186010>

⁸ KODA NEW. URL: <https://vodanews.info/upravlenie-it-proektami-opyt-ao-nizhegorodskij-vodokanal/>

⁹ How Digital Technologies Transformed Nizhny Novgorod Vodokanal. Delovoy Kvartal. 2023. <https://nn.dk.ru/news/237186010>

Table 1

Production Services

Service Name	Year of Implementation	Functionality	Effects
Production Resource Management	2020	Request tracking, task execution control, reporting statistics, and GIS-based mapping analysis	Improved efficiency of maintenance operations; reduced reporting time
Legal Digital Platform	2020	Case management, template documentation, integration with electronic document management systems, the State Automated System "Justice," and Outlook	Increased efficiency and transparency of litigation and claims management processes
Information Security Systems	2021	Prevention of data leaks and information security threats	Strengthened enterprise information security
Employee Telegram Bot	2021	Notifications about emergencies, outages, and service requests	Reduced SMS costs and improved information delivery
Address Storage and Barcode System	2022	Inventory accounting, real-time material tracking, terminal-based search and issuance, automated resource planning	Optimization of warehouse operations without the need for desktop computers
Business Intelligence (BI) Visualization Systems	2022	Real-time monitoring of key performance indicators of equipment, units, workload, and service requests	Integration of monitoring into real-time operational processes; optimization of equipment performance and staff workload
Automated Process Control System (APCS)	2022	Management of technological equipment, automated data collection from flow meters, control of smooth start-up of units, pressure regulation systems, metering, automation, etc.	Automation and real-time remote control; increased operational reliability
IP Telephony (Yeastar IP PBX)	2022	Monitoring system and transition to IP-based telephony	Faster response to incidents
Centralized Data Exchange (Datareon ESB)	2023	Integration of all enterprise information systems	Data centralization and synchronization
Digital Literacy Enhancement	Ongoing	Professional development programs, email-based practical guidance	Improved employees' IT competencies
Cisco HyperFlex Edge (Core of Updated IT Infrastructure)	2019	Servers, data storage system, and virtualization platform	Increased performance of core enterprise services and rapid deployment of new services

Source: compiled by the author.

Таблица 2 / Table 2

Customer Services

Service Name	Year of Implementation	Functionality	Effects
Mobile Inspector	2020	Automation of repair team operations, route optimization, and monitoring of customer service requests	Threefold increase in processed requests; reduced service time
Customer's Personal Account	2020	Submission of meter readings, bill payment, service requests, reconciliation reports, inspector call requests, and contract conclusion	Online access to services; improved convenience for both legal entities and individuals
Electronic Queue System	2020	Appointment scheduling for the customer service center	Improved service convenience and reduced waiting times
Unified Contact Center	2020	Web telephony, call registration, communication history tracking	Improved service quality; increased payment collection rates
Telegram Bot for Customers and Email Notifications	2021	Notifications on service outages, debts, and accrued penalties; answers to standard customer inquiries	Reduced operator workload; elimination of SMS notification costs
Automatic Meter Reading Recognition	2022	Recognition of utility meter data from photographs	Reduced manual labor; improved user convenience
Voice Robot (Aimylogic)	2023	IVR-based notifications about cold water supply interruptions	46% of customer inquiries automated

Source: compiled by the author.

Table 3

Challenges of Digital Transformation

Problem	Description
Increasing number of information systems	Systems overlap with each other, unintentionally reducing employee productivity
Cultural change	Natural human resistance to change creates implementation difficulties
Lack of top management support	Insufficiently defined digital transformation governance framework, including the absence of a unified digital development unit
Security	Successful digital transformation requires strong attention to cybersecurity and data protection
Excessive workload	Increased workload for employees during the adaptation period and introduction of new systems and services
Lack of competencies	Insufficient knowledge and skills in modern digital solutions among employees

Source: compiled by the author.

Table 4

Digital Transformation Scheme of JSC Nizhny Novgorod Vodokanal

2019	2020	2021	2022–2025
Initiation	Development	Infrastructure	Integration
Establishment of a Digital Transformation Office with a development unit; launch of pilot projects	Integration of IT and technical support functions; launch of key digital services	Modernization of server and network infrastructure; creation of a data processing center	Development of IT infrastructure, information security systems, APCS (Automated Process Control Systems), and business applications

Source: compiled by the author.

Table 5

Key Components of the Digital Water Utility complex

Component Name	Description
Component 1	Infrastructure for collecting and transmitting data on water consumption, pressure, resource usage, and other operational parameters
Component 2	Software suite designed for the collection, processing, storage, and visualization of data received from monitoring facilities
Component 3	Functional modules enabling adjustment of equipment operating modes and facilitating faster detection and elimination of energy and resource losses

Source: compiled by the author.

The key components of the “Digital Water Utility” system are presented in *Table 5*.¹⁰

The architectural modules of the “Digital Water Utility” system are presented in *Table 6*.¹¹

The implementation of the “Digital Water Utility” system led to the following outcomes¹²:

- a reduction in repeated failures by up to 17%;
- an increase in labor productivity of up to 20%;
- a decrease in network losses of up to 45%.

The high effectiveness of modern information solutions is achieved due to:

¹⁰ JSC “Rosatom Infrastructure Solutions” (official website). URL: <https://www.rusatom-utilities.ru/activities/tsifrovye-tehnologii/dlya-goroda-i-regiona/smart/informatsionnaya-sistema-tsifrovoy-vodokanal-alternativnoe-nazvanie-programmnyy-kompleks-tsifrovoe-teo-detail/>

¹¹ Ibid.

¹² JSC “Rosatom Infrastructure Solutions” (official website). URL: <https://www.rusatom-utilities.ru/activities/tsifrovye-tehnologii/dlya-goroda-i-regiona/smart/informatsionnaya-sistema-tsifrovoy-vodokanal-alternativnoe-nazvanie-programmnyy-kompleks-tsifrovoe-teo-detail/>

- increased labor productivity and optimization of payroll costs through the creation of skilled jobs and the enhancement of production staff competencies;

- reduced failure rates, leading to a significant improvement in the quality of utility services while minimizing losses and repair costs;
- increased useful output, revenue, and actual payment collection rates;
- substantial reduction in energy resource costs.

For the implementation of the “Digital Water Utility” system at Rosatom Infrastructure Solutions, a Digital Transformation Competence Center for the housing and utilities sector (HUS) was established. Its staff included specialists responsible for the development and deployment of software modules, installation of sensors, employee training, preliminary analysis of digital maturity levels, and other related functions.

At the initiation stage of the “Digital Water Utility” project, an executive order was issued at

Table 6

Architectural Modules of the “Digital Water Utility”

Module	Short description
Central Dashboard	Responsible for collecting, storing, processing, and visualizing large volumes of data. Used for building BI content (analytical reports and forecasts, preliminary managerial decisions based on machine learning). Enables evaluation of key performance indicators and process costs
Mode Analysis	Identifies and maintains optimal operating parameters of technological facilities using advanced process control (APC) technologies. The resulting data are transmitted to the control and dispatching system
Work Orders	Provides centralized management of service requests, enabling more efficient organization of repair works and optimized use of equipment and transport resources
Inspector Module	Increases the efficiency of the sales unit by automating field inspections, optimizing staff workload, and detecting cases of unauthorized water consumption using mobile technologies and AI
Balance Analysis	Reduces water losses through the analysis of data from multiple systems and the generation of recommendations for detecting abnormal consumption patterns
Third-Party Software Components	Include software solutions used in combination with the enterprise's internal systems
Low-Level Equipment	Hardware layer that ensures the operation of automated control systems and data acquisition systems

Source: compiled by the author.

the enterprise, including a detailed implementation schedule for digital transformation. Responsible personnel from all involved structural units were assigned. Project progress monitoring was carried out using Microsoft Project within a dedicated information platform of Rosatom.

In analyzing theoretical approaches to the digital transformation (DT) of resource-supplying organizations, the present study refers to the work of E. G. Evseev [9], in which, based on a review of existing research, the key stages of digitalization of heat supply organizations (HSOs) are identified:

- 1) assessment of the current level of digital maturity of the organization (technical, software, and human resources);
- 2) definition of digitalization objectives (automation of data collection, storage, processing, and analysis);
- 3) formulation of system requirements aligned with digitalization goals (functional, technical, and other requirements);
- 4) development of a digitalization plan (assessment of equipment needs, staff training, and financing; risk assessment; and task allocation);

5) implementation of the digitalization plan (installation of equipment, personnel training, software deployment, and evaluation of results).

Furthermore, E. G. Evseev proposes implementing digital transformation in HSOs using a spiral life-cycle model of information systems, in which development begins with a prototype that is progressively refined and expanded during implementation until the required outcome is achieved.

A number of authors [7–9] also consider a process similar to the one described above for the digital transformation of a utility enterprise, identifying priority areas for business process automation:

- Management processes (including economics and finance, revenue generation, and investment activities);
- Operational activities (covering quality control, supply of utility resources, operation of engineering systems, production monitoring and management, customer interaction, handling of requests, management of emergencies and incidents, as well as routine and capital repairs);
- Support activities (including construction, reconstruction, modernization, management of the

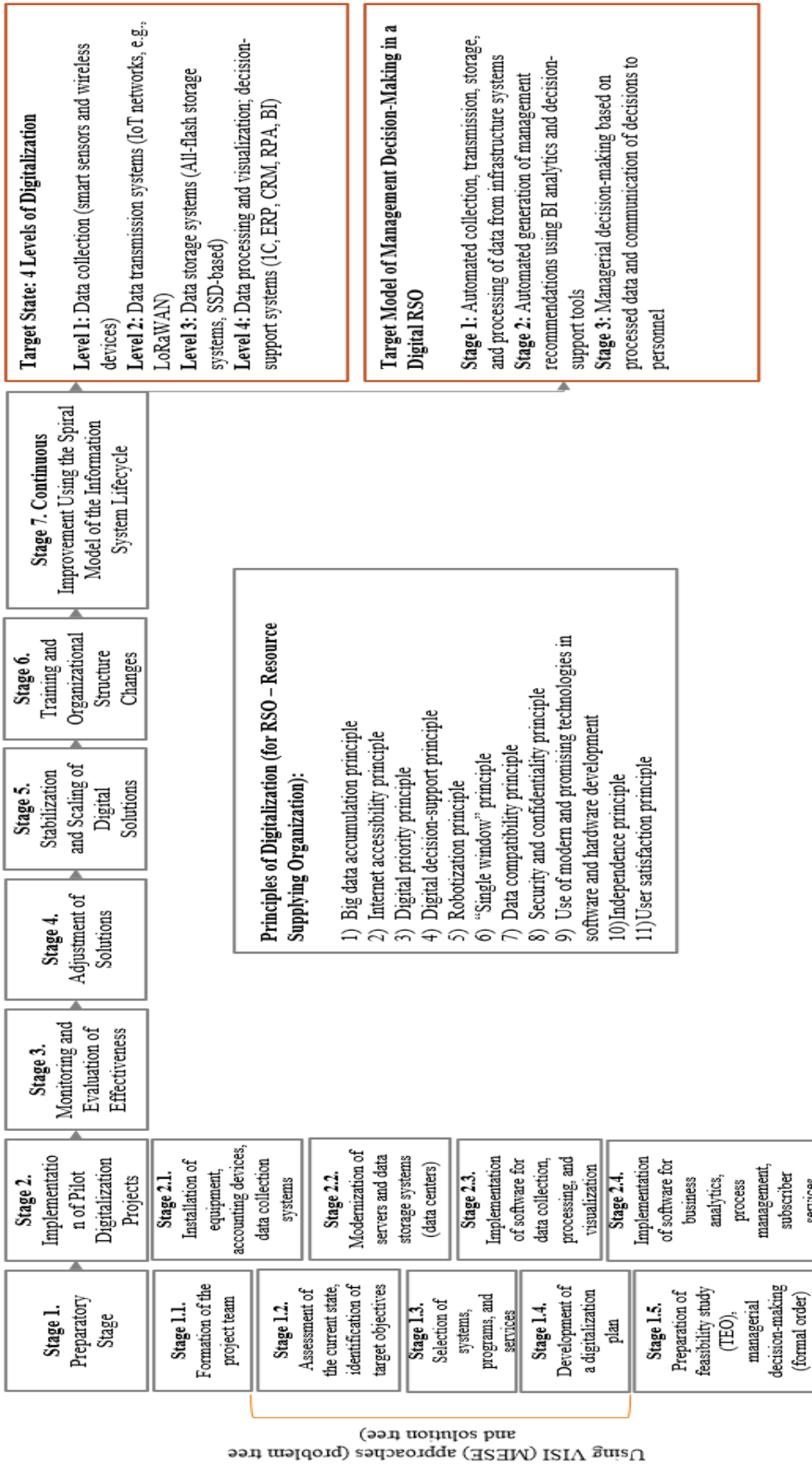


Fig. Process Model of Digital Transformation of the RSO

Source: compiled by the author.

energy complex, vehicle fleet management, contractual work, and procurement).

Based on the analysis of the theoretical foundations of innovation management, practical experience of digital transformation (DT) in resource-supplying organizations (RSOs), and academic research on the digitalization of utility enterprises, the author has developed a process model of digital transformation for RSOs (see *figure*).

Within this model, the author proposes to:

- implement a seven-stage digital transformation process for RSOs;
- apply the WISY (MECE) approach at the preparatory stage;
- use the digitalization principles previously developed by the author [10] during the implementation of the specified stages;
- ensure the achievement of the target level of digital maturity and the relevant stages of managerial decision-making.

FINDINGS

The study analyzed practical experience of digital transformation in RSOs based on the cases of Nizhny Novgorod Vodokanal and Rosatom Infrastructure Solutions. Both companies applied a systematic approach to digitalization, established dedicated working groups, and implemented a wide range of IT solutions aimed at improving both internal operational efficiency and customer service quality.

Nizhny Novgorod Vodokanal demonstrated steady development of its digital infrastructure from 2019 to 2022, implementing more than 30 innovation projects. The introduction of systems such as production resource management, BI analytics, IP telephony, Telegram bots, voice assistants, and automated customer accounting and service platforms significantly improved business process transparency, reduced costs, and increased labor productivity.

Rosatom Infrastructure Solutions implemented the “Digital Water Utility” platform, focused on automating key business processes in small cities. The platform includes both software and hardware modules for data collection and analysis, equipment management, and resource optimization. As a result,

significant effects were achieved, including reduced losses and increased labor productivity.

The analysis of these cases demonstrates that digital transformation requires not only technological resources but also organizational maturity: the presence of a competence center, strong involvement of top management, continuous employee training, and the development of corporate culture. In addition, a monitoring and project control system plays a crucial role.

Theoretical approaches presented in the reviewed literature confirm the relevance of a phased implementation of digitalization, including the assessment of digital maturity, formulation of objectives, development of a digital transformation program, and its execution using a spiral model.

Based on the analysis of both theory and practice, the author proposes a process model of digital transformation for municipal RSOs, aimed at achieving the target level of digital maturity and supporting data-driven managerial decision-making. This makes the model applicable to a wide range of organizations in the sector. Special attention is given to the MECE methodology, which is used in the formation of innovative ideas. This approach helps avoid duplication and omissions in analysis, ensuring completeness and logical consistency of possible options.

CONCLUSION

A distinctive feature of the process model presented in this article is the synthesis of classical stages of the innovation process with the sector-specific characteristics of the utility industry. The model formalizes the target state of digital maturity in resource-supplying organizations (RSOs) and the stages of managerial decision-making under process automation conditions. This enables a transition from fragmented initiatives to a coherent, integrated digital transformation strategy for utility enterprises.

The practical significance of the study’s findings lies in providing RSO managers with a structured toolkit for planning and implementing corporate digital transformation. The proposed model serves

as a basis for developing action plans and allows for the optimization of the balance between implementation costs and achieved operational effects.

Further research is expected to focus on testing the model across different RSOs and developing

methodological guidelines based on it to overcome “digital noise” and organizational-cultural barriers. This, in turn, will create opportunities for scaling best practices and improving the overall efficiency of the utility sector.

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Qualification of Human Resource Management Specialists: Assessment Experience

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ABSTRACT

In the contemporary labour market, demand for human resource management (HRM) specialists is steadily increasing. However, a comprehensive conceptual framework for this professional field still requires further development due to the fragmented coexistence of various research approaches, including economic, personnel-administrative, and socio-psychological perspectives. In the course of the study, the authors relied on an integrative, multi-aspect methodology of human resource management developed by them. The **purpose** of the research is to analyse the extent to which the actual qualification level of HRM specialists, as well as undergraduate and graduate students enrolled in programmes such as “Human Resource Management” and “Personnel Management in Organisations,” corresponds to state and industry standards. The research methods included semi-structured interviews with HR department staff and line managers of enterprises in Naberezhnye Chelny, as well as a questionnaire survey of university students in the Republic of Tatarstan based on a multistage combined sampling design. Thus, the empirical base of the study comprised HR professionals, line managers, and university students. The **findings** reveal a significant gap between experts’ perceptions of the professional competencies required of HRM specialists and the actual level of competency development among HR department employees. It was also established that students majoring in management disciplines do not possess a sufficiently formed understanding of the content and scope of their future professional activities. The multi-focus framework of the concept of “personnel” and the multi-aspect approach to the functional content of human resource management proposed by the authors may be applied both to improve the performance of corporate HR departments and to enhance the training of future HR professionals.

Keywords: enterprise; personnel; multi-focus framework of the concept “personnel”; human resource management; multi-aspect model of human resource management; HR specialists; training of future HR specialists

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INTRODUCTION

One of the consequences of the significant transformation of the Russian labor market in the post-Soviet period may be considered the emergence of a new professional group — personnel management specialists.

According to the results of our study conducted in the mid-90s at enterprises in Naberezhnye Chelny, at that time, only 60% of enterprises had regular personnel departments. Moreover, in two thirds of cases they were represented by only one employee, who was only engaged in personnel records management [1]. Today, personnel man-

agement departments are available at almost all enterprises with more than 100 employees. The total number of employees in this sector in the Republic of Tatarstan exceeds 2 thousand people. The growth of interest from employers to this sphere is due, on the one hand, to the complication of the very content of the activity, which today is no longer limited to personnel records management, but is turning into human resource management. On the other hand, the need for specialists in this field has increased significantly in the last decade due to the personnel crisis that has engulfed the entire country.

However, this process has long ago acquired an international dimension. Long before the pandemic, the global crisis in the labor market demonstrated contrasting and contradictory forms: an acute labor shortage in certain professions and regions was combined with a huge surplus in other professional areas and regions of the world [2]. According to the study conducted in 40 countries by the Organization for Economic Cooperation and Development (OECD), 70% of enterprises in both developed and developing countries currently had serious personnel problems [3].

Russia inherited some of its current problems from the Soviet times, when HR specialists were practically not trained at universities, and anyone could be found at the workplaces of specialized departments, from a former athlete to a teacher. This had its own political and ideological reasons. In the system of previous Soviet economic relations, it was believed that the principles of party management of socialist enterprises were sufficient for their successful development. And all the main classical concepts of personnel management that developed in the West in the 19th and 20th centuries were ignored as “bourgeois”, incompatible with the established practice of party-economic management of the national economy and individual teams, as a result of which they were subjected to ideological criticism and rejected. But at present, these theories in combination with more modern approaches are relatively widely used both in post-Soviet Russia and in the world [4; 5].

In modern conditions, personnel problems related to the sphere of personnel management have, in our opinion, two aspects. The first of them refers to the training of specialists for the relevant activities. At present, two similar main professional educational programs (MPEP) simultaneously coexist in Russian higher education: within the framework of the training course 38.03.02. “Management”, training is carried out in the profile (specialization) “Human Resource Management”, and within the framework of the training course 38.03.03. “Personnel Management”, training is conducted in the profile (specialization) “Personnel Management of an Organization”.

The difference in the content of the programs is not significant, and this current situation reflects, in our opinion, the fact that the transition of Russian higher education and the entire system of managing organizations from the traditional understanding of working with enterprise personnel to more modern forms is taking place without significant changes in terminology. This is also related to the fact that in most scientific studies and at most Russian enterprises the terms “Personnel Management” and “Human Resource Management” are used as equivalent, and the corresponding structural divisions are usually called personnel services. We are also not inclined to consider the issue of terms to be significant and proceed from the fact that the transition to modern methods of working with people at enterprises should not depend on the terms used.

The second aspect of the problem is to what extent training in accordance with these bachelor’s and master’s degree programs corresponds to the qualification requirements for specialists in personnel (human resource) management imposed by the modern labor market. This aspect, despite its obvious relevance, has not been fully studied in modern domestic sociological, economic and pedagogical literature.

The discrepancy between the qualification level of job seekers in most professions and the requirements of employers and employees’ lack of necessary skills is also a global problem and is one of the reasons for the current personnel shortage [6]. According to a study by the Russian Union of Industrialists and Entrepreneurs (RCIE), more than 60% of employers believe that graduates are not ready for real work. And according to a study by All-Russian Center for the Study of Public Opinion (VCIOM), 45% of students believe that the teaching methods at their universities are outdated and do not meet the requirements of the modern labor market [7]. A third part of graduates of vocational educational institutions (34%) agree that the knowledge they received at the university does not fully satisfy the employers [8].

The importance of this problem increases significantly when it comes to the professional skills of those who themselves have to manage human

resources. The purpose of the article is to analyze the compliance of the actual qualifications of current specialists in the field of personnel management with modern qualification requirements for them based on sociological research conducted at enterprises of the Republic of Tatarstan.

LITERATURE REVIEW

In the 1960s and 70s, in economic and management sciences there occurred significant shifts associated with a noticeable increase of the role of a human being in the context of accelerated scientific and technological progress. The economic theory of “human capital” emphasized the enormous importance of education, growth of qualifications, human health, and substantiated no less, if not greater, need and benefit of investing in human capital compared to other types of capital [9].

At about the same time, the concept of “human resource management” (HRM) was born, which studies employees’ motivation, empowerment of personnel through training and development, and processes for optimizing employees’ and organization’s goals. These concepts are humanistic in nature, but the problems associated with personnel management and human resources are still extremely diverse and far from being solved. They affect all modern countries, both developed and developing. Scientists rightly claim that Western corporate management models based on hierarchical integration are currently experiencing a serious crisis [10; 11]. And the way out of it is possible by rethinking and transforming the organizational methodology itself, in which human resource management becomes not only a science, but also an art [12], where employee loyalty is achieved through decentralization of management and where preference should be given not so much to orders and control, but to convictions and trust [13].

John Storey was one of those scientists who stood at the origins of research into human resource management problems. He came to the conclusion that they also comprise strategic issues related to the long-term interests of the organization’s business, personnel aspects of working with key suppliers and consumers, as well as public

health and environmental issues associated with the company’s activities [14].

Researchers from the Indian Uttarakhand Open University base their fundamental work on the concept of the uniqueness of people as the only resources that are capable of producing products through motivated creativity, the value of which exceeds the sum of all investments in them. All other resources — machines, materials, finances — are not only incapable of this, but also depreciate over time. Only the importance of human resources increases with proper management and individual motivation [15].

And since these problems are universal in nature and affect enterprises of any profile in every country, it is necessary to focus on successful experience. This is especially important for optimizing the work with employees in the process of selecting and training personnel, when designing workplaces [16].

An interesting study examines in detail the process of selecting new applicants from the point of view of its impact on organizational efficiency. It is empirically substantiated that of the three aspects of selection — an interview with a candidate, a cognitive ability test, and a personality questionnaire — it is the live conversation with a future employee that is most significant for the efficiency of the enterprise. The authors conclude that the preference of an interview as a form of selection lies in the ability to discover the most talented personnel, without whom it is impossible to achieve organizational excellence [17]. The problem of identifying and using talents has been the subject of many other studies, and in recent decades there has emerged a serious scientific direction — talent management. [18; 19].

The Fourth Industrial Revolution, which is currently unfolding, requires new approaches to working with personnel. New challenges for the personnel management system are the rapid progress in information and communication technologies, due to which technological synthesis occurs within the physical, digital and biological fields [20].

In the era of Industrial Revolution 4.0, the problems of talent management and skills development taking into account human diversity are becoming increasingly pressing [21]. Consequently, the Fourth

Industrial Revolution places the highest demands on HR specialists, who themselves must first and foremost be bearers of competencies related to the most advanced technologies. Only in this case can the HR management system play a vital role in increasing organizational efficiency and optimizing human resources [22].

It follows from this that competencies related to the management of technological change need to be more deeply integrated into the context of higher education programs and into the process of training specialists in the field of human resource management [23].

This is especially important in light of the fact that modern HR professionals often have little understanding of the technological aspects related to their companies' activities [24; 25; 26], or even of the technological developments being carried out at their enterprises. Therefore, they are usually included in the relevant processes not at the strategic planning stage, but at later stages of the implementation of these technologies [27].

A more in-depth analysis shows that only 20% of them have a good understanding of how ongoing technological processes require changes in approaches to recruiting personnel, updating employee competencies and training at least in the next two years [28].

In a number of studies, their authors emphasize that at modern enterprises for employees of the human resource management system the importance of their analytical skills is growing [29]. It is noted that their skills rarely go beyond the routine work with documents of the enterprise employees [30], they, as a rule, do not have the appropriate competencies that would allow them to pose research problems related to the sphere of their company's activities, interpret existing analytical materials [31].

Meanwhile, such work is necessary to predict all possible scenarios and risks, to constantly monitor the state of the organization, and prepare recommendations for decision-making by the company's management [32]. In addition, HR specialists must be aware of what people at their workplaces consider relevant for themselves and how they un-

derstand the technological, financial, and social aspects of the company's policies. To do this, they themselves must be open to change and be active developers of HR strategy [33; 34; 35].

MATERIALS AND METHODS

The theoretical framework of the study is the multi-aspect approach we have developed to personnel management as a type of activity, which includes the following elements: organizational, psychological, personnel, economic and social. [36].

The empirical basis of the study was as follows:

1. The data from 68 semi-structured interviews with HR specialists and 45 semi-structured interviews with lower and middle level line managers of enterprises in various fields of activity in the city of Naberezhnye Chelny, conducted in January-May 2024. A total of 28 enterprises in the city of Naberezhnye Chelny were covered. The sample was calculated based on three indicators: 1) the form of ownership of the enterprise; 2) the time of establishment of the enterprise (enterprises existing since Soviet times and post-Soviet enterprises created after 1991; type of activity of the enterprise (industrial, construction, trade). The distribution of the enterprises selected for the study is representative of the characteristics of the general set of enterprises in the city of Naberezhnye Chelny according to the specified indicators.

The gender composition of the surveyed HR specialists: 63 women and 5 men. The age characteristics of the surveyed HR specialists: up to 30 years old — 27 people; 30–40 years old — 21 people; over 40 years old — 20 people. The composition by educational profile: management education — 31 people; psychological education — 14 people; other types — 23 people.

The gender distribution of the surveyed line managers: 12 women and 33 men. The age characteristics of the surveyed line managers: under 30 years old — 6 people; 30–40 years old — 18 people; over 40 years old — 21 people. The composition of the surveyed line managers by educational profile: technical education — 23 people; economic and management education — 22 people;

The results of a questionnaire survey of 3rd-4th year students of universities in Kazan, Elabuga and Naberezhnye Chelny (n=124) studying in the profile “Human Resource Management” and “Organization Personnel Management”. The survey was conducted in April-May 2024. The characteristics of the sample of surveyed students by gender, age and nationality did not differ from the characteristics of the general population by more than 5%, which allowed us to consider the sample representative.

The survey results were analyzed using the IBM SPSS Statistics 21 software package and univariate and multivariate statistical methods.

RESULTS AND DISCUSSION

The conducted study showed that with all the variety of approaches to the concept of “personnel management”, the understanding of this activity contains a fairly common error, which concerns the interpretation of the goals of personnel management. Both in the literature and especially in practice there exists a point of view that puts business processes at the forefront, and the goal of personnel management is considered to be achieving the maximum economic effect with minimal personnel costs. In this regard, the following approaches and definitions are quite typical: “Personnel management is a set of processes aimed at maximizing the level of labor productivity through effective management of the organization’s labor resources and improving the skills of personnel” [37]; “The personnel management system (PMS) helps to control the company’s business processes related to employees. It allows managers to simplify the work of departments and increase overall productivity” [38].

But it is obvious to us that such an understanding only reflects the views and interests of the owners and management of companies, while ignoring the fact that the employees’ joining the enterprise is not due to their concern for the well-being of the enterprise. The employees do this to ensure the achievement of their own goals and interests. This has clearly manifested itself in the last few years, when the country faced an unprecedented personnel crisis. In this regard, in

modern conditions it is required a radical revision of the goals of personnel management and its performance indicators. The indicator of the effectiveness of personnel management in modern conditions should be considered as ensuring a balance of interests of the enterprise employer and the personnel working there.

When such a balance is achieved, employees’ satisfaction with their work increases significantly, and they are ready to take on more complex and creative tasks [39]. Noting the importance of employees’ creative attitude, researchers conclude from this circumstance that an organization’s performance directly correlates with employees’ creativity. The creative attitude of employees generates optimism, which in its turn helps to overcome crises, accumulate valuable experience, and solve various technological problems [40].

Based on such an interpretation of the purpose of personnel management, the concept of “personnel” should be also reconsidered. In our opinion, the traditional interpretation of personnel as exclusively a set of employees intended to achieve the goals of the enterprise seems incomplete, since it does not take into account the interests of the employees themselves. The concept of personnel should be considered based on the needs of the employees, which determine their joining the enterprise. We have developed a multi-focus scheme of the concept of “personnel”, which includes the following projections:

1. The first focus of the concept of “personnel” considers the latter as a set of people who have certain psychophysiological needs (working conditions, work schedule, etc.) and expect to realize them at the relevant enterprise.

2. The second focus considers personnel as a set of individuals who realize certain socio-psychological needs at the enterprise (communication, status, psychological comfort).

3. The third focus considers the employees of the enterprise in the context of economic relations with it.

4. Within the framework of the fourth focus, personnel are considered from the point of view of fulfilling the production tasks assigned to them.

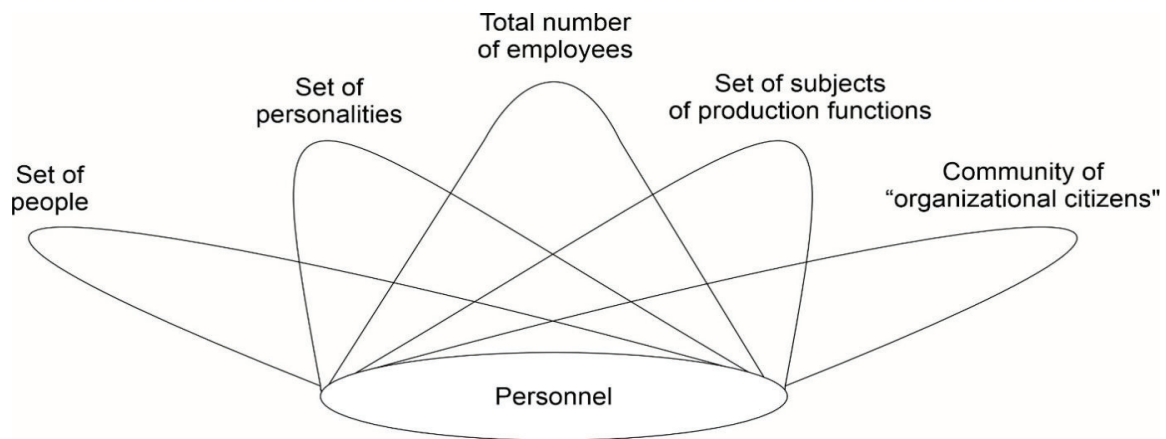


Fig. 1 Multi-focus Framework of the Concept of "Personnel"

Source: developed by the authors.

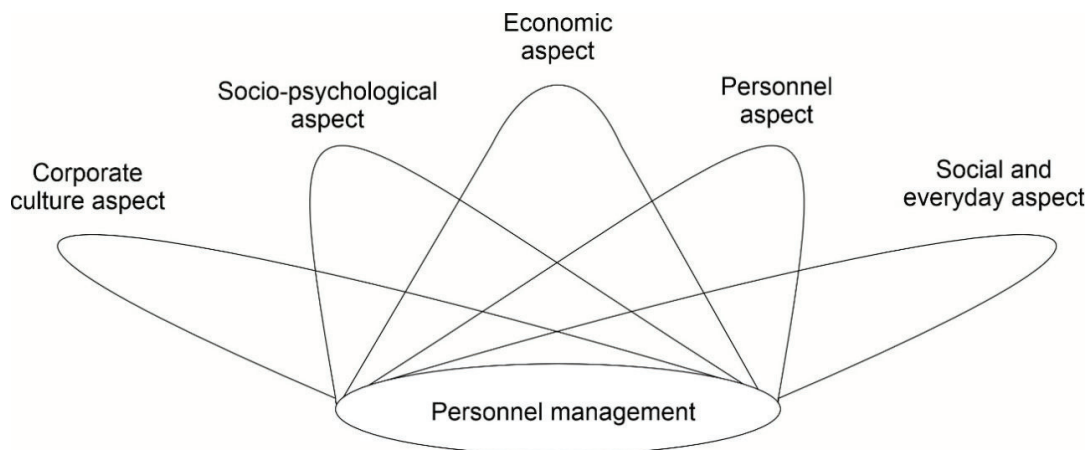


Fig. 2 Multi-aspect Framework of Human Resource Management

Source: developed by the authors.

5. The fifth focus reveals the civic principle in employees, presents personnel as a set of patriots of the organization.

The considered multi-focal approach to the category "personnel" leads to the need to reveal the process of personnel management as an integrated multi-aspect activity (Fig.2).

1. Corporate culture is based on the values of the organization, which the staff must accept.

2. Personnel management is aimed at solving such socio-psychological problems as moral motivation of personnel, maintaining a favorable psychological climate, and conflict prevention.

3. The economic aspect of personnel management involves the implementation of such functions as standardization and pricing, and the organization of material incentives for personnel.

4. The personnel aspect involves the development of professional requirements for various categories of personnel, selection, recruitment, assessment, training and professional advancement of personnel.

5. The social and everyday aspect of personnel management involves the creation and maintenance of optimal working conditions and regime, organization of food, and sanitary provision of premises.

Analysis of the relationship between the requirements for personnel management specialists and their actual qualifications

In semi-structured interviews with specialists of personnel management departments/divisions, there were discussed three groups of questions:

Table 1
The Opinion of HR Specialists on the Professional Competencies they Require

Aspects of HR management that include professional competencies	Significance of the competency (on a 10-point scale)
Corporate culture	7,8
Socio-psychological relations	6,9
Economic relations	5,2
Human resources	8,9
Social and living conditions of personnel	4,1
Average score in all the aspects	5,46

Source: developed by the authors.

1. What is the importance of professional competencies that personnel management specialists should have?

2. What is the actual level of development of the necessary professional competencies among current personnel management specialists?

3. To what extent have the necessary professional competencies been formed among master's and bachelor's degree management students undergoing industrial practice, as well as among young specialists — university graduates?

Let's touch on some of the interview results.

As we can see, the range of importance of professional competencies in terms of different aspects of management is quite large (Table 1).

It is not surprising that HR employees consider to be the key competencies the personnel aspect of personnel management (8.9 points), as well as those competencies that are designed to develop corporate culture (7.8 points). Relatively highly they rated the ability to deal with socio-psychological problems of personnel (6.9 points).

As it is clear from the interviews, the latter is especially relevant for small organizations with up to 200 employees (7.6 points). Interestingly, the increased importance of the socio-psychological aspect of HR specialists turned out to be relevant

for organizations where either men or women significantly predominate (7.9 points). Thus, it can be assumed that the mixed gender composition of an organization has a beneficial effect on its socio-psychological climate.

The need for competencies related to the implementation of the economic and social aspects of personnel management was assessed by respondents as significantly lower, 5.2 and 4.1 points, respectively. Experts explain this fact by several reasons. As for the relative insignificance of the competencies of the social aspect, this can be explained by the fact that the functions of this block are implemented in many cases only partially. This is especially characteristic of small organizations (up to 200 employees), where some functions of the social aspect simply do not exist. In small organizations, the need for professional competencies related to the implementation of the social aspect was assessed by respondents at 3.4 points. As for the economic aspect of personnel management, this is due to the fact that at large enterprises (primarily former Soviet ones), the economic aspect of personnel management is traditionally implemented by labor and wages departments.

The second block of questions concerned the assessment of the actual qualifications of current personnel specialists. The respondents were the personnel management departments specialists themselves and line managers.

A serious problem that reduces the level of actual qualification is the lack of basic management education among many personnel management service employees. Respondents with basic management education are more critical of the level of formation of professional competencies of their colleagues (their overall score for all personnel management aspects is 6.01). Experts explain the higher rank of formation of competencies of the economic aspect by the significant share of economists in the structure of personnel management service employees. A pronounced inverse relationship is noted between the assessment of the actual qualification of personnel management service specialists and the experience of the respondents (Pearson's coefficient is 0.8725). Thus, respondents with up to 3 years of experience in the personnel management field estimate the

average score of competence formation among current personnel management service employees at 7.76 points. While experienced respondents with more than 10 years of experience in the personnel management system estimate it only at 4.48 points. According to veteran respondents, the level of actual qualifications of personnel management service employees has fallen in recent years.

As it was initially assumed, the assessment of the development of the competencies of the personnel management service specialists made by their consumers – the surveyed line managers – is much more critical. If the average score of self-assessment of the development of competencies in all aspects among the personnel management service specialists was 6.58 points, then the line managers assessed their competencies only at 4.12 points, or 37.4% lower. At the same time, the Spearman's rank correlation coefficient was +1.0, which indicated the highest possible rank dependence between these two-rank series. However, the assessments given by the line managers are less reliable, since a significant part of the respondents (from 23.2% to 45% in different blocks) found it difficult to assess the development of certain competencies of the personnel management service specialists. The line managers themselves explained this fact by the insufficient business contacts between the line divisions of the organization and the functional personnel management service.

The third block of questions to respondents was related to their assessment of the qualification po-

tential of university graduates applying for jobs in the management services. Respondents noted that they had a fairly complete idea of the qualification potential of senior students studying in the profile "Human Resource Management" and "Organization Personnel Management" for the bachelor's and master's degrees. Senior students had repeatedly undergone practical training at the surveyed enterprises, regularly participated in interviews for jobs as employees of the management service, and in addition, many management services of the surveyed enterprises employed young specialists (Table 3).

Thus, according to the respondents, the average score of the degree of professional competencies actual formation among graduates of management areas with the bachelor's and master's degrees was 3.36 points within a 10-point scale, which is 3.32 points less than the qualification of current specialists in personnel management. The experts rated the professional competencies associated with the implementation of the socio-psychological aspect of personnel management most highly. This is explained by the fact that quite a lot of graduates with bachelor's degree from pedagogical universities, where psychological training is quite decent, are currently entering master's courses in management. At the same time, experts rate the competencies of university graduates associated with the implementation of the social and everyday aspect of personnel management and the aspect of forming and maintaining corporate culture very low (3.2 points within a 10-point scale). The latter is most likely due to

Table 2

Assessment of the Actual Level of Professional Competency Development Among Practicing HR Specialists

Aspects of HR management that include professional competencies	Assessment of HR specialists (on a 10-point scale)	Assessment of line managers (on a 10-point scale)
Corporate culture	5.1	3.2
Socio-psychological relations	4.9	4.0
Economic relations	6.0	5.1
Human resources	7.3	6.2
Social and living conditions of personnel	4.0	2.1
Average score in all the aspects	6.58	4.12

Source: developed by the authors.

Table 3

**HR Specialists' Assessment of the Actual Level of Competency Development
Among University Graduates in Management Fields**

Aspects of personnel management, which include professional competencies	The importance of the competence in points
Corporate culture	2.3
Socio-psychological relations	4.8
Economic relations	3.9
Human resources	3.5
Social and living conditions of personnel	2.3
Average score in all the aspects	3.36

Source: developed by the authors.

Table 4

Students' Self-assessment of Their Readiness to Work as HR Specialists (Percentage of Respondents)

Type of activity in the field of personnel management	I know but only theoretically	Ready to take practical part	Almost not ready	I find it difficult to answer
Activities to form and maintain corporate culture	34.8	21.0	38.9	5.3
Activities to maintain the socio-psychological climate, prevent conflicts, and organize moral motivation	45.8	25.8	15.6	12.8
Activities on organizing standardization, material motivation of employees	38.8	36.9	18.9	5.4
Activities related to the organization of selection, assessment and training of employees	51.0	29.5	10.5	9.0
Activities related to the organization of social and living conditions of personnel	18.0	9.2	30.7	42.1
Average percent in all the aspects	37.7	24.5	22.9	13.8

Source: developed by the authors.

the faults of university training of future bachelors and masters in management. Strictly speaking, in practice, the need to form corporate culture at an enterprise is interpreted rather primitively. Quite often, the formation of corporate culture is associated by enterprise managers primarily with the organization of holidays with the participation of the entire team (the famous “corporate parties”).

During the study, as it was noted above, there was conducted a questionnaire survey among students studying in the “Human Resource Management” and “Organizational Personnel Management” profiles regarding their professional motivation and their awareness of the content of their future professional activities.

The following picture emerged regarding readiness to work in the field of personnel management:

1. Students already working in the field of personnel management – 19.5%
2. The ones definitely planning to work in the field of personnel management – 35.0%.
3. Those who'll possibly work in the field of HR management – 21.5%.
4. Those who are not planning to work in this field or found it difficult to answer – 24%.

Regarding the professional competencies of the surveyed students related to the content of human resource management activities, the results are as follows (Table 4):

As we can see, the surveyed students of the management master's and bachelor's degree programs are generally not sufficiently prepared for practical activities as personnel management specialists, every fifth respondent noted that they were "Almost not ready for this activity" and only every fourth respondent admitted that they were "Ready to take practical part in this activity". For the sake of fairness, it should be noted that about half of those who acknowledged their readiness for practical activities (47.8%) were master's students who were already actually involved in the practice of personnel management service.

In general, as it was expected, there is a direct correlation between the level of awareness of the surveyed students regarding the content of the activities of the personnel management specialists and their readiness to work in this area.

The lowest level of readiness is observed for activities in organizing social and living conditions for personnel; it is characteristic that about half of the respondents as a whole found it difficult to assess their readiness for this activity, since they vaguely understand what its essence is. This is due to the specifics of training future bachelors and masters in personnel management; this aspect is not given enough attention.

The second place in terms of "unpreparedness" is occupied by the activity of forming and maintaining corporate culture. Just over a third of respondents know only the theoretical foundations of corporate culture, and only every fifth person is practically involved in this activity. Here we see two reasons: on the one hand, these are the same educational defects, which suggest insufficient attention to training in this aspect of personnel management, on the other hand, the technologies of forming corporate culture are rather vaguely understood by the practitioners themselves.

Future bachelors and masters in personnel management are relatively well prepared for the activities in organizing selection, assessment, and training of employees. Here, only every tenth respondent noted that they were not ready for this activity. At the same time, every second admitted that they knew this aspect of personnel management only theoretically and 29.5% of respondents

noted that they were ready to take practical part, these are again mostly masters.

Thus, the surveyed students of the management programs for the master's and bachelor's degrees are generally not sufficiently prepared for practical work as personnel management specialists.

CONCLUSIONS

An expert survey of personnel management specialists and line managers of lower and middle levels in the city of Naberezhnye Chelny, directly working with personnel, conducted during this study, confirmed our initial hypothesis that personnel management is a multi-faceted activity, which includes the aspect of forming and maintaining organizational culture, psychological, personnel, economic and social aspects.

The study showed that a significant portion of employees of modern personnel management services do not have basic management education.

The identified serious gap in the assessment of the required qualification competencies of personnel management service specialists and their actual formation can be considered an important result of the study. The high level of ignorance of the surveyed line managers about the qualifications of HR specialists, revealed during the study, confirms the initial hypothesis about poor interaction between HR services and the most important divisions of companies due to the low status of these services.

The study showed a low level of compliance of university graduates with a bachelor's and master's degrees in "Human Resource Management" and "Organizational Personnel Management" with the qualification requirements for personnel management service employees. Experts note particular gaps in the professional training of these graduates in the following areas:

- management of social and living conditions of employees of enterprises;
- methods of forming and maintaining corporate culture;
- methods of moral and material motivation of personnel;
- organization of professional advancement of personnel.

The low level of readiness for practical activities in personnel management is also confirmed by a questionnaire survey of the students of management programs for the bachelor's and master's degrees conducted at the universities of Tatarstan. The greatest qualification gaps, according to the self-assessment of the students surveyed, are observed in the activities of organizing social and living conditions of the personnel and in the activities of forming and maintaining corporate culture. This leads to the conclusion that there is a need for a more qualitative development of these aspects of management in the practice of enterprises, as well as the need to pay more attention to these problems in the preparation of future bachelors and masters in personnel management.

The results of the conducted research show that the training of future specialists in personnel management should be based on an integrated approach determined by the multi-aspect nature of personnel management activities. Bachelor's and Master's

degree graduates in the "Human Resource Management" and "Organization's Personnel Management" profiles should have broad knowledge in the field of the organization's sociology, social psychology, physiological characteristics of work activity, theory and practice of forming the corporate culture of the enterprise. And they should not limit themselves only to work on selection, training of personnel and personnel records management.

It is also important to keep in mind that issues of working with personnel are the responsibility of not only professional employees of HR departments, but they concern all levels of management and all divisions of enterprises. Consequently, future engineers and economists should be trained not only to perform their immediate functions, but also to master many subtleties of managerial work with personnel.

The integrative approach to the functional content of personnel management proposed by the authors can be used in the process of training future personnel management specialists.

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Human Resources as a Dynamic Category in The Management Discourse of Information Economy

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ABSTRACT

Dynamism is an ability to qualitatively change, influencing the socioeconomic situation, and is an important characteristic of human resources (HR) as a scientific category. The **purpose** of the paper is to identify trends and characteristics of management discourse related to HR dynamism and developing in the information economy. This research identifies stages in researching HR as a dynamic category and identifies an impact of the ICT on studying relationships between HR, management practices, and economic systems' performance. It also identifies ways for HR-practices development and touches on the issue of synergy between HR and technology. The primary **research method** is substantive and conceptual analysis of scientific works from recent decades. The **results** of the paper may be useful to scholars and practitioners working on human resources management.

Keywords: human resources; human resource management; management of organizational and economic systems; HR-practices; management discourse; dynamic connections; information economy

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INTRODUCTION

Human resources (HR), understood as a set of human attributes, qualities, and characteristics, undergo continuous transformation as a result of economic and societal development. Accordingly, their nature and role can be examined through their interrelations with other components of socio-economic development in the processes of accumulation, utilisation, transformation, and integration of HR into overall economic dynamics. The nature and depth of the links between human resources and economic performance are determined by the objectives, initial conditions, and specific features of socio-economic systems, which in turn shape the particular forms of managerial influence in the HR domain. According to some scholars, over recent decades the contribution of human resource management theory to the broader concept of organisation and management has grown at a faster pace than other functional areas of management, demonstrating a shift from the “organised simplicity” of people management towards “disorganised complexity” under conditions of increasing unpredictability and uncontrollability in the external environment. “As early as the 1960s and 1970s, a number of authors had suggested that a change in the conventional organizational wisdom was in progress... which have demanded a fundamental break with the (modernist and functionalistic) past in terms of preferred analytical frameworks and projected institutional forms” [1].

The academic literature highlights the significant contribution of Industry 4.0, which has integrated information and communication technologies (ICT) into various sectors of the economy and intensified HR-related processes. This is reflected in changing skill requirements for employees, the improvement of organisational structures within economic systems, the expansion of managerial functions, the development of HR practices, the evolution of business communications, the transformation of societal norms, and the search for a better work–life balance, among other developments.

The study of human resources through the dynamics of the processes that shape them and are shaped by them represents one of the key directions of contemporary management science, which is developing primarily in the context of technological concepts of social progress. Numerous and diverse studies over the past half-century have significantly enriched the theoretical, methodological, and analytical-toolkit base of HR management; however, the number of relevant research questions has by no means diminished. In the context of ICT, managerial discourse itself becomes increasingly information-intensive and dynamic: the range of addressed issues expands further, research methods become more complex and diverse, findings more heterogeneous, and proposed solutions more comprehensive. HR is no longer viewed as merely a set of managerial functions; rather, it has evolved into a developed discursive field with strong interdisciplinary tendencies. This necessitates deeper analysis of the system “human resources — management practices — economic outcomes” in all the diversity of interconnections that characterise it.

RESEARCH RESULTS

Stages of Human Resource Analysis in the Context of Dynamic Interrelations

Contemporary management science examines a wide range of dynamic relationships within various economic systems, taking into account different approaches and influencing factors. The general logic is as follows: inherent human qualities and abilities are shaped by HR practices of varying levels and orientations, being transformed into economically relevant attributes (more precisely, into knowledge, skills, and competencies that constitute human capital). These, in turn, form or influence business processes and contribute to efficient, sustainable, and environmentally responsible development. It should be noted that the distinction in terminology — human resources versus human capital — does not narrow the scope of research, as accumulated HR represents the core of human resources directly utilised in social production (see *figure*).

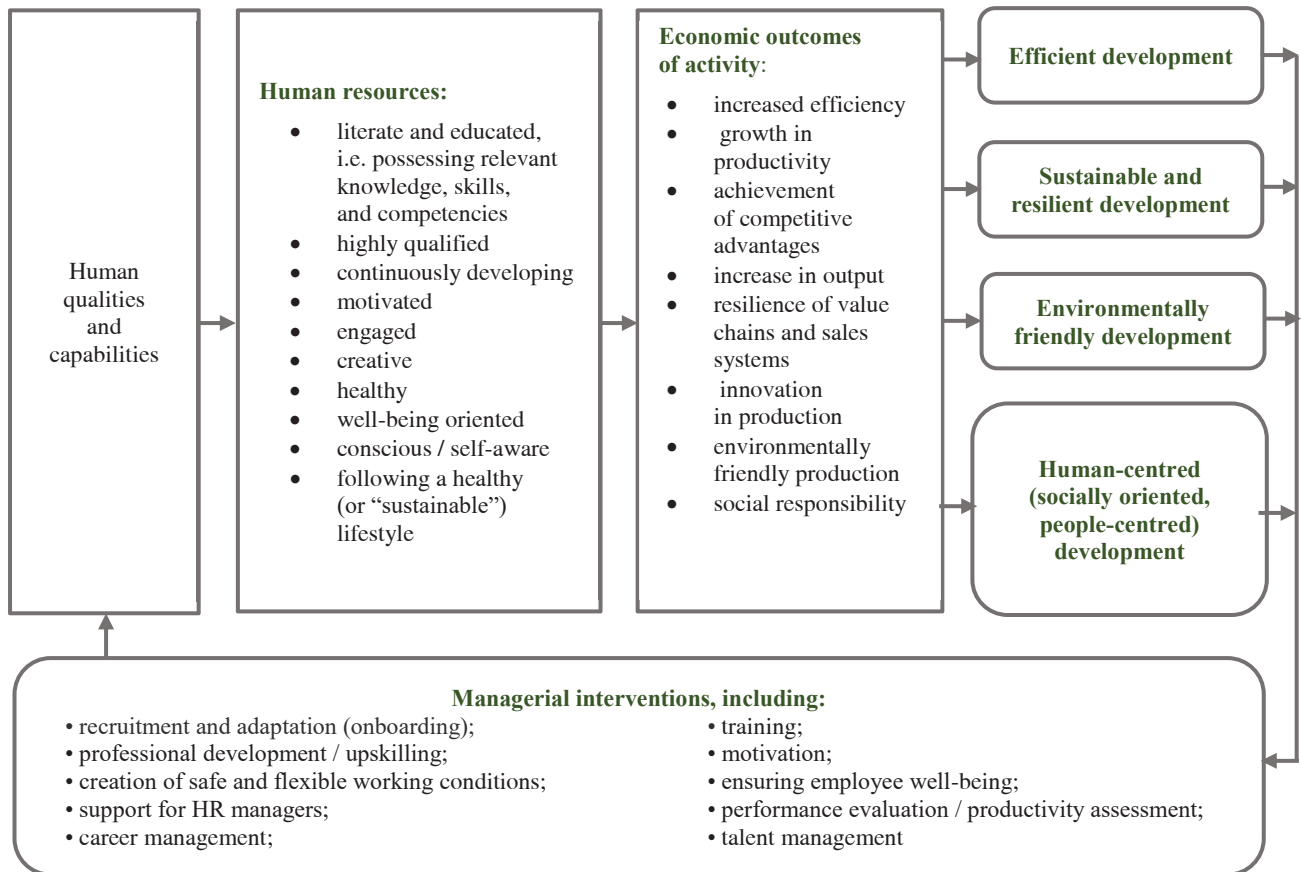


Fig. The Dynamism of Human Resources in the General Logic of Contemporary Research

Source: compiled by the author.

The process of analysing dynamic relationships in human resources can be conventionally divided into three stages. The first stage covers the formation of the foundations of classical HR management in the 1970s-1980s, when personnel management ceased to be perceived as part of administrative activity and evolved into a fully developed field of management science, becoming a functional component of the business model oriented towards the achievement of strategic organisational objectives. Human resources began to be regarded as a significant object of management and a component of competitive advantage, achieved through the development of knowledge, skills, competencies, commitment, motivation, and employability. These attributes are acquired through training, professional development, career management, and personal growth, and are

realised through a complex system of HR practices within both operational and strategic management. This system includes elements such as organisational behaviour, corporate culture, business communication, automated information systems, knowledge management, and others [2].

During the 1990s-2000s, scholarly attention shifted towards understanding how HR contributes to the achievement of development goals and competitive advantages of core organisational and economic systems – firms, corporate groups, and industries. Researchers sought to identify best high-performance HR practices that deliver the greatest effectiveness and organisational outcomes [3; 4]. This was achieved by logically linking HR practices to human resource characteristics, and subsequently to productivity and financial performance, thereby capturing

both process and outcome indicators of organisational activity. Additive and multiplicative models were developed, incorporating various dependent, intermediate, and control variables, based on the consensus view of the uniqueness and inimitability of human resources and their decisive role as a strategic lever and a distinctive source of competitive advantage within an evolving information and communication environment [3–5]. The AMO framework (Abilities, Motivation, Opportunity) became widely used, explaining the impact of HR practices on organisational performance through behavioural components — abilities, motivation, and opportunity — whose combination can increase productivity even under conditions of limited resources [6]. A specific HR architecture also emerged, understood as a configuration of HR practices based on investment in employees with the most valuable knowledge and skills for the organisation [7]. The proposition that “an organisation should enable employees to do what they are able and willing to do” [8] is supported by empirical meta-analytical research demonstrating the positive effects of HR practices aimed at developing employee abilities and motivation on retention, productivity, and financial performance [9].

According to Russian scholars, studies conducted in the 2000s “demonstrate the existence of a relationship between strategy, human resources, HR practices, and firm performance; however, a comprehensive conceptual justification of the intermediate mechanisms for achieving these results has not yet been fully developed” [10, p. 133]. The tendency towards universalism — the search for best practices as a single formula for efficiency applicable to all organisations — on the one hand firmly established HR as a strategically important object of management, but on the other hand led to the extrapolation of empirical findings from certain firms and industries to others without sufficient consideration of national socio-economic and institutional contexts. The emphasis on efficiency and productivity placed individual employee behaviour and managerial

functions (with clearly defined economic performance criteria) at the centre of analysis, somewhat marginalising employees’ human needs and broader societal interests. A “soft”, human-oriented rhetoric often masks the actual rigidity of applied HR practices, while ethical issues are primarily addressed within the framework of corporate values. The AMO model illustrates the effectiveness of this approach but also introduces a differentiated treatment of employees, raising the question of whether organisations should invest in all employees or only in those who contribute most significantly to productivity.

Despite certain controversial aspects, it is possible to speak of the systematic nature and maturity of the human resource concept at the micro level, developed within the Western HR management tradition and viewing HR as “an element of an integrated mechanism, a chain of influence of various factors on final economic performance” [11, p. 42]. Russian scholars and practitioners, traditionally guided by the principles of national personnel policy, have since the 1990s closely followed the achievements of their foreign counterparts, critically evaluating and adopting their experience [12, 13]. Domestic approaches to human resource management are broadly similar to international ones, particularly in terms of HR characteristics, managerial functions and areas of personnel work, influencing factors, as well as types and indicators of HR effectiveness. The results of a limited number of empirical studies available in Russian literature also indicate a positive impact of HR practices on organisational performance. For example, a study conducted in 2006–2007 on a sample of 80 business companies revealed a lagged effect of implementing integrated HR tools in recruitment, selection, training, performance appraisal, and certification, provided these were supported by “positive” employee work practices [11]. An analysis of the performance of 67 banks over the period 2011–2015 identified the influence of variables such as strategic orientation, functional composition, automation, flexibility, and

innovativeness of HR management systems on organisational outcomes [14]. According to experts, advanced domestic HR developments are concentrated in large Russian companies; therefore, studying their experience may serve as an additional driver for the development of national human resource theory [10].

In response to the universalism of American HR management and in parallel with the search for “best practices,” “best fit” models have emerged, arguing that HR strategies are largely shaped by context and depend on the competitive environment and macroeconomic policy. In the 2000s, within the framework of the “contextual turn,” European scholars proposed a broader and more critical perspective, incorporating national, sectoral, technological, and organisational factors. This approach creates room for analysing more complex and mediated chains of dynamic influence [15, 16].

Since the 2010s, particular emphasis in the academic literature has been placed on changes in the HR landscape driven by information and digital technologies. Scholars widely agree that requirements for human resources are evolving, while their position within social production and their role in interaction with material resources are becoming more clearly defined. Accordingly, dynamic interrelations are expanding and being updated, including through: the implementation of HRIS (Human Resource Information Systems) [1]; the use of data analytics and robotic systems [17]; the application of e-HRM (electronic Human Resource Management) systems, which contribute to value creation, cost reduction, improved communication, and enhanced service quality, among other effects, through the Internet and other ICT tools applied to HR processes [18]; the use of artificial intelligence (AI) in HR management [19]; the development of digital leadership, digital employee productivity, and corresponding organisational culture [20, 21]; the promotion of innovative behaviour [22]; and the optimisation of human resource allocation through digital models (including alignment between evolving knowl-

edge bases and the creation of conditions for developing employee competencies) [23], among others. Digitalisation and informatization are increasingly seen as catalysts — both at the micro (organisational) and macro (national) levels — for the accumulation of knowledge, skills, competencies, and experience. The development of human capital, traditionally central to the study of economic dynamics, has thus gained even greater relevance today. “Technologies stimulate the development of different competencies (which go beyond digital skills and include, e.g. soft skills and critical thinking). ... Using digitalization, employees will develop competencies as learning through practice is the principal process through which human capital can be developed” [23].

The understanding of human resource characteristics known as employee dynamic capabilities has also been updated. Previously, these capabilities were largely associated with the principle of dynamic complementarity, according to which learning generates further learning, meaning that previously acquired skills facilitate subsequent learning [24]. Today, however, this concept refers not only to effective competence formation, but also to the ability to maintain and even increase labour productivity in rapidly evolving markets characterised by economic uncertainty and volatility. Some scholars argue that it is precisely dynamic capabilities, grounded in “personal human capital and organisational knowledge,” that are paramount for sustaining long-term organizational performance, ... achieving sustainable competitive advantages, ... empowering dynamic management capabilities” [21].

Such employee capabilities represent a source of strategic competitive advantage, as they establish a link between human resources and final organisational performance (competitiveness), realised through knowledge accumulation, social integration, and the reconfiguration of existing competencies in response to changing conditions. HR management itself is increasingly viewed as a set of dynamic HR practices aimed at achieving system-level objectives [25].

Features of research on the dynamics of human resources in the context of ICT implementation

In the 21st century, technology is regarded as the key trigger for further development of HR management. At the same time, however, it objectively complicates the study of dynamic relationships, acting as an additional mediating link between managerial practices, human resources, and economic outcomes. Despite the development of methodological tools and the increasing quantity and quality of research, many classical issues in HR management remain unresolved. In addition, in the new environment they have become more complex due to continuously changing conditions, the lack of clear criteria for evaluating HR practice effectiveness, issues of employee burnout and shifting motivation, and the need to account for social and environmental factors, among others.

The emphasis on productivity growth driven by informatization, automation, robotisation, and digitalisation in leading countries has reinforced a technocratic view of HR and given rise to a socio-technical concept. Within this framework, attention is focused on the integration of technological and HR processes in order to generate additional economic value from existing resources. "Of the various forces affecting HR, the development of technology is the most significant" "human capital is the most universally valuable and imperfectly imitable resource, a central driver of strategy and performance. Since both IT and HR functions are evolving to assume new organizational roles, it is unsurprising that HR and IT executives work together... The worth of technology is contingent upon its interconnection and harmonization with other organizational assets and capabilities (i.e., HR practices) ... Technology and personnel are integrated and create synergistic effects that transform employee experience, reduce costs, improve branding, and generate revenues" [26].

Human resources, in combination with technology, are often perceived as a unified asset that has the strongest impact on the performance

of various types of organisations and serves as a source of higher profitability (and, in some industry segments, even as the only significant asset capable of ensuring competitive advantage over rivals) [22].

In response to the technocratic tendencies of Industry 4.0, greater attention has been paid to social factors, although a truly human-centred approach has not yet become dominant in either management theory or practice. In models developed by scholars, parameters such as employee health and well-being, psychological safety and self-determination, career strategies, and talent management are increasingly incorporated [27, 28]. Today, dynamic relationships are studied not only through methods focused on the formation of professional competencies, but also through such characteristics as job satisfaction and job attractiveness. This is particularly relevant in the context of pressures related to productivity, digitalisation, corporate interests, and increasingly heterogeneous forms of employment.

HR practices under conditions of informatization are also widely discussed in Russian academic literature. Many domestic studies are characterised by a normative approach to human resource management, according to which employees are expected to develop their competencies in order to adapt to the "new reality" and support organisational performance growth. Organisations, in turn, are expected to effectively implement new technologies in HR management in order to contribute to overall economic development. This normative dimension reinforces the technocratic approach adopted from Western HR management traditions. In addition, there remains a shortage of empirical studies based on Russian data that demonstrate that ICT enhances the positive impact of HR practices on labour productivity and financial performance.

The influence of technology has encouraged scholars to reconceptualise the category of "human resource management" itself, viewing HRM within "new theoretical frameworks as a dynamic ecosystem," the development and transforma-

tion of which generates the aforementioned synergistic effects. Within these new frameworks, some researchers have developed a digital HR strategy consisting of nine core practices and approximately 130 sub-practices — originally digital (or non-digital but subsequently digitised) [26]. The pace of digital technology adoption and corresponding organisational change reflects increasing dependence on “digital” HR parameters. As noted in the literature, “digital transformation is less about technology and more about people, as it depends on their ability to accept, adapt, and learn” [29]. It requires internal human resources to effectively use digital applications and implies the formation of new capabilities, competencies, and forms of leadership [20]. It can therefore be concluded that the synergy between HR and ICT represents a new stage in the development of dynamic relationships that mediate between resource bases, management practices, and organisational outcomes.

Taking a broader view of management literature beyond the “human–technology” nexus, it can be argued that human resources act as an imperative for effective, sustainable, human-centred, “green,” and other forms of development within the resource–role model of the economy that has emerged over recent decades. In this model, each type of resource — natural, human, material, technological, financial, institutional, and others — plays a vital role. The global academic discourse demonstrates that it is precisely the integration and synergy of all factors that enable the achievement of final objectives of economic systems, such as output growth, improved efficiency and productivity, enhanced competitiveness, sustainability, and societal well-being. Emphasising the important and even “quintessential” role of human resources, scholars stress that their potential is fully realised only through interaction with other resource types — for example, natural resources — which may lead to economic growth and the reduction of informational and technological gaps [30]. “Sustainability requires investment not only in human resources

but also in the effective management of energy and material resources” [27]. A distinctive feature of recent research is the detailed examination of indirect dynamic relationships between human resources and variables such as the intensity of ICT implementation, organisational structure efficiency, institutional quality, and the degree of political stability, among others, which are manifested through various processes, stages, and effects [26, 30]. These and other studies demonstrate the complexity, non-linearity, heterogeneity, and multi-criteria nature of such interrelationships across different economic systems.

Within this framework of complementarity, it should be noted that in international literature human resources are generally treated as an important factor of production that interacts with other equally significant factors in achieving economic outcomes. In contrast, Russian academic sources tend to present HR more as a dominant factor of development, exerting a direct influence on economic processes. Russian scholars often justify the superiority of the human factor itself through the role of knowledge and the potential of human cognition, which in an information economy leads to the primacy of intangible production. “In the development of innovation, particularly in education, ICT, pharmaceuticals, biotechnology, and healthcare, the role of the human factor has become dominant” [31, p. 17]. “In the context of the transition to a digital economy, human capital becomes the key driver of innovative economic growth” [32, p. 25]. “It is human capital, to a much greater extent than material resources, that ensures competitive advantages at national and regional economic levels” [33, p. 8]. Such an emphasis on the human factor may be related to the structural characteristics of the national economy, which over the past three decades has not experienced sufficient development of advanced technologies and, consequently, has lacked a strong demand for in-depth studies of production factors. Drawing on post-industrial theories developed in leading economies, many Russian scholars attempt to integrate these ap-

proaches into domestic practice, viewing the human factor as the primary source of hope for national economic development.

CONCLUSION

A substantial part of contemporary management discourse is devoted to the study of dynamic interrelations in the economy involving human resources. This focus has emerged as a result of the objective increasing complexity of socio-economic processes, including informatization and digitalisation, which are transforming the form, speed, and effectiveness of management processes. A substantive and conceptual analysis of such studies (starting from the 1970s) shows that in none of the periods examined was a universal algorithm of managerial influence on human resources identified, nor was a single “best” HR practice or a key element found that ensures maximum system-wide productivity, whether at the level of a firm, industry, or national economy. It can therefore be concluded that, in each specific case, unique dynamic relationships are formed, depending on a wide range of external and internal factors, which in turn generate a context-specific approach to human resource management. Nevertheless, a common criterion of systemic effectiveness is the inclusion of human resources among the priorities of strategic management, contributing to increased competitiveness and the trajectory of sustainable development.

The analysis also reveals a growing influence of technology on the formation of human resource characteristics, as well as an increasing impact

of managerial intervention in the form of digital HR practices and tools. The information economy acts as the overarching environment, while ICT functions as an additional mediating mechanism that simplifies value creation processes but simultaneously increases the complexity of dynamic relationships within the corresponding links of the management chain.

Systematising and critically interpreting contemporary management thought makes it possible to identify priority directions for the further development of HR management and to link them with practical challenges. On the one hand, the role of ICT in improving the effectiveness of HR practices supports the expansion of HR information systems, HR analytics, HR metrics, artificial intelligence in HR, and related tools, with the aim of enhancing overall organisational performance. On the other hand, the ambiguous nature of this impact highlights the need for cautious and balanced adoption of advanced HR technologies, taking into account emerging issues related to productivity, motivation, and employee engagement in today’s increasingly technocratic environment. The findings of this study suggest that ICT should be implemented not merely on the basis of the widespread assumption that “new technologies must be introduced,” but rather with regard to the specific characteristics of the surrounding context and the interests of employees. It is essential to recognise that technology is only a tool, while final effectiveness is determined by the quality of management across the entire chain of dynamic interrelations.

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Conceptualizing the Phenomenon of Academic Borrowing within the Knowledge Management Paradigm

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ABSTRACT

The lack of consensus regarding quantitative measures for assessing text originality gives rise to the problem of interpreting the results generated by algorithms of information systems designed to detect academic borrowing in texts, as well as the comparability of expert evaluations of the originality of intellectual outputs. The **aim** of this study is to reveal the nature and essence of the phenomenon of academic borrowing through the methodology of knowledge management. The author considers quality management of the work performed by research units as a new function of knowledge management capable of regulating the quality of scientific knowledge. An original interpretation of the nature and essence of academic borrowing is proposed, distinguishing between its epistemological nature and its ethical-deontological essence. It is demonstrated that the contemporary (1990–2025) discourse on academic borrowing has been shaped by digital transformation and comprises approximately sixty definitions, which the author classifies into three groups. This inventory is conducted with a view to constructing a systematic terminological framework for academic borrowing. The **findings** of the study may be useful to specialists in general issues of the science of science and epistemology; in management studies, particularly in the field of knowledge management, including the organization and supervision of research activities; in the regulation of copyright and intellectual property rights; in the preparation, editing, and processing of academic texts; and to faculty members, students, and postgraduate researchers engaged in these areas, as well as to all those who require skills in academic writing.

Keywords: phenomenon of academic borrowing; knowledge producer (knowledge worker); research unit; quality of knowledge; circulation of unreliable knowledge; pistemological nature of academic borrowing; ethical-deontological essence of academic borrowing; semantic field of academic borrowing

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INTRODUCTION

The informatization and digital transformation of all spheres of life necessitate a reconsideration of the phenomenon of academic borrowing. Alongside the well-known Antiplagiat system in Russia, a number of functionally similar tools have become widespread, including Author.net, Detector-plagiata.ru, Etxt Antiplagiat, Plagiata.NET, Copyscape.ru, Findcopy.ru, Miratools, Istio.com, Advego Plagiatus, Praide Unique Content Analyzer, and Double Content Finder [1, 2]. In 2025, this range was further expanded with the introduction of the {do}mate system.¹ The growing diversity of software solutions has only intensified the challenge of interpreting their results. At present, there is no unified approach to the quantitative assessment of text originality, plagiarism, self-plagiarism, improper and unethical borrowing, or self-citation. Without the harmonization of expert perspectives on these definitions, it is impossible to standardize procedures for the expert evaluation of the originality of intellectual outputs (IO).

In this context, we consider it essential to conduct a systematic analysis of the phenomenon of academic borrowing within the framework of knowledge management.

PROBLEM STATEMENT AND RESEARCH METHODOLOGY

A comprehensive understanding of the nature and essence of the phenomenon of academic borrowing is most effectively achieved from the perspective of knowledge management (KM). In earlier historical periods, reflections on knowledge were primarily the domain of theoretical philosophers, who engaged with the issues within the fields of epistemology and gnoseology. At the same time, a materialist analysis of world culture led to the conclusion that knowledge emerges autonomously under

conditions of creative freedom exercised by the individual in the process of understanding the world. A fundamental shift in perceptions regarding the very possibility of managing cognitive activity occurred in the second half of the twentieth century. This shift was driven by the recognition of the economic value and utility of knowledge, as well as by the growing awareness that knowledge itself can be subject to management.

THE QUALITY OF RESEARCHER'S WORK

In 1979, Peter F. Drucker, a leading authority in management theory, introduced the concept of the “knowledge worker” into scholarly discourse [3]. He was among the first to argue that the performance of knowledge producers should be evaluated not by the volume of labor expended, but by the quality of the outcomes achieved [4–6].

As a functional domain, KM initially emerged as the management of organizational knowledge in the context of creating and delivering commercial goods and services. The knowledge-based theory of the firm, proposed in 1996 by Robert M. Grant [7], continues — nearly three decades later — to shape the research agenda in this area of management science [8]. At the threshold of the second quarter of the twenty-first century, the universal applicability of the KM paradigm has become increasingly evident, extending to organizations of all types, including research institutions and universities² [9–12].

The present study focuses on so-called research units: individual scholars or groups engaged in collaborative scientific activity and producing new academic knowledge. It should be noted that, to date, in the fields of science and higher education, KM tools have been applied primarily to organizational knowledge.

¹ An intelligent system for the analysis of scientific and educational texts. URL: <https://www.domate.ru/>

² Blyumin, A.M. Knowledge management in research activities: a textbook. Moscow: Dashkov and Co. 2022, 296 p.

We argue, however, for the introduction of an additional function of knowledge management — namely, quality management of research work produced by such units.

This argument is grounded in two key considerations. First, it concerns human resources. As early as 2003, the prominent economist Boris Milner observed that “knowledge management is based on the capabilities of modern information technologies and human resources” [13]. Autonomy, reflexivity, and the capacity for self-management were identified by P. Drucker — apparently proceeding from a presumption of good faith — as defining characteristics of knowledge workers. However, empirical practice demonstrates that such individuals may engage in delinquent behavior, including various forms of copyright infringement and academic misconduct. The scale of this phenomenon has now reached a point where isolated incidents are evolving into a systemic challenge to the reliability and integrity of scientific knowledge.

The second consideration arises from the expanding capabilities of contemporary information technologies, particularly those associated with artificial intelligence (AI). Its appeal as a technical assistant to research units is certain to increase rapidly and may ultimately pose a significant risk to science, given AI’s current limitations in reliably assessing the validity of knowledge — unless timely preventive and mitigating governance mechanisms are established. In the pre-digital era, unreliable scientific knowledge, often associated with delinquent practices, once introduced into academic circulation, tended to remain marginal and gradually fade into obscurity. In contrast, in the context of digitalization, such knowledge is far more likely to be disseminated widely and to become uncontrollably intertwined with verified facts. Without purposeful and sustained counteraction, this trend will inevitably lead to the contamination and, ultimately, the devaluation of the corpus of scientific knowledge. Accordingly, to effectively anticipate and miti-

gate the adverse consequences of delinquent behavior by research units in the context of digitalization and the advancement of AI technologies, it is essential to develop a modern system for managing the quality of scientific knowledge.

MANAGING KNOWLEDGE GENERATION PROCESSES

As early as 1998, Dorothy Leonard and Sylvia Sensiper emphasized that knowledge creation is a social process grounded in personal interaction and interpersonal relationships, through which individuals’ creative potential is realized [14]. In 2007, Vladimir E. Raskov synthesized key parameters of the organizational context and KM instruments, highlighting the autonomy of teams generating new knowledge; the absence of standardized, mandatory rules and procedures; the diversity of cultural and professional backgrounds within autonomous groups; as well as uncertainty and constructive chaos. An organizational culture conducive to knowledge creation is therefore characterized by an orientation toward originality and novelty, a high tolerance for risk, acceptance of errors, and the absence of objectively superior models in the search for new solutions [15].

These universal characteristics, valid within the framework of the knowledge-based theory of the firm, require specific reinterpretation when applied to teams directly engaged in research and development — that is, within higher education and scientific institutions.

It is essential to recognize that managerial attention is primarily directed toward the circulation of so-called tacit knowledge. Defined by Richard Lubit (2001) and David W. DeLong (2004) as the manifestation of experience at an intuitive and largely unconscious level — expressed as a readiness to act in a particular context — this type of knowledge is inseparable from individuals’ life experience, values, beliefs, and emotional domains, which underscores its inherently holistic nature [15].

A structural unit of an organization engaged in research and development may be viewed as a focal point of tacit knowledge aligned with the subject matter and specific features of the research undertaken. It is characterized by an informal environment of scientific creativity and emotionally charged interaction, which together create conditions for the realization of the creative process under a high degree of interpretive freedom. Dorothy Leonard and Dorothy Strauss (2006) argue that the originality and value of collaborative creative inquiry are directly determined by the diversity of participants' expertise, their cultural backgrounds, and the intensity of competing viewpoints [16].

According to J.-C. Spender and Andreas G. Scherer (2007), the essence of knowledge management lies precisely in developing approaches to governing agent-based practices under conditions of uncertainty, with practice understood as the embodiment of tacit knowledge [17]. Finally, Ikujiro Nonaka, Florian Kohlbacher, and Nigel Holden (2006) identify as a key element of KM the distinctive phronetic³ role of the leader responsible for managing knowledge generation processes. Within this concept — encompassing both practical and ethical dimensions — the leader's capacity to discern the common good and to determine how it may be achieved is of central importance [15].

We, in turn, argue that the phronetic role of the leader of a research team also entails the responsibility to ensure lawful conduct on the part of researchers. Its fundamental principles — respect for human rights and freedoms, avoidance of harm to life and health, and protection of the environment — are enshrined in Russian legislation (Article 4(7) of the Federal Law on Science⁴). Among the most prevalent

violations are infringements of intellectual property rights, the majority of which concern the author's moral (non-property) rights.

It should be noted that the contemporary Russian culture of intellectual property protection has not yet reached full maturity. The law enforcement practice concerning dispute resolution in this area for the period 2004–2022 is comprehensively analyzed in the work of V.N. Lopatin,⁵ based on extensive long-term research conducted by the Russian Research Institute for Intellectual Property under the auspices of the Federation Council of the Federal Assembly of the Russian Federation. Nevertheless, the practice of safeguarding authors' personal non-property rights remains largely unexplored. It can be suggested that such protection is sporadic, extremely limited, and constrained by the inefficiency of legal mechanisms, including the absence of mediation procedures — a point rightly noted by V.N. Lopatin. At the same time, the active development of information systems that enable automated text comparison, originality assessment, and detection of borrowed fragments is expected to advance disputes over authorship to a fundamentally new level.

RESEARCH RESULTS

The originality of intellectual property objects (IPOs) is aimed at protecting the intellectual rights of authors and is assessed using expert evaluation methods. Its specificity is determined by an evident reliance on the subjective judgment of the specialist. An expert's conclusion regarding the degree of originality of an IPO is grounded in the constitutional right of individuals to creative freedom and may serve as a basis for the application of state coercive

³ Phronesis (Ancient Greek: φρόνησις, Latin: phrónēsis) is a type of wisdom associated with practical action — practical or everyday wisdom (one of the intellectual virtues according to Aristotle).

⁴ Law No. 127-FZ of August 23, 1996, "On Science and State Scientific and Technological Policy." URL: https://www.consultant.ru/document/cons_doc_LAW_11507/

⁵ Lopatin, V.N. (2023). On the current state of regulation and law enforcement in the field of intellectual property in the Russian Federation. Current issues of protection of intellectual property rights in modern conditions. Analytical Bulletin of the Federation Council of the Federal Assembly of the Russian Federation. Moscow: Information and Analytical Directorate of the Office of the Federation Council, pp. 7–41.

measures. Therefore, such an assessment cannot be arbitrary and must be objectified to the greatest extent possible through a system of standardized terminology, unified procedures, and verification of the competencies of the experts making the decisions. Furthermore, we argue that legal liability should be established for those who make expert judgments.

As the prominent Soviet linguist A. A. Reformatsky [18, p. 164] rightly noted, terms carry a socially obligatory character, as they reflect socially organized reality. Accordingly, a consensus must be achieved among experts regarding approaches to assessing the originality of IPOs, and the formalized results of this consensus could form the basis for the unification of reports on text similarity checks, including within the “Antiplagiat” system. Additionally, it is important to systematize the terms reflecting the relationships between the corresponding concepts, thereby forming a coherent terminological system.

THE NATURE AND ESSENCE OF ACADEMIC BORROWING

From a cultural perspective, creativity in all its manifestations is inseparable from borrowing. This appears to be rooted in the social nature of humans. As far back as 2,500 years ago, the ancient Chinese philosopher Confucius stated: “There are three paths to knowledge: the path of reflection is the noblest, the path of imitation is the easiest, and the path of experience is the bitterest.”⁶ Imitation — which essentially constitutes borrowing — has permeated all spheres of creative activity since time immemorial. Our focus here is limited to scientific and technical creativity and the associated use of prior results in the creation of new scientific, technical, or educational outcomes — that is, academic borrowing.

⁶ Likhtenstein, E.S. *A Word about Science: Aphorisms, Sayings, Literary Quotations*. Moscow: Znanie, 1981, 271:100.

A defining feature of creative outputs is the uniqueness of the resulting product. However, the uniqueness of any given creative product is dialectically grounded in the experience of preceding generations of its creators; thus, every creation contains a measure of universality.

From an epistemological standpoint, S.A. Lebedev (2020) convincingly demonstrated that the structural complexity of scientific knowledge inevitably gives rise to epistemological pluralism [19], caused by the constructive nature of scientific thinking (epistemological basis), the diversity of methods of scientific inquiry (methodological basis), and the fragmentary nature of any scientific theory in relation to its subject matter (logical basis). An unavoidable consequence of the ontological, epistemological, and logical-methodological pluralism of science is the pluralism of truth criteria across domains, levels, and types of scientific knowledge [19].

Moreover, as early as 1996, J.-Ch. Spender proposed the concept of epistemological pluralism as a methodological foundation for knowledge management. He distinguished four types of knowledge that could serve as a basis for developing a knowledge-based theory of the firm: individual explicit, individual tacit, social explicit, and social tacit, emphasizing the latter as having particular strategic value from a knowledge-based perspective [20, 21].

It is likely that social tacit knowledge constitutes the primary “nutrient medium” in which individual explicit knowledge matures and crystallizes, subsequently entering scientific circulation through mechanisms of authorship. In the realm of academic creativity, this knowledge emerges as a result of the dialectical transformation of the general and the particular into the singular. This allows us to assert the epistemological nature of borrowing: as the outcome of imitation and continuity, it is implied in the well-known metaphor of “standing on the shoulders of giants.” The study of the origin of this metaphor brilliantly

illustrates how new individual explicit knowledge is formed and matures within the depths of social tacit knowledge. Our approach to interpreting borrowing as an integral component of knowledge — and as a mode of its existence — requires clarifying its epistemological nature by examining the relationship between the epistemological, gnoseological, and cognitive components in the structure of borrowing.

It is well established that the subject of epistemology concerns the philosophical content and structure of knowledge, whereas gnoseology focuses on the process of knowing. In both cases, intersubjectivity is implied, understood as the shared experience of interacting subjects and the general significance of its results, which enables mutual understanding. Yet, in the “here and now,” only individual knowing subjects — specific humans with specific cognitive capacities — exist. Knowledge acquires the quality of intersubjectivity when it transforms from the individual to the social, passing through three stages of maturation: the cognitive stage, as a product of the mental activity of individual thinkers; the gnoseological stage, as the result of discourse within the thinking society; and the epistemological stage, as a means of reflecting truth. Throughout this process, borrowing is inseparably intertwined with the formation and transformation of knowledge. At the first (cognitive) stage, borrowing most often manifests as imitation. At the second (gnoseological) stage, it appears as continuity between discrete individually expressed ideas of people connected by shared assumptions and views. At the third (epistemological) stage, borrowing embodies the generalized experience of humanity’s understanding of particular objects. Thus, the epistemological nature of borrowing also encompasses its gnoseological and cognitive dimensions. Based on the intersubjectivity of knowledge, we argue that borrowing represents a specific mode of existence of social knowledge.

At the cognitive stage of knowledge formation, due to its intersubjective nature, individual thinkers may independently arrive at identical conclusions. The history of science provides numerous examples supporting this claim, and in sociology, this phenomenon is referred to as “multiple independent discoveries.”⁷ Robert K. Merton (1963) defined these as cases in which a discovery was made independently by each working scientist [22]. However, it is important to note a significant practical point: when several researchers working autonomously reach the same conclusion, their works (i.e., the texts of their publications) are never identical. The idea is the same, but the text is not.

The intersubjectivity of knowledge also determines the existence of limits to borrowing. A practically significant interpretation of these limits is provided in Part Four of the Civil Code of the Russian Federation.⁸ In our view, the theoretical limit of borrowing is absolute truth.

We posit that within the structure of an individual’s mental activity, processes of imitation and borrowing play a fundamental role, forming the basis of cognitive activity according to the principle of *a posteriori* knowledge (knowledge derived from experience). Only certain individuals, due to exceptional mental ca-

⁷ Examples of multiple independent discoveries include the formalization of differential and integral calculus, independently carried out in the seventeenth century by Isaac Newton, Gottfried Wilhelm Leibniz, and other mathematicians; the rediscovery of oxygen in the eighteenth century by Carl Wilhelm Scheele, Joseph Priestley, and Antoine Lavoisier; the law of the physical state of gases, independently formulated in the seventeenth century by Robert Boyle and Edme Mariotte; the independent development of the theory of non-Euclidean geometry in the early nineteenth century by Nikolai I. Lobachevsky in Russia, János Bolyai in Hungary, and Carl Friedrich Gauss in Germany; and the development of the theory of biological evolution in the nineteenth century by Charles Darwin and, independently, Alfred Russel Wallace.

⁸ Civil Code of the Russian Federation (Part Four) No. 230-FZ of December 18, 2006 (as amended on July 23, 2025), Section VII, Articles 1259, 1349–1352, 1412–1413, 1448, 1465, 1473. URL: https://www.consultant.ru/document/cons_doc_LAW_64629/ https://www.consultant.ru/document/cons_doc_LAW_64629/2bb6d57fd429e6c04ee080e73ceef708aa442fc8/

An Inventory of Definitions Characterizing the Manifestations of the Borrowing Phenomenon and Present in Scientific Circulation at the Present Stage (1990–2025) (in Alphabetical Order)

Manifestations corresponding to the natural epistemological nature and ethical essence of academic borrowing	Manifestations contradict the ethical essence of academic borrowing	Phenomena not related to academic borrowing (adjacent polysemous categories)
Conscientious self-citation [25]	Duplicate (multiple) publication [24]	Author self-citation [28–30]
Borrowing established terms (including definitions, anatomical and physiological concepts, classifications) and illustrations [23] ¹	Conscientious self-citation in incorrect form [25]	Bibliometric self-citation (self-citation, rarely self-reference) [28]
Paraphrase ²	Duplicate publication [25] ³	Direct self-citation [28]
Republication, reprinting (copywriting) [25] ³	Borrowing individual words, expressions, text fragments, formulas, plots, ideas [26]	Co-author self-citation [28]
Proper borrowing in correct form ⁴	Redundant publication [25] ³	Self-citation-T (Kurpakov V. Yu.) ⁵
Direct quotation ²	Slicing (fan publication) [24]	Journal self-citation [28, 31]
Self-citation ²	Multiple submissions, salami slicing ²	Disciplinary self-citation [28, 32, 33]
Self-citation-T (Kurpakov V.Yu.) ⁵	Dishonest borrowing in dissertation work [27]	Publisher self-citation [28, 34]
Citing (Citedness, Citation, Quotation) ²	Dishonest self-citation (self-plagiarism) [25]	Institutional self-citation [28, 35–37]]
	Unauthorized borrowing ⁶	Country-level self-citation [28, 38, 39]
	Unauthorized borrowing (plagiarism) ⁴	Fractional self-citation (degree or Jaccard coefficient of self-citation) [28, 40]
	Paraphrase (rewriting) [25]	Self-citation coefficient [28]
	Reworked publications [25] ³	Self-citation index s [28, 41]
	Gift author ²	Self-citation rate coefficient [28]
	Proper borrowing in incorrect form ⁴	
	Direct copying of publication [25] ³	
	Self-plagiarism [25]	
Self-plagiarism [23]		

Окончание таблицы / Table (continued)

Manifestations corresponding to the natural epistemological nature and ethical essence of academic borrowing	Manifestations contradict the ethical essence of academic borrowing	Phenomena not related to academic borrowing (adjacent polysemous categories)
Citing (Citedness, Citation, Quotation) ²	Plagiarism ⁷	Self-citation rate coefficient [28]
	Plagiarism [23] ¹	
	Plagiarism ²	
	Plagiarism (Kurpakov V.Yu.) ⁵	
	Very small, small, large, very large plagiarism [26]	
	Idea plagiarism [23, 42]	
	Coded plagiarism [26]	
	Criminal plagiarism (legal reference "Dissernet") ⁸	
	Mosaic plagiarism [23, 43, 44] [23, 43, 44]	
	Non-criminal plagiarism (legal reference "Dissernet") ⁸	
	Direct plagiarism (verbatim, text plagiarism) [23, 42, 44]	
	Updated plagiarism [26]	
	Meaningful plagiarism [26]	
	Edited and partially edited plagiarism [26]	
Partially clean plagiarism [26]		
Clean plagiarism [26]		

Source: compiled by the author.

Notes: 1 – Based on recommendations of World Association of Medical Editors, WAME), Italy; 2. Kirillova O.V., ed. Methodological recommendations for the preparation and design of scientific articles in journals indexed in international scientometric databases. Moscow: ANRI; 2017. 144 p.; 3 – Based on the analysis of recommendations of Committee on Publication Ethics, COPE), United Kingdom; 4 – Shakhrai S.M., Arister N.I., Tedeev A.A. On plagiarism in dissertations for an academic degree. Moscow: MII; 2015. 191 p.; 5 – Kurpakov V.Yu. Copyright in a modern university: materials of an additional professional development program.; 6 – Belenkaya O.S., Strelkova I.B., Filippova O.A., Chekhovich Yu.V. Methodological recommendations for expert assessment of the originality of dissertation texts in the Antiplagiat system. St. Petersburg: Lan; 2021. 92 p.; 7 – Plagiarism. Large academic dictionary of the Russian language. T. 16. Moscow; St. Petersburg: Nauka; 2011. 638 p.; 8 – The legal concept of plagiarism and some features of its application in practice. URL: <https://www.dissernet.org/about/instructions-and-documents?key=ЮРИДИЧЕСКОЕ%20ПОНЯТИЕ%20ПЛАГИАТА%20И%20НЕКОТОРЫЕ%20ОСОБЕННОСТИ%20ПРИМЕНЕНИЯ%20ЕГО%20НА%20ПРАКТИКЕ.%20СПРАВКА%20ЮРИСТОВ%20«ДИССЕРНЕТА/>

capacities —specifically, a highly developed level of abstract thinking — are capable of *a priori* cognitive activity (knowledge preceding experience). Thus, in the process of transforming from individual tacit knowledge to social explicit knowledge, knowledge undergoes a distinctive cascade of transformations, similar to the way songs, epic tales, proverbs, and omens were transmitted orally in ancient times. The essence of borrowing, which is both necessary and inevitable in cognitive activity, lies in the fact that the individual who employs it relies on certain principles of morality and ethics, the meaning of which can be summarized by the biblical injunction: “Thou shalt not steal.”

Since Merton, the ethical norms of scientific practice have unequivocally condemned plagiarism and fraud in all their forms and manifestations, leaving no room for justification. Consequently, it is the principles of the scientific ethos that must guide researchers whenever a research unit, working with borrowed material, produces new scientific knowledge. This implies that the natural systematization and classification of academic borrowing can only be grounded in an ethical-deontological principle, namely: 1) respecting scientific priority when presenting facts, ideas, hypotheses, and theories, and acknowledging the sources of one’s scientific and creative inspiration; 2) observing authorship rights and the author’s right to attribution; 3) ensuring the generation of new scientific knowledge as the justification for the borrowing undertaken.

MANIFESTATIONS OF THE PHENOMENON OF ACADEMIC BORROWING

The contemporary discourse on academic borrowing has developed over the past 35 years (1990–2025), a period during which this issue has reemerged with renewed intensity. In 2016, A.S. Ostrovskaya [23], based on a content analysis of publications indexed in the international Scopus database under the keyword

“Plagiarism,” noted that between 2000 and 2015, the number of publications mentioning the term “plagiarism” increased eightfold; in the field of medicine, threefold; and in non-medical disciplines (including biomedical research), thirteenfold. What explains this exponential growth in publications on plagiarism after 2000?

It is known that in 1994 the WebCrawler service — the world’s first text-based search engine — began operating. From 1995, the AltaVista service allowed users to formulate queries and receive responses in “natural languages” (the user’s native language), with Russian added in 1996. In 2005, domestic users were offered the “Antiplagiat” plagiarism detection system. These developments have significantly enhanced the relevance of the issue of academic borrowing over the past 35 years.

New IT capabilities have revealed its complex phenomenology (the terminological apparatus of academic borrowing comprises approximately 60 concepts) and the considerable inconsistency of existing definitions (see *Table*). Analyses of these definitions show a semantically rich and complex field for the phenomenon of academic borrowing. This is because, within a single semantic space, heterogeneous manifestations coexist: those consistent with the natural epistemological and ethical essence of academic borrowing (citation, paraphrase, proper lawful borrowing, conscientious self-citation, republication); those contradicting it (plagiarism, self-plagiarism, multiple publications); and finally, phenomena not strictly belonging to academic borrowing but semantically related due to polysemy.

In conducting an inventory of the definitions of the phenomenon of academic borrowing, our goal was not to trace the natural evolution of each term. Rather, we selected from this set a circle of concepts deemed necessary and sufficient for an expert to prepare relevant managerial decisions. We hope to continue this work by describing the methodological

apparatus of academic borrowing, elucidating the specifics of its main manifestations, analyzing the polysemy of the most significant definitions, and proposing a classification of academic borrowing for practical use by experts.

CONCLUSION

1. The theoretical and methodological discourse of knowledge management provides a productive scientific foundation for the systematic study of the phenomenon of academic borrowing.

2. Managing the quality of work of research units — the producers of knowledge — can be

considered a new function of knowledge management, capable of ensuring the quality of new scientific knowledge.

3. Academic borrowing possesses an epistemological nature as well as an ethical (ethico-deontological) essence.

4. The phenomenon of academic borrowing is characterized by a complex semantic field of existing definitions, which can be divided into three groups: categories consistent with the natural epistemological and ethical essence of academic borrowing; categories contradicting this essence; and phenomena not directly related to academic borrowing (adjacent polysemous categories).

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ORIGINAL PAPER



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Structural and Functional Analysis of Organizational Systems of Agricultural Higher Education Institutions

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ABSTRACT

State policy in the field of science and higher education is aimed at the modernization of educational institutions in order to ensure their closer alignment with labor market demands and societal needs. The **purpose** of this study is to assess the current parameters and operating conditions of educational institutions, taking into account the specific characteristics of the agro-industrial complex. The article provides an overview of the agricultural higher education system and presents an analysis of the current state of the network of educational organizations. Particular attention is paid to their structural features, elements, interconnections, and operational efficiency. The **object** of the study is the network of higher education institutions that train specialists for the agro-industrial complex, while the **subject** of the study is the efficiency of these educational institutions, as well as the factors, relationships, models, and algorithms governing the interaction of elements within their organizational systems. The data sources used in the study include strategic, methodological, organizational, and other materials characterizing the activities of educational institutions subordinate to the Ministry of Agriculture of the Russian Federation and the Ministry of Science and Higher Education of the Russian Federation, as well as analytical and statistical information. The **findings** of the study may be used by government authorities (primarily the Ministry of Agriculture of the Russian Federation) in managing the activities of agricultural educational institutions in order to obtain a more comprehensive assessment of the performance of subordinate organizations. In addition, the results can be applied in the development of prospective (strategic) plans for the advancement of specialized universities under contemporary conditions.

Keywords: organizational design; organizational system; higher education institution; information modeling; agro-industrial complex; efficiency

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INTRODUCTION

The doctrinal documents¹ defining the strategy for national and societal development up to 2030 establish the following priority objectives:

“...the development of human potential...”;

“...the provision of the digital economy with competent personnel...”;

“...the formation of an information space that meets the needs of citizens and society for high-quality and reliable information...”;

“...the use and advancement of various educational technologies, including distance and e-learning, in the implementation of educational programs...”.

Their implementation imposes increased obligations on educational institutions of all levels and specializations, including those that train specialists for the agricultural sector. The high relevance of such training is determined by the designated trajectory of sectoral development, particularly in terms of achieving ambitious targets for increasing production volumes, ensuring food security, expanding exports of high value-added non-resource products of the agro-industrial complex (AIC), integrating into national and global trends, and digitalizing all aspects of social life [1].

The creation of favorable conditions for the sustainable growth and development of the AIC is impossible without adequate human resource provision. Therefore, the issue of aligning educational and professional standards with employers' demands has become particularly pressing. Which workforce needs of agribusiness should be prioritized in the context of rapidly evolving trends in automation and digitalization of the AIC? How can scientific and technological capacity be enhanced, international cooperation expanded, and effective interaction with business strengthened?

¹ Decree on the National Development Goals of the Russian Federation for the Period up to 2030 and for the Outlook up to 2036. URL: <http://kremlin.ru/events/president/news/73986>; Resolution of the Government of the Russian Federation No. 1642 dated December 26, 2017 (as amended on December 17, 2025) “On Approval of the State Program of the Russian Federation ‘Development of Education.’” URL: https://www.consultant.ru/document/cons_doc_LAW_286474/cf742885e783e08d9387d7364e34f26f87ec138f/

Market dynamics compel educational institutions to increase their competitiveness and efficiency through the transformation of their activities. To achieve this, they must be prepared to formulate and implement forward-looking development strategies; optimize their processes and organizational structures; develop new incentives for staff motivation; ensure the preservation of scientific schools; attract internationally recognized experts, and so forth — objectives that are unattainable without the continuous development of the educational institutions themselves. The need for transformation, in turn, implies the improvement of organizational mechanisms, the adoption of new approaches to structural design, and the implementation of advanced managerial solutions, including those based on emerging information technologies developed and applied in agricultural universities and demanded under current conditions.

To achieve the research objective, which consists in analyzing the current characteristics and operating conditions of educational institutions (EIs) training personnel for the agro-industrial complex (AIC), it is necessary to address the following tasks:

- to form a dataset of educational organizations (EOs) and to select the most representative ones for subsequent analysis;
- to conduct an analysis and provide a characterization of the organizational system (org-system) and its key elements;
- to assess the efficiency of the organizational system (with respect to its individual components).

MATERIALS AND METHODS

In the course of the study, the following methods and tools of scientific inquiry were employed:

- at the data collection stage: content analysis and survey methods (collection of statistical data; examination of documentation and information support of management systems in agricultural universities);
- during the processing of the obtained data: functional analysis (where the object of analysis is considered as a set of functions it performs)

and structural analysis (where the object is represented as a hierarchical system of interrelated elements);

- at the stage of graphical modeling of the organizational structure, as well as describing functional relationships among its elements: information modeling based on graph theory;
- for processing statistical data and identifying relationships: the computational-analytical method and comparative analysis.

RESULTS

The study was conducted in several stages.

Stage 1. Data collection and analysis of the educational network

At this stage, data were collected and analyzed based on the following sources²:

- information-analytical materials from monitoring the activities of higher education institutions;
- performance indicators of educational organizations implementing higher education programs;
- the register of state assignments for the provision of services (performance of works);
- selected sections of educational organizations' websites containing mandatory information: charter; regulations on structural units; organizational structure and governance bodies; self-assessment reports; accounting data; financial and economic activity plans, etc.

During Stage 1, it was found that more than 6.2 million people are currently employed in the agricultural and processing sectors. At the same time, current labor demand, according to estimates by the

Ministry of Agriculture of the Russian Federation, amounts to no less than 150,000–220,000 workers³ annually.

The task of ensuring human resources for the agro-industrial complex (AIC) is assigned to the agricultural education network, represented by a wide range of educational institutions that train students under higher education programs (bachelor's, master's, and specialist degrees) as well as secondary vocational education programs in various fields and specialties for the agro-industrial sectors of Russia and foreign countries [2].

Training of highly qualified specialists is carried out on the basis of 54 state universities located in most regions of the country, as well as 153 research institutions, including research institutes (RIs), federal research centers (FRCs), and federal scientific centers (FSCs) [3]. Funding for educational organizations is provided under the State Program of the Russian Federation "Development of Education" until 2030.⁴ As of early 2024, approximately 250,000 students were enrolled, of which 77.2% studied at the expense of public funding, while 22.8% paid full tuition fees.

The distribution of students across specialized groups (fields of study) shows that 44.5% are enrolled in programs related to agriculture, forestry and fisheries, ecology, land management, biotechnology, etc.; 21.5% study veterinary science and animal husbandry; 9.6% are trained in economics and information sciences (accounting, management, informatics, etc.); and 8.3% are preparing for engineering professions in areas such as electrical and thermal power engineering, transport, mecha-

² Information and analytical materials based on the results of monitoring the performance of higher education institutions. URL: <https://monitoring.miccedu.ru/?m=vpo>; Performance indicators of educational organizations implementing higher education programs. URL: <https://fedstat.ru/organizations/?expandId=1565257#fpr1565257>; Register of state assignments for the provision of public services (performance of works). URL: <https://www.budget.gov.ru/>; Order of the Federal Service for Supervision in Education and Science No. 1493 dated August 4, 2023 "On Approval of Requirements for the Structure of the Official Website of an Educational Organization in the Information and Telecommunication Network 'Internet' and the Format of Information Presentation." URL: <http://publication.pravo.gov.ru/document/0001202311290017>

³ New Solutions in the Agro-Industrial Complex as Keys to Global Food Security. St. Petersburg International Economic Forum — 2025. URL: <https://roscongress.org/sessions/spief-2025-delovaya-programma-novye-resheniya-v-apk-klyuchi-k-globalnoy-prodovolstvennoy-bezopasnosti/translation/#/>; The Labor Shortage in Russian Agriculture Has Exceeded 200 Thousand People. Interfax. URL: <https://www.interfax.ru/russia/1004817>

⁴ State Program of the Russian Federation "Development of Education." Strategic priorities in the implementation of the state program of the Russian Federation "Development of Education" up to 2030** (as amended by Resolution of the Government of the Russian Federation No. 1701 dated October 7, 2021). URL: <https://docs.edu.gov.ru/document/f9321ccd1102ec99c8b7020bd2e9761f/download/4444/>

nization, construction, and others. The remaining specialties account for 0.2% to 4.3%.

All educational organizations are characterized by a variety of organizational system indicators (size, functionality, structure, mechanisms of interaction between organizational units, etc.). To analyze them, it is appropriate to group the entire set of educational organizations into clusters with similar parameters using taxonomic methods, and then select, within each group, an organization with average, typical characteristics for subsequent analysis (Fig. 1, left).

To perform clustering of the latter, it is necessary to construct a set of criteria (with uniform measurement scales for each object). Given the specifics of the present study, these may include student enrolment size and staff size.

Based on the characteristics of the subject area and the availability of existing data (statistical, managerial, regulatory, and others), the set of educational organizations (EOs), according to expert opinion, was divided into several intervals, hereafter denoted by the letters “A” to “I” (Fig. 1, right).

Cluster A includes nine educational organizations (16.4% of the total number) with up to 3,000 students. According to its characteristics, approximately 19,000 students are enrolled across all institutions in this cluster, supported by more than 2,500 staff members. The boundary parameters of the cluster are as follows: 1,543 students and

146 staff members (in the smallest institution included in the cluster), and 2,990 students and 288 staff members (in the largest institution). To identify a typical representative, average indicators of the group were calculated—2,164 students and 289 staff members — according to which the Federal State Budgetary Educational Institution “Velikie Luki State Agricultural Academy” can be considered a typical organization (Table 1).

Cluster B comprises educational organizations with student enrolment ranging from 3,000 to 5,000 students, represented by 16 universities (29.1% of the total number of EOs). Overall, this group includes more than 40,000 students and 8,700 staff members.

The minimum number of students and staff (respectively) is 3,589 and 328, while the maximum values are 4,924 and 836. The average indicators are 4,013 students and 545 staff members. A typical representative of this cluster is the Federal State Budgetary Educational Institution “State University of Land Management”.

Cluster C includes educational organizations with student enrolment ranging from 5,000 to 7,000 students. This group consists of 12 universities (21.8% of the total), with a combined student population exceeding 60,000 and approximately 8,300 staff members.

The minimum number of students in this group is 5,156, and the maximum is 6,657. The corre-

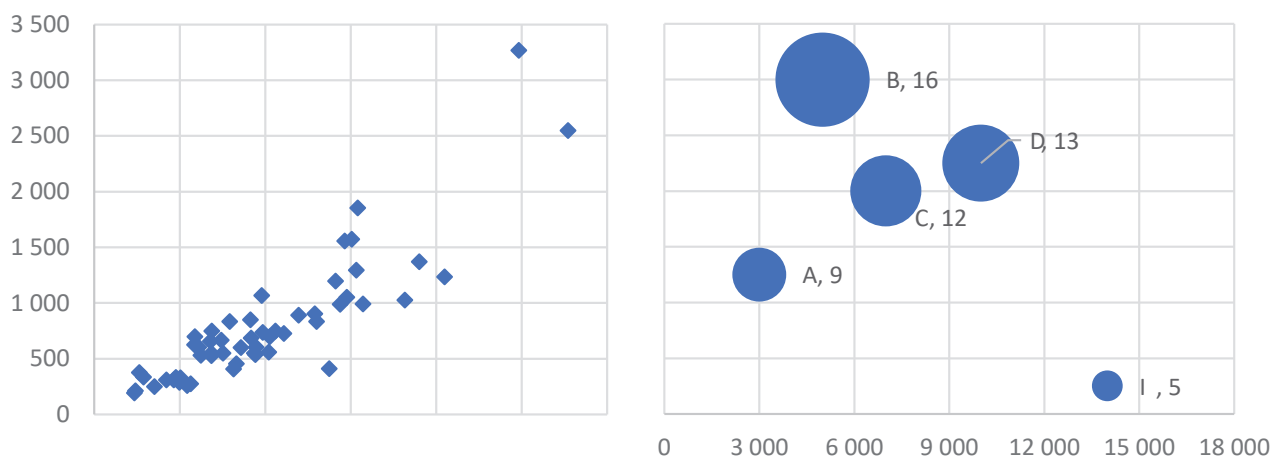


Fig. 1. Grouping of Educational Institutions by the Ratio of the Number of students (x axis) to the Number of Staff (y axis), Persons (left) and the Clusters Identified on This Basis (right)

Source: compiled by the authors.

Table 1

Taxonomic Characteristics of Educational Institutions According to Grouping Indicators

Cluster name	Number of universities in the group (pcs.)	Average number per group (people)		Name of the educational organization (typical organizations are in italics)
		students	staff	
A (up to 3,000 students)	9	2164	289	<i>Smolensk State Agricultural Academy, Yaroslavl State Agrarian University, Voronezh State Agrarian University, Kazan State Academy of Veterinary Medicine, Velikie Luki State Agricultural Academy, Primorsky State Agrarian Technological University, Saint Petersburg State Academy of Veterinary Medicine, Penza State Agrarian University, Kurgan State University</i>
B (3,000–5,000 students)	16	4013	545	<i>Vologda State Dairy Academy, Tver State Agricultural Academy, Chuvash State Agrarian University, Kostroma State Agricultural Academy, Vyatka State Agrarian and Technological University, Buryat State Agricultural Academy, Arctic State Agrarian and Technological University, State University of Land Management, State Agrarian University of Northern Trans-Urals, Samara State Agrarian University, Moscow State Academy of Veterinary Medicine, Nizhny Novgorod State Agrarian and Technological University, Kursk State Agrarian University, Kuzbass State Agrarian University, Kazan State Agrarian University, Far Eastern State Agrarian University</i>
C (5,000–7,000 students)	12	5853	697	<i>Russian State Agrarian Technological University, Oryol State Agrarian University, Dagestan State Agrarian University, Ural State Agrarian University, Kabardino-Balkarian State Agrarian University, Altai State Agrarian University, Saint Petersburg State Agrarian University, Irkutsk State Agrarian University, Ulyanovsk State Agrarian University, Gorsky State Agrarian University, Udmurt State Agrarian University, Perm State Agrarian and Technological University</i>
D (7,000–10,000 students)	13	8556	1129	<i>Bryansk State Agrarian University, South Ural State Agrarian University, Belgorod State Agrarian University, Russian State University of National Economy, Stavropol State Agrarian University, Bashkir State Agrarian University, Orenburg State Agrarian University, Omsk State Agrarian University, Don State Agrarian University, Volgograd State Agrarian University, Saratov State University, Michurinsk State Agrarian University</i>
E (more than 10,000 students)	5	13 227	1891	<i>Krasnoyarsk State Agrarian University, Novosibirsk State Agrarian University, Voronezh State Agrarian University, Russian State Agrarian University, Kuban State Agrarian University</i>

Source: compiled by the authors.

sponding staff numbers range from 602 to 757. The average values are 5,853 students and 697 staff members. A typical representative of this cluster is the Federal State Budgetary Educational Institution “Saint Petersburg State Agrarian University”.

Cluster G is the leader in terms of student enrolment and includes 13 educational organizations (23.6% of the total number). The total number of students is approximately 82,000, while more than 13,000 staff members are employed across these institutions. The boundary parameters of the group are as follows: a minimum of 7,181 students and

891 staff members; a maximum of 9,436 students and 1,854 staff members. The average indicators are 8,556 students and 1,129 staff members per educational organization. A typical representative of this cluster is the Federal State Budgetary Educational Institution “Stavropol State Agrarian University”.

Educational institutions with a student population exceeding 10,000 are grouped into Cluster D. This cluster includes five educational organizations (9.1% of the total number), with a total student population of more than 46,000 and

9,500 staff members. The minimum number of students in this cluster is 10,991, and the maximum is 16,107. The corresponding staff numbers range from 1,027 to 2,550. The average values are 13,227 students and 1,891 staff members. A typical representative of this cluster is the Federal State Budgetary Educational Institution “Voronezh State Agrarian University named after Emperor Peter I”.

Stage 2. Analysis of the parameters of the organizational management system, its elements, goals, and tasks. In the context of the present study, an organizational system is understood as a set of elements of the organizational structure (OS)—including units, levels, and management links—with defined relationships, roles, and hierarchy, as well as the corresponding mechanism for structuring managerial processes and functions (the organizational mechanism), which collectively ensure the achievement of the objectives set for the enterprise [4–6, 8, 9].

The primary purpose of the organizational system (OS) is to manage business processes (or support their functioning) in accordance with pre-defined target orientations. In practice, this is expressed through the following tasks:

- formation of the value creation flow by types of enterprise activity, taking into account the influence of the external and internal environment;
- allocation of business tasks across functional areas and organizational units;
- definition of responsibilities and areas of accountability for each employee or unit in the process of task execution;
- maintenance of linkages between employees (units);
- formation of a management hierarchy;
- description of decision-making procedures across hierarchical levels.

As is well known, the design of an organizational system is influenced, to varying degrees, by a wide range of factors such as the complexity and dynamism of enterprise operations, strategic priorities, production technology (works), and the availability of motivated personnel with appropriate qualifications, etc.

At the same time, a major role is played by the operating conditions of educational organizations, which are determined by their founder—the state. All analyzed educational organizations are publicly funded and operate within the framework of state assignments.

In view of the above, it can be stated that the existing organizational system of educational organizations has been formed not so much under the influence of market requirements expressed in the need to provide (deliver) competitive educational services, but primarily as a result of large-scale reform—territorial and sectoral reorganization (consolidation) of profile educational institutions carried out by the Ministry of Agriculture and the Ministry of Education of the Russian Federation in 2014–2016. Its main objectives were the reduction of duplicated functions, consolidation of educational and research potential in priority areas, as well as attraction of investment and reduction of funding costs for educational organizations of the same sectoral affiliation.

The presence of specific organizational elements is determined by statutory types of activity—educational, research, international, educational (upbringing), etc.—for which the structure is formed, and each element is responsible for a specific set of functions.

Having analyzed the statutory documents of educational organizations, it can be argued that the structure of the organizational system is, in most cases, standardized: it consists of a corporate center (collegial governing body) and a business unit.

The corporate center performs the functions of strategic planning, control, and management of business units and includes several levels of governance (*Table 2*):

- central level: rectorate, Academic Council, trade unions of staff and students, councils of veterans, young scientists, parents, etc., Board of Trustees, Development Fund, representatives of the founder (Ministry of Agriculture);
- peripheral level: heads of subordinate structural units.

Elements of the organizational system that perform strictly defined (specialized) types of activities — educational, research, administrative, financial, economic, auxiliary, etc. — are referred to as business units. These include structural subdivisions of any level of the organizational hierarchy, such as institutes, branches, faculties, colleges, departments, human resources units, accounting departments, educational and methodological offices, swimming pools, catering facilities, IT departments, libraries, publishing units, dormitories, laboratories, garages, security services, museums, apiaries, etc. The structure of each business unit is generally similar, although it retains specific features related to its functional specialization. In this context, the typical elements of the organizational system are employees (executors) and managers at different hierarchical levels.

Analysis of its parameters and architecture shows that, for all studied educational organizations, they are similar. Depending on the size of the educational organization, the organizational system may include from several dozen (as in Velikie Luki State Agricultural Academy) to several hundred (Voronezh State Agrarian University) business units of different levels.

As a rule, a typical organizational system (OS) includes educational and training units (departments, training centers, faculties, workshops, libraries), scientific units (laboratories, experimental facilities, trial fields, farms, technical installations, scientific and dissertation councils, etc.), socio-cultural and welfare units (student dormitories, sports facilities and clubs, tourist bases, medical facilities, cafeterias, museums, etc.), managerial units (deans' offices, directorates of institutes and faculties, teaching and methodological departments, departments for extra-curricular activities, research administration units), as well as various administrative and support units (maintenance services, civil defense and emergency headquarters, legal services, registry offices, human resources departments, archives, garages, etc.).

The study of OS elements and the relationships between them shows that in all educational organizations they are built according to a functional-

hierarchical principle and combine a linear-functional foundation with elements of a divisional structure. This conclusion is based on the grouping of organizational units' functions in accordance with the types of services they provide (or products they generate), as well as the presence of multiple management levels (hierarchy) with predefined levels of subordination and division of responsibilities.

To ensure the functioning of the organizational mechanism, horizontal and vertical relationships are established between business units. Horizontal links represent information flows connecting units of the same hierarchical level (e.g., laboratories, departments, institutes, administrative units, etc.) in order to ensure effective interaction in the execution of all types of activities. Vertical links are managerial information flows and document circulation that ensure communication between levels of the management hierarchy, defining the allocation of authority and responsibility for managerial decision-making at operational, tactical, and strategic levels. This configuration enables unified coordination combined with decentralized management of individual elements of the organizational system at different hierarchical levels.

Schematically, this type of interaction among organizational structure elements can be represented as a graph, where the vertices (objects indexed from 0 to 4) represent nodes — subdivisions (objects of management) subordinate to respective managers (subjects of management), edges indicate their dependence on a specific management element, and color coding reflects the distribution of managerial functions and types of activity across management levels (*Fig. 2*) [7].

The scale of manageability primarily depends on the level of "maturity" and the overall size of the organizational system of an educational organization and may range from several to dozens of elements. A typical pattern of coordination within educational organizations can be described by the following management levels (common to most EOs) (*Fig. 3*) [9–11, 12]:

- five-level structure (for core academic units): collegial governing bodies (rector) → vice-

Table 2

Inter-cluster Comparison of Organizational Design Parameters for Educational Institutions

Name of indicators	Cluster representatives (typical representatives)				
	A	B	C	D	E
Type of organizational system (OS)	Linear-functional, with elements of a divisional structure				
Governing bodies	Conference of employees and students, Academic Council, Board of Trustees of the university, Rector				
Number of management levels	Five-level structure for product units – heads of centers/laboratories, heads of departments (heads of support units) / directors of institutes (deans of faculties) / vice-rectors responsible for areas / collegial governing bodies (rector). Three-level structure for support units (administrative, economic, and managerial) – head of structural unit, vice-rector, rector				
Number of management links	Five links for product units – centers/laboratories, departments, institutes (faculties), rectorate, collegial governing bodies. Three links for support units – structural unit, rectorate, collegial governing bodies				
Level (type) of centralization	Multi-type system with a rigid hierarchy, high formalization of rules and procedures, centralized decision-making, and narrowly defined responsibility for results				
Number of OS elements (units), pcs.	56	89	118	111	137
Structure of OS elements by function, %:					
educational and upbringing	42.9	40.4	34.7	40.5	37.2
administrative and managerial	14.3	30.3	23.7	28.8	27.0
service/support	32.1	15.7	25.4	18.9	25.5
scientific	8.9	11.2	13.6	9.9	9.5
international	1.8	2.2	2.5	1.8	0.7

Source: compiled by the authors.

rector responsible for the area → director of institute (dean of faculty) → head of department → heads of centers (laboratories);

- three-level structure (for support units – administrative, economic, and managerial): rector → vice-rector responsible for the area → head of structural unit.

For example, the management of the educational process, the supervision of academic, methodological, and educational work, as well as the training of highly qualified personnel, is carried out by the Vice-Rector for Academic, Methodological, and Educational Work. His/her area of responsibility covers from 34.7% to 42.9% of organizational units, the main ones being institutes, faculties, and departments, as well as various ad-

ministrative units (academic and methodological administration, educational work administration, doctoral training offices, etc.) (Fig. 4).

Issues related to improving the efficiency of scientific activity, the implementation of research projects (R&D), and the enhancement of publication output are overseen by the Vice-Rector for Research. His/her area of responsibility covers 8.9–13.6% of organizational units, including the administration of scientific and innovation activities, various centers (breeding, information-analytical, technology transfer, experimental, field stations, etc.), laboratories (plant protection, milk quality, agro-ecological monitoring, etc.), teaching and production units, a business incubator, an innovation center, and others.

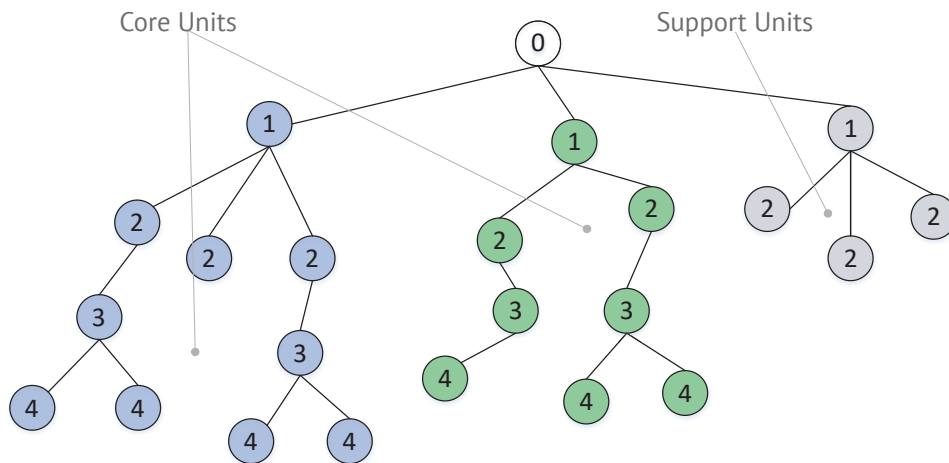


Fig. 2. Tree (Mixed Graph) Representation of the Organizational System of a Typical Educational Institution

Source: compiled by the authors.

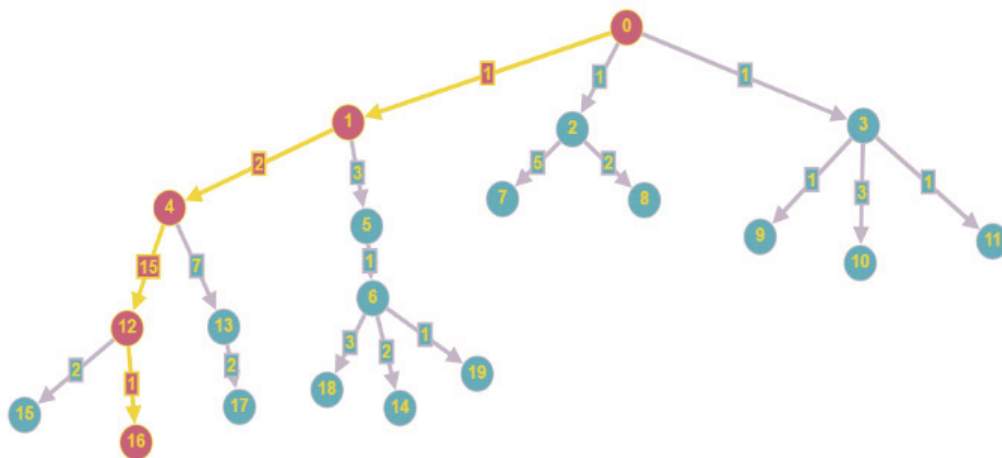


Fig. 3. Visualization of the Subordination of Organizational Units Across Hierarchical Levels Using Weighted Characteristics of Vertices and Edges

Source: compiled by the authors.

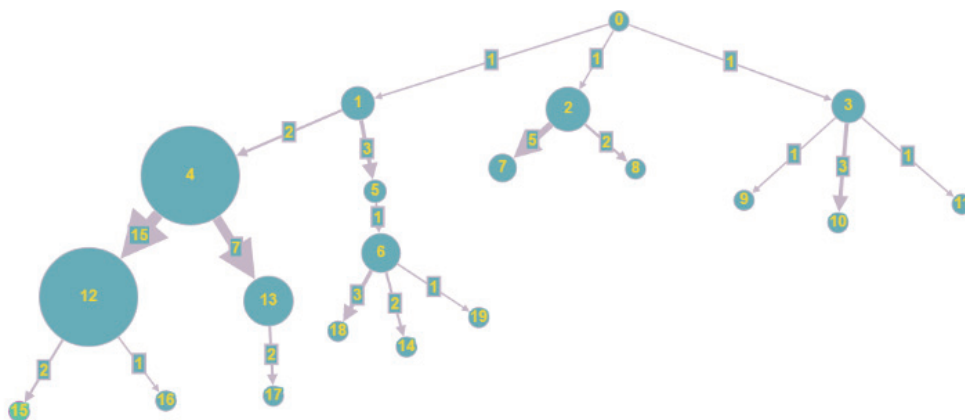


Fig. 4. Visualization of the Intensity of Interaction Between Management Levels Across the Hierarchy Using Weighted Characteristics of Vertices and Edges

Source: compiled by the authors.

Administrative and economic activities are managed by the Vice-Rector for Administrative and Economic Affairs. His/her responsibilities include ensuring the functioning of units related to the use and maintenance of material and technical infrastructure: maintenance and operation services, logistics and technical supply units, vehicle fleet, chief engineer and energy services, procurement and supply departments, student campuses, various administrative units (integrated security, educational and production management, construction and facilities operation), catering services, etc., accounting for a total of 11.2–14.3% of organizational units.

The block of issues related to the strategic development of the university, taking into account current trends in education, science, and the economy, is assigned to the Vice-Rector for Strategic Development. This portfolio covers 5.7–7.4% of organizational units, including strategic development and project management departments, digital transformation units, student (alumni) relations offices, PR (GR) services, career development centers, and project-analytical units, among others.

The Vice-Rector for International Affairs coordinates the implementation of the university's policy aimed at addressing tasks in the field of international cooperation, establishing partnerships and contractual relations with foreign universities, and promoting academic mobility programs, etc. His/her area of responsibility includes 0.7–2.5% of organizational units.

University-wide managerial functions requiring collegial decision-making, including planning and controlling financial and economic activities of the university, are carried out by the central administration (the rectorate and Academic Council), as well as by heads of structural units at the corresponding hierarchical levels: at the lower level – heads of structural units (department heads, chairpersons, laboratory managers, etc.); at the middle level – heads of standalone business units (directors of branches, colleges, canteens, museums, etc.); and at the top level – vice-rectors responsible for specific areas and the rector.

Stage 3. Assessment of the performance indicators of the organizational system of an educational organization

According to classical methodologies, the efficiency of an organizational system can be assessed in several ways. The first approach consists in determining how effectively it ensures the achievement of the organization's overall performance indicators. In this case, a set of indicators is used, characterizing financial-economic, production, commercial, and certain other types of enterprise activity (revenue, profit, output volume, unit price of sold products, various profitability indicators, relative performance measures, etc.) [13].

An alternative approach involves identifying the degree of compliance between the functioning of organizational system elements and the requirements embedded in the strategic development documents of the enterprise, from the perspective of ensuring minimal costs under the existing level of resource potential. The advantage of this method is that it allows for the assessment of the "effectiveness" of both the current composition of OS elements and the procedures of their interaction, i.e., the entire organizational mechanism as a whole, as well as individual elements separately.

From an applied perspective, it is more practical to combine both approaches depending on the research objectives, the availability of input data, the chosen efficiency assessment method, and other factors, in order to obtain a more accurate representation of the analyzed object. In the present case, the use of the indicators presented in *Table 3* and *Figure 5* is considered appropriate.

Thus, the educational activity indicator (E.1) for most of the analyzed educational organizations does not reach the national average and ranges from 55.92 to 63.18, compared to the national average of 61.8 points. This situation can be explained not only by multidirectional dynamics in admission quotas, the updating of training programs, the redistribution of publicly funded places in favor of regional universities, and changes in applicants' preferences, but also by the intention of educational organizations to increase the number of fee-

Table 3

Selected Indicators of Organizational System Efficiency

Name of indicators	Cluster representatives (typical representatives)				
	A	B	C	D	E
Monitoring indicators (by type of activity):					
E.1. Educational activity, score on ... scale	58.30	60.44	61.23	63.18	55.92
E.2. Research activity, score on ... scale	336.2	525.3	410.3	367.9	380.9
E.3. International activity, score on ... scale	1.36	5.23	7.25	3.19	8.67
E.4. Financial-economic activity, score on ... scale	3511.1	5078.6	4229.0	5270.5	2922.3
E.5. Academic staff (PPS) salary, score on ... scale	212.93	207.35	197.17	254.42	221.37
E.8. Additional indicator, score on ... scale	29.87	4.42	–	4.31	3.05
Share of academic staff (PPS) in total workforce, %	50.9	57.0	48.9	49.4	52.7
Share of administrative and managerial staff (AUP) in total workforce, %	26.2	19.3	15.4	14.8	15.6
University expenditures on core activities per student, thousand RUB	141.40	294.03	144.20	178.76	127.96

Source: compiled by the authors.

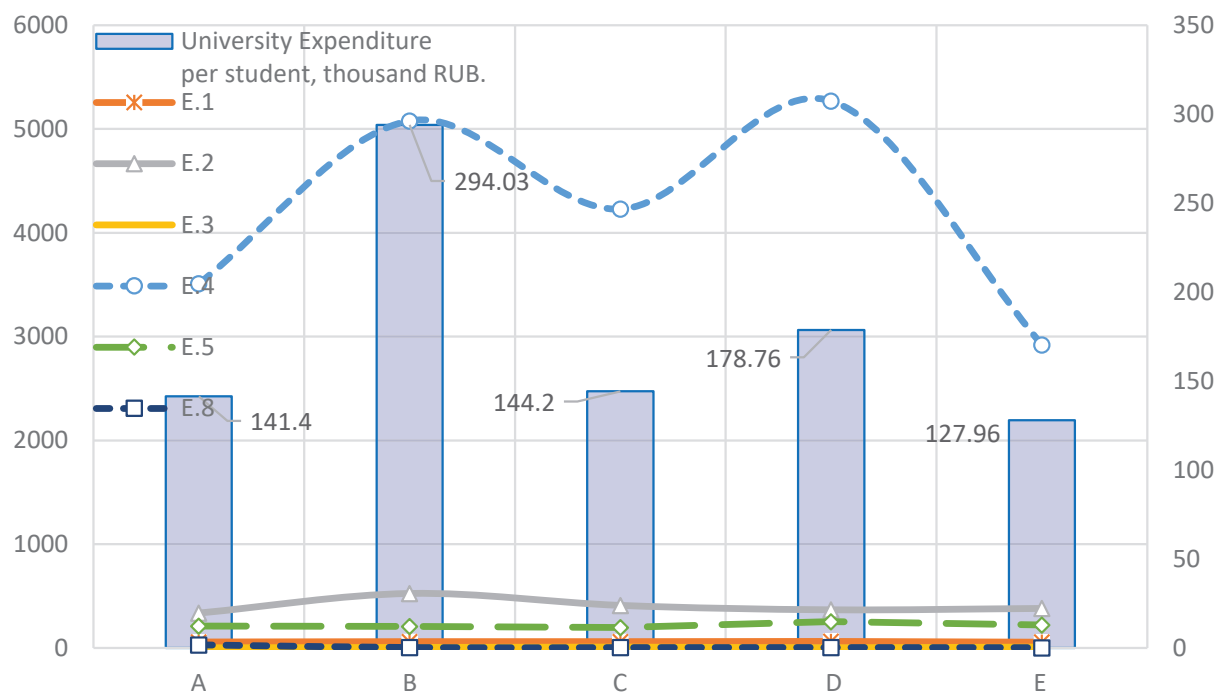


Fig. 5. Indicators of the Comparative Efficiency of Organizational Systems of Educational Institutions (Indicator Names are Provided According to Table 3).

Source: compiled by the authors.

paying students. The latter may, in turn, lead to a certain decline in the quality of graduate training in some specializations.

In terms of research and development (R&D) output per academic staff member (E.2), all analyzed educational organizations exceed the national average values: 336.2–525.3 thousand RUB versus 127.8 thousand RUB, which has a positive impact on their positioning in domestic and international academic rankings.

Indicators of international activity (E.3) in most of the considered educational organizations are higher than the national average: 1.36–8.67 compared to 4.93, which, *ceteris paribus*, can be interpreted as a relatively successful policy of exporting educational services to foreign audiences.

Analyzing the financial and economic indicators (E.4): 2,922.3–5,270.5 thousand RUB (compared to the national average of 3,785.2 thousand RUB), it can be concluded that the revenues of educational organizations are generated from multiple sources, and the more actively a university engages in educational, research, and international activities, the higher its aggregate income.

A consequence of more coordinated staff performance within educational organizations is the high level of academic staff salaries relative to the regional average. As shown in the data, indicator E.5 for most analyzed educational organizations is above the national average: 197.1–221.3% versus 202.4%.

Another indicator characterizing the production potential of an educational organization is its personnel structure (by staff categories), corresponding to defined qualification requirements. According to Table 3, in all analyzed organizations, the share of academic staff in total employment is approximately one half (48.9–52.7%). At the same time, the number of academic staff (adjusted for full-time equivalent) holding Candidate or Doctor of Sciences degrees per 100 students ranges from 3.05 to 4.42, compared to the national average of 3.29 persons. Meanwhile, the share of administrative and managerial personnel varies between 14.8% and 26.2%, which generally indicates a possible imbalance in staffing provision

for certain educational programs, as well as an excessive growth of administrative personnel.

The most important complementary (but not aggregate) indicator characterizing the organizational and economic efficiency of the organizational system is the total amount of expenditures of an educational organization per unit of output – in this case, per student. A relatively low level of such costs (for the provision of educational services), while maintaining the required quality level, indicates the efficiency of the organizational system as a whole, and of the management system in particular.

Considering the above, it can be stated that the lowest per-student unit costs are characteristic of the largest educational organizations (Cluster D), amounting to 127.96 thousand RUB per year. For other participants in the inter-cluster comparison, this indicator is higher by 10.5–229.1%.

CONCLUSION

Based on the results of the study, the following conclusions can be drawn:

- the shortage of labor demand in the agro-industrial complex (AIC) and related industries averages 200,000 persons per year, with a total employed population of 6.2 million (AIC – 4.1 million; processing industry – 2.1 million);
- the agricultural education system is represented by a wide range of institutions (44 universities under the Ministry of Agriculture, 14 universities under the Ministry of Science and Higher Education, and 153 research institutions), with a total student population of approximately 250,000;
- the educational network includes a diverse set of institutions differing in composition, student body, implemented programs, applied technologies, infrastructure, human resources potential, financial provision, and other characteristics, which is determined by current demands of the agro-industrial complex;
- a five-cluster model of the educational network was developed to compare educational organizations, in which a typical institution was selected for each cluster based on defined criteria;

- analysis of the organizational structure of typical representatives of each cluster made it possible to identify factors influencing its formation, including the type of organizational system, composition of governing bodies, number of management levels and links, degree (type) of centralization, number of organizational system elements across levels, horizontal and vertical linkages, etc.;

- based on system modeling methods, a graph-analytical model of the organizational system of a typical educational organization was developed, the structure of which is based on a functional-hierarchical principle;

- comparative analysis of organizational systems of educational organizations showed that, alongside evident advantages (such as centralized authority, clear hierarchy, and ease of control), they also exhibit significant drawbacks, including functional “autonomy” of individual units; focus of some managers on narrowly defined tasks to the detriment of overall organizational outcomes; difficulties in interaction between production and support units due to differing interpretations of business context; lack of rapid coordination under high informational

and managerial workload at lower and middle management levels; and absence of standardized internal process regulations, resulting in employees at operational level becoming “centers of competence,” which significantly reduces organizational stability in the event of key staff turnover;

- low digital maturity and fragmented automation of individual functions and processes, combined with a large volume of routine operations, lead to a significant increase in the workload of management and academic staff and, as a consequence, a decrease in customer orientation;

- assessment of the efficiency of organizational systems of educational organizations based on general and specific indicators revealed that the lowest per-student costs are observed in the largest educational organizations (Cluster D).

Thus, the results obtained in this study may serve as a basis for developing a unified approach to constructing an evaluation system for educational organizations involved in training personnel for the agro-industrial complex, taking into account current technological trends and the evolving needs of the industry.

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I.S. Konstantinov — development of the general concept of the work, and scientific and methodological supervision.

M.N. Stepanyevich — collection and formation of the initial data array, and processing of performance indicators of educational institutions.

M.I. Gorbachev — information modeling of the work of educational institutions.

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ORIGINAL PAPER



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Development of Project Experience Management Tools at Industrial Enterprises

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ABSTRACT

The **purpose** of the study is to systematize project experience management (PEM) tools and to develop recommendations for Russian industrial enterprises. The **methodology** employed in the research is based on an analysis of publications by Russian and international scholars, the examination of selected project management case studies, and expert assessments provided by experienced employees of industrial companies directly involved in project activities. The **findings** of the study are as follows. First, the main stages of project experience management are identified. Second, a classification of project experience management mechanisms is proposed, taking into account the management of both formalized and tacit knowledge, and practical tools and IT solutions are systematized. Third, key development trends in project experience management are determined. Fourth, a lag in the maturity level, technological support, and implementation of a knowledge-oriented organizational culture within Russian enterprises' project experience management practices is revealed. The **practical significance** of the research lies in the development of recommendations for Russian manufacturing companies aimed at overcoming barriers to the implementation of advanced and best-practice PEM tools.

Keywords: project experience; project management; knowledge management; industrial enterprise

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INTRODUCTION

In the context of an increasingly competitive global market, industrial enterprises are required to continuously improve their operational processes in order to maintain and enhance their competitiveness. One of the key factors contributing to improved organizational performance is the effective management of project experience (hereinafter referred to as project experience management, PEM). The systematic accumulation and application of knowledge generated during project implementation enable organizations to reduce project duration, mitigate risks, optimize resource utilization, and enhance the quality of final outputs. Consequently, new products can be developed and brought to market more rapidly, facilitating the adoption of innovations.

The academic literature does not provide a universally accepted definition of project experience. In this study, project experience is understood as a transferable set of knowledge, skills, practices, and lessons learned derived from the implementation of both successful projects and those that did not achieve the expected outcomes. This definition synthesizes approaches reflected in leading professional standards. In particular, the PMBOK Guide¹ conceptualizes project experience as part of organizational process assets, primarily in the form of lessons learned, whereas the IPMA Individual Competence Baseline (ICB²) considers it a key component of professional competence, encompassing the ability to derive value from prior experience. Unlike risks — defined as uncertain future events requiring management — project experience represents codified knowledge of past events, formed on the basis of completed activities.

The deliberate implementation of PEM enhances both the quality and the speed of mana-

gerial decision-making through the application of best practices. Combined with accumulated knowledge, these practices help prevent the recurrence of errors and contribute to process optimization. Ultimately, this leads to cost reduction and increased profitability of project activities. However, in Russia, this aspect of project management remains insufficiently studied and under-implemented. Furthermore, findings from surveys and interviews with project management professionals indicate that many relevant approaches and practices are still under development or are not widely adopted by enterprises, whereas international companies make extensive use of advanced technologies and methodologies to capture and leverage project experience.

The above considerations highlight the importance of further research in this area as a means of enhancing the competitiveness of domestic industrial enterprises.

MATERIALS AND METHODS

Several research methods were employed in the course of this study. First, a comprehensive review of the academic literature by both international and Russian scholars in the field of project management was conducted. To this end, searches were performed in Google Scholar and eLIBRARY using the keywords “project management,” “project experience,” and “knowledge management in projects.” Publications from the past ten years were subsequently selected through manual screening based on relevance and publication date. In total, more than 30 sources were identified and analyzed. Second, the authors conducted five in-depth interviews with experts, including employees of industrial enterprises and researchers specializing in improving the effectiveness of project management. Third, the analysis of specific case studies involving the successful accumulation of knowledge following the completion of individual projects at JSC “Chepetsky Mechanical Plant” enabled the authors to refine the proposed recommendations for industrial companies.

¹ Project Management Institute. URL: <https://www.pmi.org/standards/pmbok>

² International Project Management Association, версия 4.0. URL: https://products.ipma.world/wp-content/uploads/2016/03/IPMA_ICB_4_0_WEB.pdf

THE ROLE OF PROJECT EXPERIENCE MANAGEMENT IN THE PROJECT MANAGEMENT SYSTEM

Project management as a distinct discipline began to take shape in the mid-twentieth century, when complex investment construction projects and research and development (R&D) activities required more structured approaches. In the 1950s, the first formal methodologies emerged, including the Critical Path Method (CPM) and the Program Evaluation and Review Technique (PERT). By the 1980s, numerous professional associations (e.g., the Project Management Institute, PMI) had been established, contributing to the development of standards and best practices in the field. With the advancement of information technologies in the 1990s and 2000s, project management became more accessible; this period also witnessed the widespread adoption of agile methodologies such as Agile [1, 2].

At present, project management is increasingly recognized as a cross-functional discipline characterized by a wide range of methodologies that take into account the specific features of individual projects and their implementation

contexts. At the same time, growing emphasis is placed on the importance of accumulating project experience, which is increasingly regarded as a valuable organizational asset [3]. It should be noted that project experience management is closely related to risk management, as the effective use of accumulated experience can significantly reduce risk levels and increase the likelihood of successful project outcomes [4, 5]. Effective project management requires not only knowledge and technical skills but also the ability to learn from prior experience. According to the PMBOK Guide, project experience management encompasses activities related to the accumulation, analysis, and application of knowledge derived from previously implemented projects [6]. The IPMA Individual Competence Baseline (ICB) additionally emphasizes the importance of continuous improvement; in this context, project experience management can be viewed as a process of organizational learning. Lessons derived from each completed initiative — both successes and failures — should be systematically documented, analyzed, and applied in future projects. Thus, the contemporary understanding

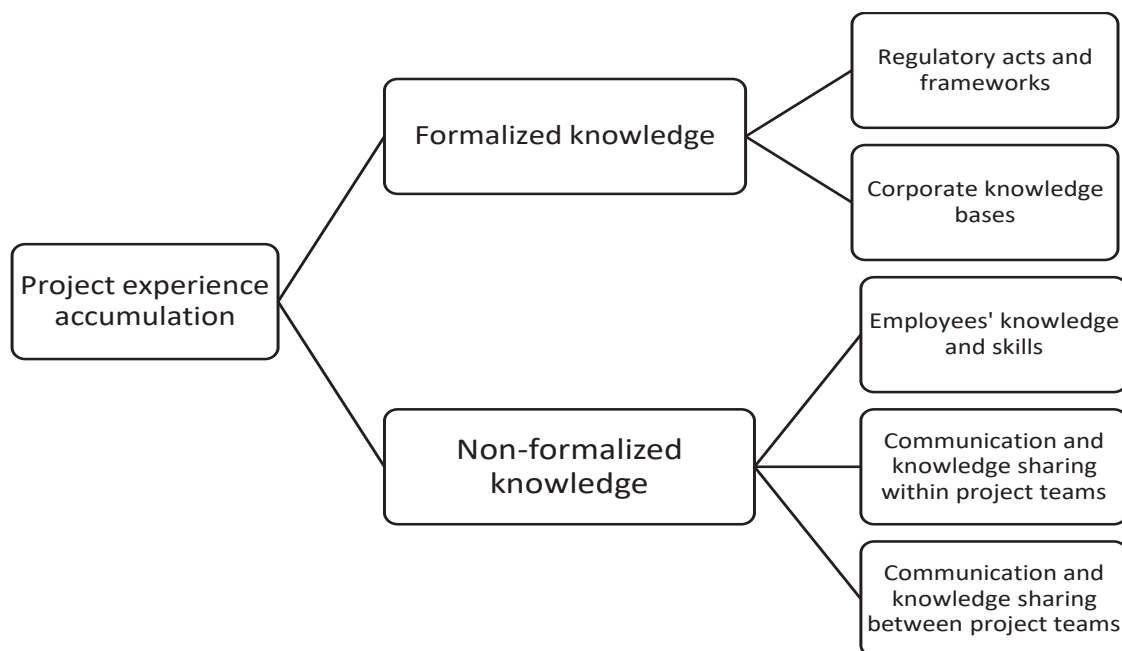


Fig. Forms of Accumulating Project Experience at an Enterprise

Source: compiled by the authors.

ence accumulation, particularly with respect to the distinction between formalized and informal knowledge, as well as the alignment between the knowledge lifecycle and project experience management processes. The present study seeks to address this gap (see *Figure*).

Table 1 provides a brief description of each stage illustrated in *Figure 1* and presents examples of project experience management activities.

As the literature review has shown, the majority of publications are devoted to general issues of integration between project management (PM) and knowledge management (KM), whereas sector-specific aspects of this synthesis are poorly represented. At the same time, the distinctive features of PM in the context of different industries are considered in [2, 5], while issues of KM with an industry focus are addressed in [4, 9]. In this regard, the specifics of project management organization (PMO) for industrial enterprises represent an interesting research field with significant potential for practical application.

PROJECT EXPERIENCE MANAGEMENT IN INDUSTRIAL ENTERPRISES

The activities of industrial companies have specific features that affect the field of project experience management (PEM). This is related, in particular, to the complexity of implemented projects, which require the integration of multiple disciplines and technologies [2], making the accumulation and systematisation of project experience especially important. Due to the long duration of investment and construction projects [4], for example in metallurgy, a more rigorous approach to knowledge management is required to ensure long-term success. This applies both to individual types (scope) of work and to the enterprise as a whole [3]. An important factor for industry is also increased regulatory requirements, which necessitate a more systematic approach to documentation and PEM [9].

Despite the obvious advantages, the implementation of a PEM system may be challeng-

ing. The analysis of the literature [9, 10] and the results of expert interviews made it possible to identify three types of barriers related to organisational culture, the structure of industrial enterprises, and insufficient investment in PEM technologies. The first manifests itself in the absence of both generally accepted values of knowledge accumulation and exchange, and an environment that facilitates the accumulation and dissemination of experience. This leads to resistance to change among employees who act as carriers of project experience. One way to overcome this barrier may be the development of an organisational culture oriented towards learning and innovation. In one of the interviews, a respondent noted: *“...it is very important that employees working on a project themselves want to share their experience and their observations, what they did well and what they did poorly. But in most cases, experience analysis is reduced to the formal completion of templates.”*

Barriers related to the structure of industrial enterprises are quite often caused by a lack of management support and the absence of a clear knowledge management strategy [11]. Production companies typically have a traditional or, less frequently, a matrix organisational structure: they are not project-oriented organisations [12]. Their task is uninterrupted production of serial products, while everything else (including project management implementation) is perceived as a factor that may interfere with this [13]. One respondent formulated this issue as follows: *“How are the priorities of industrial enterprises structured? First of all, it is the fulfilment of state orders, since failure to fulfil a state defence order entails punishment up to criminal liability; then we aim to fulfil the production programme for civilian products, since material remuneration and bonuses depend on its completion. And only after that do we deal with organising project work for the development of new products or R&D activities.”* Another expert noted that *“...as a rule, enterprises do not have a separate structure responsible for project management. This leads to*

an unsystematic approach to the accumulation of project experience.”

The third critically important barrier to successful PEM is the lack of investment in modern technologies and tools for the effective collection and analysis of project experience. Experts associate this with the high labour intensity of implementing a PEM system and the delayed nature of economic effects, which is confirmed by an excerpt from an interview with a representative of a project office at an industrial enterprise: “...when it comes to implementing modern IT solutions for the accumulation and

analysis of project experience, management often asks: ‘And when will it pay off?’ The economic effect is not immediately visible, and this becomes the main argument for postponing investments indefinitely.”

In order to systematise and present information on PEM tools (used by companies to achieve economic effects), they were conventionally divided into three categories: basic, advanced, and cutting-edge (innovative). As noted in study [14], in such a classification, knowledge (in our case, PEM tools) is differentiated according to its ability to support organisational

Table 2

Classification of Project Experience Management Tools

Categories	Basic	Advanced	Innovative
Description	Based on classical methods and approaches used in most organisations. They often include formalised processes and documentation, which makes it possible to systematise knowledge and experience.	Include complex methods and technologies that enable the effective collection, analysis, and use of knowledge. These tools require a high degree of employee involvement and may include elements of automation.	Include the latest methods and technologies that enable effective work across the entire knowledge life cycle of an individual project and the organisation as a whole. These tools are based on both technological and managerial innovations, requiring a high level of involvement from both employees and top management.
Types of knowledge accumulated	Formalised	Formalised; non-formalised	Formalised; non-formalised
Dominant stage of the knowledge life cycle [18]	Identification, storage	Identification, storage, dissemination, use, and evaluation	Identification, creation, storage, dissemination, use, preservation, and evaluation
Examples of tools	Project reports: documentation. Lessons learned: a formalised process for collecting and analysing lessons learned during project execution. Knowledge databases: repositories of information on best practices and mistakes made in projects.	Knowledge management systems: platforms for storing and sharing knowledge among employees. Data analytics: use of analytical tools to identify patterns and trends in project data. Feedback from project participants: systems for collecting and analysing feedback from teams and stakeholders, e.g., Agile and Scrum methodologies [15]. Experience-based learning, reflection methodologies. Mentoring and succession [16]. Application of the Kaizen concept aimed at continuous process improvement.	PMBOK, IPMA ICB4*. Artificial intelligence, big data, and machine learning: used to automate data analysis and predict project success. Virtual and augmented reality: used for training and project simulation, enabling teams to better understand complex processes. Organisational project office: a unit responsible for project management methodology, project coordination, and PEM activities [17]. Communities of practice and groups where specialists can exchange knowledge and experience, contributing to the development of a learning corporate culture.

Окончание таблицы 2 / Table 2 (continued)

Categories	Basic	Advanced	Innovative
Examples of IT tools **	Microsoft Project, Primavera, etc. for project planning and management, enabling tracking of deadlines and resources. Basecamp – a project and team management platform focused on simplicity of use. Trello – a visual tool for task and project management using cards and boards. Asana – a project and task management system enabling teams to organise work and track progress.	Cloud-based collaboration platforms enabling real-time project work and knowledge sharing. SAP Knowledge Management – a knowledge management system designed for collecting, organising, storing, and distributing organisational information and experience. Jira – a project management and issue-tracking system widely used in the IT sector. Monday.com – a project management platform adaptable to specific team needs. Smartsheet – a project management and collaboration tool with automation features. ClickUp – a universal task and project management platform with numerous integrations. Microsoft Teams – an enterprise platform integrating chat, meetings, notes, and file sharing in a single workspace.	Notion – a universal project management and knowledge base platform with AI integration capabilities. Airtable – a cloud database enabling project management using templates and automation. Miro – an online collaborative whiteboard with AI-supported brainstorming features. Trello with Butler – process automation in Trello using AI. Monday.com with AI – the use of artificial intelligence to optimise project management processes. Confluence – a scalable wiki system for internal organisational use aimed at creating a unified knowledge base. Microsoft SharePoint – a collaboration platform facilitating knowledge and information exchange among employees. Advanta, Naumen, and other project management information systems (PMIS).

Source: compiled by the authors.

Note: * – in the context of the present study, advanced project management standards (PMBOK Guide, IPMA ICB) are considered as a methodological foundation for the development of PEM tools. Their classification as “innovative” is justified by the fact that with each new version of these standards, approaches to knowledge systematisation are refined, and modern practices are introduced (such as the “Project Knowledge Management” process in PMBOK or the “Experience” competence in ICB), which organisations adapt to create specific tools (tools – text truncated in the original). ** – It should be taken into account that the primary purpose of the aforementioned IT systems is not project experience management. These systems are primarily designed for organising project work, planning, team coordination, and providing data for managerial decision-making. Exceptions include SAP Knowledge Management, 1C: Project Management, Confluence, and Microsoft SharePoint. It is necessary to note that the presence of the listed IT systems within a company does not always indicate their full and deliberate use.

competitiveness. Each of these categories has its own specific features in terms of handling formalised and non-formalised knowledge, as well as in terms of emphasis on the stages of the knowledge life cycle. *Table 2* presents a description of PEM tools across the three categories.

Given that the aim of the study is to systematise PEM tools and develop recommendations for domestic industrial enterprises, it is necessary to assess the availability of relevant IT solutions under current conditions. At present, among the solutions available in Russia, it is worth noting Kaiten, “ProstoyBiznes”, 1C: Document Management, Directum RX, “Smart Tables” in Yandex 360, VK Boards, MTS Link Boards, Esboard, as well as Worksection, which continues to support its existing clients.

Successful companies often apply a comprehensive set of PEM tools, combining basic, advanced, and innovative methods. This enables them not only to learn from past experience but also to adapt to changes in the business environment, thereby increasing their competitiveness. For example, at the Rosatom State Corporation, basic methods are used, such as the creation of a project experience database [19], as well as innovative approaches in the form of expert communities and methodological and managerial project offices, where deliberate PEM activities are carried out [20, 21]. The higher the category of tools applied within organisations, the more clearly project experience is identified and utilised as an asset. The implementation of leading project manage-

ment and PEM systems is not a consequence of company success, but rather its cause. Russian enterprises are currently oriented mainly towards basic, less frequently advanced, and even more rarely innovative tools, which is associated with the barriers described above.

It is also necessary to highlight the current trend in PEM, namely the use of information and communication technologies, which provides companies with a number of advantages. First, it increases process efficiency through the automation of routine tasks. Second, IT systems contribute to improving the quality of decision-making due to access to up-to-date and accurate data. Third, these technologies enable enterprises to maintain competitiveness by ensuring rapid access to accumulated knowledge. Fourth, the integration of IT systems enhances both process transparency and efficiency, while reducing project management risks. The digitalisation of innovation and project activities in the industrial sector is currently one of Russia's priority directions, which confirms the need for wider implementation of such tools [22]. The programme of the Ministry of Industry and Trade of the Russian Federation, launched in 2019,⁴ is aimed at the digitalisation of production processes, including knowledge management, thereby stimulating the development of more effective mechanisms for knowledge accumulation and transfer. For example, KAMAZ has implemented a knowledge management system that has reduced the time required for onboarding new employees, demonstrating the potential of digital solutions in improving efficiency.

Public policy exerts a significant influence on the processes of accumulating project-based experience in Russia [23]. Programs implemented by the Ministry of Industry and Trade of Russia are aimed at promoting the adoption of advanced technologies and develop-

ing infrastructure for knowledge management. However, despite these efforts, many enterprises continue to face a shortage of qualified personnel [24]. Consequently, education and training become key factors in the effective development and renewal of employees' knowledge and skills.

One of the fastest-growing technologies — artificial intelligence (AI)—is increasingly playing a crucial role in the analysis of project data, offering enterprises new opportunities to optimize operational processes. The primary advantage of AI lies in its ability to process large volumes of data, identify hidden patterns, and generate optimal solutions. This is particularly important for complex industrial projects, where multiple variables must be considered and rapid adaptation to change is required. The Project Management Institute identifies around 100 neural network tools applicable to project management [25]. Advanced tools also include collaborative knowledge management platforms such as Microsoft SharePoint and Confluence, which provide a unified environment for storing, sharing, and updating knowledge. Their implementation enables employees to interact effectively, exchange experience, and collaboratively solve problems. This, in turn, fosters a corporate culture based on knowledge sharing, which is particularly critical for large-scale industrial companies where coordination across multiple departments is essential.

TRENDS AND RECOMMENDATIONS FOR RUSSIAN INDUSTRIAL ENTERPRISES

The analysis of the literature [26–31] made it possible to identify the following trends in contemporary PEM:

1. Digitalisation and implementation of IT systems.
2. Establishment of project offices. These units help standardise PM processes, provide support and training for project teams, and

⁴ National Program “Digital Economy of the Russian Federation” URL: <https://digital.gov.ru/target/naczionalnaya-programma-czifrovaya-ekonomika-rossijskoj-federaczii>

facilitate the accumulation and exchange of project experience [26].

3. Increasing complexity of cross-functional teams, bringing together specialists from different domains for successful project implementation. This enables more effective resolution of complex tasks and accelerates decision-making processes [27, 28].

4. Focus on organisational culture. Enterprises are increasingly recognising its importance for effective project management. Support for experience sharing, openness to new ideas, and active employee involvement in project management are becoming key success factors [29].

5. Competence development. Increasing attention is being paid to improving employees' qualifications in both hard skills (PM methodologies, planning and analysis tools) and soft skills (communication, teamwork, leadership, problem-solving) [30, 31].

A comparative analysis of approaches to PEM in Russia and abroad, based on sources [1–3, 7, 13, 15, 24, 27], demonstrates methodological, technological, and cultural gaps between domestic and international practices. First, there is a significant difference in the level of methodological maturity of PEM. In Russia, particularly in the public sector, PEM tools are applied fragmentarily and irregularly [1, 24]. Foreign companies, by contrast, demonstrate a high level of standardisation of PEM processes and the implementation of innovative approaches [2, 3]. Regarding the depth of PEM integration into organisational systems, Russian enterprises (including large industrial ones) often face the problem of the absence of a unified project experience database. According to research, in many organisations there is “no unified database integrating all information on past projects” [13]. At the same time, foreign companies regard knowledge management as a critical strategic resource, recognising that “an organisation’s ability to manage its innovation product creation processes is

crucial for its long-term competitiveness” [3]. This is reflected in a deeper integration of PEM tools with other corporate systems and the active development of project offices as centres of competence [9, 26].

From a technological perspective, there is a noticeable lag in the maturity level of software solutions, IT tools, and digital platforms used to support PEM processes. Domestic enterprises are only beginning to implement specialised IT solutions, whereas abroad, complex systems based on AI and other advanced tools are already widely used for PEM purposes [6]. This enables the creation of a unified information environment for the accumulation and dissemination of project experience, opening new opportunities for project risk management and improving the efficiency of project activities.

Another area of contrast is organisational culture. In Russia, problems persist related to its insufficiently high level; at the same time, “many organisations do not consider knowledge management an important asset” [7]. International studies, by contrast, emphasise the decisive role of organisational culture, noting that it “appears to be a crucial factor for successful KM in projects” [27]. Particular importance is also attached to soft skills and the leadership qualities of project managers, as “a project manager’s leadership skills positively influence both explicit and tacit knowledge sharing” [30].

Thus, the comparative analysis confirms the existence of significant differences in PEM approaches. While foreign enterprises demonstrate a strategic approach with deep integration of PEM into corporate culture and technological infrastructure, Russian practice is often fragmented in nature. At the same time, positive examples such as Rosatom [20] and SIBUR indicate the emergence in Russia of a group of leading companies that are successfully adopting advanced PEM practices.

Taking into account the diversity of policies of Russian enterprises in the field of PEM, the

following recommendations have been developed:

1. Creation of sectoral and cross-sectoral platforms for the exchange of project management experience, including the identification of best PEM practices.
2. Development of methodologies for diagnosing the level of PEM maturity and assessing its effectiveness.
3. Development of an organisational culture oriented towards knowledge sharing.
4. Improvement of organisational structures that facilitate PEM, including the establishment of project offices within industrial enterprises.
5. Development of educational programmes aimed at building competencies in the application of advanced PEM tools.

CONCLUSION

The theoretical contribution of this work lies in the comprehensive study of the scientific fields of project management and knowledge management in order to understand the phenomenon of PEM as a whole and its role for industrial enterprises in particular. The analysis has shown that the accumulation of project experience is an important tool for improving organisational performance. Foreign companies actively use modern technologies and knowledge management methods, which allows them to adapt more quickly to changes in the market environment and ensure sustainable growth. In Russia, significant gaps are observed in the integration of accumulated project experience into management processes. This is due both to the insufficient development of information systems and to the lack of a knowledge-sharing culture within enterprises. Nevertheless, suc-

cessful examples of the use of acquired competencies by domestic companies demonstrate the potential for improving the current situation. The comparative analysis has shown that international practices, such as the use of collaborative knowledge management platforms and the application of AI for data analysis, can be adapted to Russian conditions. This will make it possible to increase the competitiveness of national enterprises on the international stage.

To improve practices of project experience accumulation in Russian enterprises, it is recommended to implement modern information systems and knowledge management platforms. This will enable the structuring and effective use of accumulated data to optimise processes. It is also important to develop a corporate culture and organisational structure oriented towards knowledge and experience sharing through regular training sessions, seminars, and retrospective analyses, as well as by encouraging employees' contributions to the development of the company's knowledge base.

In the future, it is necessary to focus on studying the specifics of adapting foreign PEM methods and tools to Russian conditions in order to identify the most effective approaches for their integration. Another promising direction is the analysis of the impact of new technologies, such as AI and blockchain, on the processes of accumulating and using project experience. In addition, it is important to investigate the role of state policy and educational programmes in shaping a knowledge management culture. This will make it possible to develop recommendations for stimulating the implementation of advanced practices at the sectoral and enterprise levels.

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ORIGINAL PAPER

Integration of Artificial Intelligence-Based Marketing Technologies into the Strategic Management System of a Company

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ABSTRACT

At the current stage of digital transformation, the strategic role of marketing in the management of trading companies is significantly increasing. The integration of artificial intelligence (AI)-based technologies – such as AI agents, synthetic respondents, AI-powered CRM systems, and predictive analytics – is transforming not only the functions but also the very nature of marketing management. In conditions of a highly turbulent external environment and sanctions-related constraints, the use of AI-based tools enables companies to develop flexible and adaptive strategies, make decisions in real time, and build personalized customer interactions. The **aim** of this study is to analyze the transformation of marketing management under the influence of AI technologies and to identify their contribution to the resilience of trading companies. The article examines the theoretical aspects of marketing management, the classification of its tools, as well as the risks and barriers associated with the application of artificial intelligence. The **result** of the research is the development of an authorial model for integrating AI-based marketing into the strategic management system of a trading company, as well as a classification of tools taking into account their strategic role and practical applications. The findings of the study may be useful for managers of trading companies, specialists in strategic development and digital transformation, as well as researchers in the field of management seeking to enhance business resilience and adaptability in conditions of external turbulence.

Keywords: marketing; strategic management; artificial intelligence; digital technologies; AI-agents; CRM; trading company; marketing analytics; automation; marketing technologies

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INTRODUCTION

Contemporary trading companies operate in an environment characterized by continuous and often unpredictable change. Against this backdrop, marketing is no longer confined to its traditional role as a tool for product promotion; rather, it has evolved into a core element of strategic management. In this context, technologies based on artificial intelligence (AI), machine learning, end-to-end analytics, and full-scale automation are becoming particularly significant. Marketing tools such as AI agents, synthetic respondents, intelligent CRM systems, and SEO platforms enable companies to make data-driven decisions based on large volumes of real-world data. They also facilitate real-time strategy adaptation and support the development of deeper, more personalized relationships with customers. Amid sanctions pressure, supply chain disruptions, and declining consumer activity, marketing technologies are emerging as a critical lever for ensuring business resilience and competitiveness. They not only complement traditional modes of operation but also enable the creation of new channels of interaction with target audiences.

The study addresses the following objectives: to examine the evolution of marketing within the framework of strategic management; to classify contemporary AI-based marketing tools and analyze their impact on managerial processes; and to identify the risks, barriers, and prospects associated with the adoption of AI technologies in trading companies.

RESEARCH METHODOLOGY

Despite the evident growth in the popularity of AI-based marketing technologies, the academic literature has yet to sufficiently address their impact on the strategic management systems of trading companies.

The theoretical foundation of the study is based on the works of Philip Kotler [1], Michael Porter [2], as well as other domestic and international scholars [3–5] relevant to the research topic, alongside studies examining the application of

artificial intelligence in business processes [6, 7]. In selecting sources, particular attention was paid to publications in peer-reviewed journals, monographs, and academic textbooks reflecting contemporary concepts of digital marketing and approaches to the development of intelligent management systems. The methodological framework is grounded in a systems approach, which considers AI-driven marketing as an integral component of strategic management. To achieve the research objectives, the study employs comparative and content analysis, as well as classification methods and expert evaluation techniques.

RESEARCH RESULTS

Theoretical Foundations of Marketing Integration into Strategic Management and Its Functions

Contemporary corporate management presupposes the integration of marketing into strategic planning and organizational development. A classical illustration of this approach is the 4P framework proposed by Philip Kotler [1]. More recently, particular attention has been given to customer-oriented digital models advanced by Jean-Jacques Lambin [8]. In the context of digitalization, the concept of dynamic capabilities developed by David Teece [9] becomes especially relevant, emphasizing a firm's ability to integrate new technologies as a foundation for long-term competitiveness. According to A. V. Titov [10] and Dave Chaffey [3], the digital transformation of marketing gives rise to a new managerial architecture in which artificial intelligence functions as an integrator of analytical, predictive, and communicative capabilities. Within the framework of strategic management, marketing transcends its traditionally operational role and evolves into a mechanism that ensures market resilience, fosters competitive advantage, and supports the achievement of long-term business objectives. These objectives include the following key tasks:

- analysis of the external environment (PEST analysis, Porter's Five Forces, competitive intelligence);

- assessment of internal marketing potential (marketing audit, brand analysis, product portfolio analysis, etc.);
- strategy development (product positioning, target audience segmentation, product lifecycle management);
- market entry (implementation of marketing campaigns, promotion, logistics, pricing);
- monitoring and adjustment (end-to-end analytics, ROI, ROAS).

Within an integrated corporate management system, marketing acts as a linking mechanism between internal resources and external opportunities, thereby ensuring sustainable development and the realization of the company's mission through market-based mechanisms. The key objective of marketing management is to secure a product's long-term competitive advantage through effective engagement with targeted customer segments. Within the broader strategic framework, this approach underpins the formation of a customer-centric orientation. Marketing tools are applied in business planning alongside financial, operational, and IT instruments, thereby enabling sustainable product differentiation in the marketplace.

Contemporary trading companies increasingly conceptualize marketing within the broader management architecture as a platform through which market interaction logic, digital processes, and adaptive growth strategies are constructed. In the context of digitalization and volatile market conditions, traditional marketing technologies are gradually being supplanted by more advanced solutions capable of processing large volumes of data to forecast demand and customer behavior, automate routine tasks, and enhance decision-making capabilities. Under these conditions, marketing technologies are becoming an integral component of strategic management, enabling organizational transformation and rapid adaptation to changes in the external environment through digital solutions, including those based on artificial intelligence (AI). This is particularly significant for trading organizations, where decision-

making is influenced by intense competition, complex supply chains, and high sensitivity to consumer behavior. The flexibility and proactivity required by companies are increasingly ensured through the deployment of AI-driven tools.

Key Challenges of the Digital Environment

Contemporary marketing technologies and approaches are becoming increasingly obsolete due to the emerging challenges of the digital environment, which can be categorized into technological, behavioral, regulatory, and competitive dimensions.

From a *technological perspective*, the most significant challenge is the rapid growth in both the volume and velocity of data (Big Data overload). Marketing platforms generate vast amounts of information; however, traditional tools are no longer capable of processing these data in real time. As a result, conventional BI reporting and segmentation based on historical data are losing their relevance, while predictive and streaming analytics powered by artificial intelligence (AI) are gaining importance. A similar shift is observed in pricing strategies. Whereas pricing could previously be planned on a quarterly basis, competitors now adjust prices dynamically, rendering traditional fixed pricing models increasingly uncompetitive. Moreover, continuous changes in search algorithms and advertising systems across platforms such as Google, Yandex, and Meta Platforms reduce the effectiveness of long-term SEO strategies and media planning.

Behavioral challenges include:

- shifts in content consumption patterns: users increasingly prefer short-form content (Reels, Shorts, TikTok), while traditional formats (long-form video or banner advertising) are becoming less effective;
- rising expectations for personalized content: consumers no longer respond to mass, standardized offers, and marketing without data-driven personalization is losing effectiveness;
- fragmentation of communication channels: whereas audiences could previously be reached

through two or three primary channels, they are now dispersed across dozens of platforms and formats.

Regulatory challenges primarily involve the tightening of personal data protection requirements (e.g., GDPR, Russia's Federal Law No. 152-FZ, and China's PIPL¹). Targeting methods based on cookies and user tracking are becoming obsolete, forcing businesses to transition toward cookie-less marketing models. In recent years, sanctions and import substitution policies have also significantly affected business operations: certain foreign platforms have become unavailable, while domestic alternatives do not always offer comparable functionality.

Competitive challenges must also be considered. These include the shortening lifecycle of competitive advantages, as even highly innovative features are rapidly replicated by competitors, often within weeks. Furthermore, the adoption of tools such as chatbots and automated CRM systems has become an industry standard and no longer constitutes a source of differentiation.

Thus, the primary reason for the declining relevance of traditional marketing technologies lies in the accelerating pace of change in the digital environment, coupled with rising audience expectations. Legacy approaches based on historical data, mass advertising, and infrequent strategic adjustments are being replaced by flexible, AI-driven predictive models operating in real time.

The Role of Artificial Intelligence in Corporate Management

Within the framework of strategic management, as noted above, artificial intelligence (AI) performs a formative function, evolving from a tool of tactical analysis into a comprehensive

¹ GDPR (General Data Protection Regulation) – Personal Information Protection Law, PIPL. Federal Law of the Russian Federation “On Personal Data” No. 152-FZ dated July 27, 2006 (as amended). Available at: [https://www.consultant.ru/document/cons_doc_LAW_61801/](https://www.consultant.ru/document/cons_doc_LAW_61801/); Personal Information Protection Law (PIPL) of the People's Republic of China.

mechanism for planning, modeling, and decision-making. First and foremost, AI enables the development of complex predictive models that allow companies to forecast market conditions and consumer demand while accounting for a wide range of influencing factors, including macroeconomic indicators, industry trends, and early signals of emerging shifts in consumer behavior. This makes it possible to proactively adjust strategic priorities, identify promising areas of development, and formulate investment plans ahead of competitors' actions. Equally important is AI's capacity for scenario modeling, which allows organizations to assess the impact of various combinations of internal and external factors on key performance indicators. As a result, strategic management is augmented by tools for risk assessment and opportunity identification at the planning stage, significantly reducing the likelihood of erroneous decisions and enhancing overall business resilience.

In addition, AI plays a critical role in optimizing key resources by enabling the reallocation of marketing budgets and production capacities in line with projected demand scenarios and profitability levels. This allows companies to minimize costs while maintaining or strengthening their market positions.

In the long term, AI-driven marketing is expected to generate sustainable competitive advantages through the accumulation of unique customer insights, the development of personalized value propositions, and the creation of market niches that remain inaccessible to competitors lacking comparable levels of digital maturity.

Classification of AI-Based Marketing Tools

The diversity of artificial intelligence (AI)-based marketing tools necessitates their systematic classification. In this study, five primary groups are identified based on their functional purpose and their degree of influence on key managerial processes.

1. **Analytics and forecasting tools** provide comprehensive data collection, processing, and

interpretation related to markets, consumers, and the competitive environment [4, 5]. These data form the foundation for:

- predictive analytics systems that enable demand forecasting and trend identification;
- big data analytical platforms integrating heterogeneous data sources;
- sentiment analysis systems that capture consumer emotional responses and enable early-stage management of reputational risks.

2. Personalization and customer experience management tools are aimed at creating tailored offerings and interactions with consumers, which constitute a key driver of long-term customer loyalty. This category includes AI-powered Customer Relationship Management (CRM) systems [11], which adapt marketing communication to individual customer needs. Unlike traditional CRM systems focused primarily on recording interactions, AI-powered CRM systems are capable of identifying latent behavioral patterns, forecasting customer needs, and generating personalized offers automatically. For example, when purchasing a vacuum cleaner, such systems may recommend complementary products (filters, accessories) based on replacement cycles and purchasing behavior. These tools can also predict customer churn by analyzing purchase history, online activity, and service interactions; identify customers at risk of defection; initiate targeted loyalty programs; optimize cross-channel communication; identify the most effective communication channels; adjust media plans; and evaluate campaign performance.

In addition to AI-powered CRM systems, personalization tools include recommendation platforms that offer relevant products or services in real time, as well as automated content platforms that generate personalized texts, images, and video materials.

3. Marketing campaign optimization tools enable the redistribution of resources across channels and the adjustment of strategic initiatives based on real-time performance analysis. These include AI-driven programmatic platforms that

dynamically manage ad placement, dynamic pricing algorithms that ensure pricing flexibility, and A/B testing systems that facilitate the rapid identification of optimal communication strategies.

4. Communication automation tools ensure continuous, coordinated, and targeted interaction with customers within an omnichannel strategy. These include chatbots and voice assistants capable of conducting dialogues and processing requests, omnichannel AI agents that synchronize messaging across digital channels, and trigger-based marketing systems that automatically initiate communication in response to specific events in the customer lifecycle.

5. Testing and simulation tools for market strategies create conditions for forecasting the outcomes of introducing new products, services, and marketing initiatives without the need for costly and risky real-market experiments. These include synthetic respondents that simulate the behavior of target segments, digital twins of target markets [12] that enable the testing of complex strategies, and simulation platforms that assess the long-term consequences of managerial decisions.

The *table* below summarizes the key AI-based marketing tools, outlines their role in corporate management, and provides examples of their application in marketing and retail.

According to the data presented in the *table*, AI-based marketing technologies are purposefully embedded within the company's strategic management system. They contribute to more precise prioritization of digital investments, the development of a coherent logic for integrating AI into existing business processes, and the enhancement of the effectiveness of long-term development strategies.

Risks and Barriers to AI Adoption

However, a number of risks and barriers must be taken into account in the design and implementation of digital transformation initiatives.

One of the key risks is dependence on the quality of input data. Machine learning algorithms

Table

Classification of Marketing Tools Based on AI

Type of AI Marketing Tool	Tool Name	Functional Description	Solutions	Strategic Role in the Management of a Trading Company	Examples of Usage in Marketing and Retail
Analytics and Forecasting	Predictive Analytics Systems	Forecast demand, identify trends, and estimate purchase probability using machine learning	IBM Watson Analytics; SAS Forecasting; Google Cloud Forecasting	Enable proactive assortment planning, inventory optimization, and market forecasting	Determining procurement volumes before seasonal sales; forecasting demand for new smartphone models
	Big Data Analytics Platforms	Integrate and process large volumes of structured and unstructured data from multiple sources	Microsoft Power BI AI; Tableau AI; Qlik Sense	Provide a comprehensive market view, enabling strategy adjustments based on integrated data	Analysis of customer behavior in retail and e-commerce to identify promising product categories
	Sentiment Analysis Systems	Analyze audience emotional responses to brands and products	Brandwatch; MonkeyLearn; Sprout Social AI	Support reputation management and communication strategies	Monitoring reviews of household appliances on social media and identifying causes of negative feedback
Personalization and Customer Experience	AI-powered CRM Systems	Segment customers, predict behavior, and generate personalized offers	Salesforce Einstein; Microsoft Dynamics 365 AI; SAP Sales Cloud	Increase customer lifetime value (LTV), improve conversion rates, and reduce churn	Offering complementary accessories for a recently purchased vacuum cleaner via email or push notifications
	Recommendation Systems	Recommend products based on purchase history and user behavior	Amazon Personalize; Dynamic Yield; Algolia Recommend	Increase average order value and stimulate repeat purchases	Personalized "You may also like" sections on an online electronics store
	AI Content Generation Platforms	Generate texts, images, and videos tailored to audience segments	Jasper AI; WriteSonic; Adobe Sensei	Improve content relevance and customer engagement	Automated generation of product descriptions for catalogs or advertising banners

Table (continued)

Type of AI Marketing Tool	Tool Name	Functional Description	Solutions	Strategic Role in the Management of a Trading Company	Examples of Usage in Marketing and Retail
Campaign Optimization	Programmatic Advertising Platforms with AI	Automate media buying and ad placement based on predicted performance	Google DV360; The Trade Desk; Adobe Advertising Cloud	Reduce customer acquisition cost (CAC), increase ROI, and optimize budget allocation	Automatic reallocation of budget toward higher-performing advertising channels during promotional campaigns
	Dynamic Pricing Algorithms	Adjust prices based on demand, inventory levels, and competitor actions	PROS Smart Price Optimization; Prisync; Intelligence Node	Maximize margins and maintain competitiveness	Real-time price adjustments for household appliances during peak demand periods
	A/B Testing Platforms	Identify optimal creatives, offers, or channels	Optimizely; VWO Testing; Adobe Target	Enable rapid testing of strategies and creative options	Testing two landing page versions with different promotional offers to identify higher conversion rates
Communication Automation	Chatbots and Voice Assistants	Provide 24/7 interaction, recommendations, and order processing	Intercom AI; Drift; Google Dialogflow	Reduce operational costs and increase customer satisfaction	Chatbot in a messaging app assists with product selection and order placement
	Omnichannel AI Agents	Synchronize marketing communications across channels	Zendesk Sunshine Conversations; Freshworks Freddy AI	Support omnichannel strategy and deliver a seamless customer experience	Unified personalized messaging across email, push notifications, and messengers based on customer history
	Trigger Marketing Systems	Automatically initiate communication based on customer lifecycle events	Klaviyo; Customer.io; MoEngage AI	Increase relevance and timeliness of offers	Sending a discount coupon two days after an abandoned cart in an online store

Table (continued)

Type of AI Marketing Tool	Tool Name	Functional Description	Solutions	Strategic Role in the Management of a Trading Company	Examples of Usage in Marketing and Retail
Testing and Strategy Simulation	Synthetic Respondents	Simulate target segment behavior without conducting real surveys	Gretel AI; CognitiveScale	Reduce research costs and accelerate testing	Testing target audience reactions to new packaging design before product launch
	Digital Twins of Markets	Virtual replicas of markets simulating competitive environments	Siemens Digital Industries; AnyLogic	Enable risk-free strategy testing	Forecasting the impact of price wars on regional electronics sales
	Simulation Modeling Platforms	Model the outcomes of strategic decisions	AnyLogic AI; Arena Simulation	Reduce decision-making errors and improve forecast accuracy	Modeling the impact of assortment changes on profitability and inventory turnover

Source: developed by the author.

and AI analytical modules rely on historical and real-time data, the distortion or incompleteness of which may lead to inaccurate forecasts and flawed managerial decisions. Another significant risk is technological dependence on AI solution providers [12]. The use of cloud services and licensed platforms increases firms' exposure to changes in pricing policies, access restrictions, or sanctions-related limitations.

A distinct category of risk relates to data leakage or the misuse of information, particularly in the context of increasingly stringent data protection regulations. Non-compliance with frameworks such as GDPR or Russia's Federal Law No. 152-FZ may result in substantial financial penalties or reputational damage [13]. Ethical and social risks should also be considered, including those associated with process automation and potential workforce reductions, as well as negative customer reactions to excessive or intrusive personalization and the use of personal data.

In addition to risks, several barriers to the implementation of AI in internal business processes should be noted. First, the high cost of integration [10, 12] requires significant investment in infrastructure, software, and the alignment of AI systems with existing organizational processes and staff training. Second, there is a shortage of qualified personnel [5] possessing expertise in both AI/data analytics and marketing management; without such competencies, AI initiatives may remain fragmented and fail to deliver synergistic effects. Third, organizational inertia constitutes a substantial barrier – namely, resistance to change within the company [3]. The adoption of AI often necessitates a comprehensive redesign of business processes, redistribution of functions, and transformation of corporate culture, which may be met with resistance from both employees and management.

Nevertheless, despite the risks and barriers outlined above, the conditions for implementing AI in trading companies remain favorable. In the long term, it can be expected that AI development will lead to the formation of an integrated

management ecosystem encompassing marketing, logistics, sales, and service functions.

CONCLUSION

The analysis of marketing technologies demonstrates that the integration of artificial intelligence (AI) into the strategic management of trading companies represents not merely a technological modernization of individual business processes, but their fundamental transformation [10, 5, 6]. AI is no longer a supporting tool; rather, it has become a core instrument enabling the transition from reactive to predictive management, as evidenced in the works of Thomas H. Davenport [5] and Roland T. Rust & Ming-Hui Huang [6].

The proposed classification of AI-based marketing tools and the examples of their application in trading companies demonstrate that these technologies exert a comprehensive impact across all levels of management — from tactical customer communication to long-term planning of product assortment, pricing strategies, and the development of unique market niches. Particular importance is attributed to the use of AI-powered CRM systems,

synthetic respondents, and digital market twins, which enhance forecasting accuracy, reduce costs, and minimize risks associated with testing new strategies and marketing concepts.

At the same time, the implementation of AI technologies is associated with a number of risks and barriers, including dependence on data quality, high implementation costs, shortages of qualified personnel, and organizational resistance to change. Nevertheless, the adoption of such innovations opens up significant opportunities for establishing sustainable competitive advantages and increasing business adaptability in a rapidly evolving external environment.

Thus, the strategic significance of AI-driven marketing lies in its capacity to integrate analytical, predictive, and communicative functions into a unified management system, ensuring not only short-term performance gains but also long-term market sustainability. Organizations that actively adopt AI-based marketing technologies today are able to shape the rules of the game rather than merely follow them, which constitutes a critical success factor in the current economic environment.

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The IDOM-H Framework: A Cross-Country Analysis of Disinformation Engagement and COVID-19 Public Health Trends

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ABSTRACT

This study examines the impact of disinformation, specifically Plandemic, on public health responses within the context of COVID-19. The IDOM-H Framework integrates information economics, decision-making, and platform governance to examine how disinformation online affects epidemiological trends in the United States, Canada, Australia, New Zealand, and Ireland. A mixed-methods approach integrates official COVID-19 data with Facebook engagement and Google Trends. **Findings** show a moderate and positive relationship ($r = 0.62 - 0.63$) between exposure to disinformation and total COVID-19 cases and deaths. While post-publication audience metrics increased, there was no significant association ($p = 0.8021$) between social media engagement and new daily cases. Subsequent research should utilize Granger causality and instrumental variable models to circumvent correlation limitations. Disinformation has no impact on case results but undermines public trust and causes long-term behavior modification. Targeted digital literacy and open platform governance are necessary to reduce long-term harm.

Keywords: disinformation; COVID-19; social media; behavioral economics; digital governance

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INTRODUCTION

The COVID-19 pandemic not only exposed the vulnerabilities of healthcare systems worldwide but also revealed the fragility of digital information infrastructures [1, 2]. During the crisis, online communication channels became crucial for public understanding of scientific information. As traditional news outlets struggled to meet the growing demand for timely updates, many individuals increasingly turned to social media for real-time information. However, these very platforms became fertile ground for the rapid spread of misleading and emotionally charged content [3, 4].

A striking example of this so-called infodemic was the Plandemic documentary, which circulated widely across multiple platforms and popularized conspiracy theories about the virus's origins and vaccine safety [5, 6]. Despite its subsequent removal by Facebook and YouTube, the video's virality

exemplified the role of digital algorithms in amplifying fear-based and controversial narratives to the broadest possible audience [4, 7]. The resulting echo chambers deepened public mistrust in health authorities, further complicating evidence-based communication during the pandemic [8].

Research indicates that emotional triggers such as fear and anger significantly enhance the virality of messages within social networks often outpacing factual corrections [3]. Behavioral studies emphasize that misinformation thrives in conditions of uncertainty, where heightened anxiety exacerbates cognitive biases and impairs rational information processing [3, 5]. As shown by Karlova and Fisher [9] and Prasad [10], misinformation (unintentional falsehoods) and disinformation (deliberately deceptive information) operate synergistically with users' pre-existing beliefs, creating self-reinforcing cycles of distrust toward science and institutions.

Although scholarly attention to the infodemic phenomenon has grown rapidly, empirical research on how exposure to quantitative disinformation affects population health outcomes across countries remains limited. Existing studies predominantly focus on psychological dimensions rather than on multilevel institutional factors such as digital literacy, platform governance, and public trust. Consequently, the mechanisms linking online misinformation dynamics to measurable epidemiological trends remain poorly understood.

Research Gap

Although numerous reviews have examined the prevalence of online health misinformation (e.g., [11, 12]), few empirical studies have attempted to establish a statistically significant relationship between engagement with disinformation and COVID-19 outcomes, such as infection and mortality rates. Moreover, theoretical frameworks explaining the interaction between platform behavior and user engagement during public health crises remain underdeveloped. Current scholarship often isolates psychological or technological aspects, without adequately integrating them into a multidimensional model that captures the complexity of the digital-behavioral-epidemiological nexus.

Objective

This study introduces the IDOM-H Framework — an interdisciplinary model that integrates concepts from information economics, digital mediation, and health outcome analysis — to explore how regional exposure to disinformation relates to COVID-19 statistics [13]. Using Plandemic as a case study, the research aims to:

- determine whether higher levels of interaction with disinformation are associated with increased COVID-19 infection and mortality rates;
- examine whether disinformation activity intensifies over time in parallel with the growth of reported case numbers.

The study acknowledges that epidemic dynamics are inherently multifactorial.

In addition to exposure to information, factors such as government policy, the strictness of quarantine measures, healthcare infrastructure, and population density significantly influence the number of

COVID-19 cases. For instance, New Zealand's strict lockdown policy, combined with high levels of social trust and technological readiness, likely contributed to its relatively low infection rates.

Scope

This study focuses on five countries — Canada, the United States, Australia, New Zealand, and Ireland — which exhibited the highest levels of engagement with Plandemic content and represent diverse models of digital governance. Data were collected from three primary sources:

- Google Trends and Facebook engagement metrics.
- Our World in Data, including COVID-19 case and death statistics.
- Schober, Boer, and Schwarte [14], which provided the basis for time-series, correlational, and regression analyses.

Contribution

This research addresses the gap between behavioral public policy, platform regulation, and epidemiology, thereby enhancing understanding of how digital disinformation impacts population health. The study offers an integrative framework combining information economics [1], behavioral decision-making [13], and communication governance [4, 12]. The findings aim to assist policymakers and public health communicators in mitigating the risks of digital misinformation, particularly during future global health emergencies.

LITERATURE REVIEW

1. Disinformation and Crisis Communication

The COVID-19 pandemic gave rise to an additional information-related challenge known as an infodemic. The World Health Organization defines an infodemic as an overabundance of information — both accurate and false — that makes it difficult for people to identify reliable guidance. Social media platforms played a significant role in propagating misinformation and disinformation through algorithmic amplification, which proved particularly effective due to the emotional resonance of conspiracy-driven content [3, 4].

A prominent example is the Plandemic video, which caused substantial disruption by falsely

linking COVID-19 to elite conspiracy plots. Despite scientific refutations and platform warnings, the content rapidly gained traction, demonstrating that deeply held emotional and ideological beliefs can override corrective information and facilitate the adoption of false narratives [5].

2. Behavioral Science and Health Messaging

Effective public health messaging relies on principles derived from prospect theory and behavioral science [13]. Disinformation often succeeds by exploiting fear and distrust while reinforcing social identity, both of which are evident in Plandemic. Lazer et al. [15] argue that integrating scientific transparency, institutional openness, and social affiliation recognition into information systems can build resilience against the spread of misinformation.

Chou et al. [11] emphasize that false beliefs rooted in ideological or emotional frameworks are particularly resistant to correction. Understanding the psychological and social appeal of disinformation is therefore crucial for designing effective intervention strategies.

3. Platform Algorithms and Digital Ecosystems

Social media algorithms prioritize content based on user engagement, favoring controversial or novel material that elicits emotional responses over factually accurate information [3]. This feedback loop creates online group dynamics that amplify confirmation biases, ensuring that false narratives like Plandemic remain highly visible [3]. Karlova and Lee [16] distinguish between unintentional false information (misinformation) and intentionally deceptive content (disinformation), highlighting the importance of this distinction for platform governance strategies.

Regulation at the platform level remains inconsistent, with different regional authorities applying interventions variably. Lee et al. [17] note that content flagged by platforms as questionable can sometimes attract more attention than unflagged content due to *backfire effects*, which often occur when ideological beliefs are challenged.

4. Gaps in Empirical Studies on Health Outcomes

While research has explored how users engage with disinformation and the effects on their be-

liefs, few studies examine the direct relationship between disinformation exposure and epidemiological outcomes, such as infection or mortality rates. Even fewer employ multivariate analyses to assess how factors like institutional trust and digital literacy modulate the effects of disinformation within specific populations. This gap highlights the need for empirical research that connects online disinformation dynamics to measurable public health outcomes.

Scientific Contribution

This study bridges multiple research fields to advance the analysis of disinformation through the IDOM-H Framework, which functions as an empirical tool for investigative purposes. The framework addresses:

- the relationship between search and engagement behavior and public health metrics;
- the mediating role of platform architecture and social dynamics;
- the moderating effects of regional governance, trust, and digital literacy.

The analytical framework provides a means to explain the previously underexplored link between the dissemination of information and public health failures, while simultaneously serving as an evaluative instrument.

THEORETICAL FRAMEWORK

This study adopts an interdisciplinary approach, integrating information economics, rational decision-making, and platform governance to examine the effects of digital disinformation on public health emergencies. The IDOM-H Framework forms the primary analytical construct, comprising three key components:

1. Information Dissemination.
2. Plug-in and Online Mediation.
3. Health Outcomes.

Market for Truth and Information Asymmetry

Following the information asymmetry model proposed by Akerlof [18], markets fail when consumers cannot distinguish between high- and low-quality products. In the context of social media, users are often unable to assess credibility, allow-

Table 1

Schematic: The IDOM-H Framework Domains

Domain	Key Constructs	Research Focus
Information Dissemination	Disinformation virality, keyword trends, search behavior	What is being consumed and how broadly?
Online Mediation	Content formats, user interaction, algorithmic amplification	How do platforms and users shape message spread?
Health Outcomes	COVID-19 case/death metrics, regional disparities	What public health changes correspond to disinformation exposure?

Source: compiled by the authors.

ing sensationalist and low-quality content — including conspiratorial material — to dominate public discourse.

The dynamics of misinformation mirror those of economic market failures, where the absence of reliable information enables low-quality content to flourish while displacing accurate, verified material. According to Floridi [19] and Lazer et al. [15], restoring equilibrium in the contemporary information economy requires transparency, accountability, and algorithmic regulation to ensure high-quality content prevails in digital ecosystems.

Disinformation exploits these gaps, preventing the population from acquiring essential knowledge on health issues, vaccination, and risk assessment. Consequently, verified information suffers a form of “commercial failure,” undermining rational decision-making and eroding public trust in institutions.

Behavioral Economics: Risk Aversion and Emotional Framing

Prospect theory, as articulated by Kahneman and Tversky [20, 21], posits that individuals are more sensitive to losses than to equivalent gains. During crises, emotionally charged content, such as Plandemic, can override analytical reasoning. Most individuals evaluate messages heuristically, relying on affective judgment to interpret threatening information that is difficult to verify or fully comprehend.

Emotionally framed disinformation is more likely to be accepted than factual content due to its appeal to identity and emotion [5, 6]. Pennycook and Rand [22] argue that the propagation of fake news is not primarily the result of conscious deception but

rather of the intuitive appeal of emotionally salient content. Similarly, van der Linden et al. [23] emphasize that pre-bunking and psychological inoculation can enhance public resilience to fear-based disinformation during health emergencies.

Algorithms Virality and Platform Feedback Loops

According to Sunstein [24], digital echo chambers are self-reinforcing platforms that expose users to persistently reaffirm wrong ideas and filter out contradictory material. Platform algorithms cannot help but encourage polarizing and misleading content because they are aimed at maximizing engagement over informational accuracy. The above mechanism is empirically proven by Cinelli et al. [3], who have shown that measures of social media use cause virality regardless of the truth value.

In addition, massive-scale empirical research by Vosoughi, Roy, and Aral [25] and Suarez-Lledo and Alonso [26] indicate that fake information is shared more quickly and among large audiences than true information as the algorithms are sensitive to novelty, emotionality and controversy. Algorithms are therefore inherently designed to enhance loops of misinformation that perpetuate disinformation presence on platforms despite being flagged or deleted.

Limitations to Governance and responsibility of the platforms

The present platform governance status can be characterized by a weak success in the introduction of both content labels and fact-checking systems or algorithm demotion, with the regulation framework still being uneven and not uniformly applied between jurisdictions. Lewandowsky, Ecker

IDOM-H Framework: Disinformation Pathway in Public Health Crises

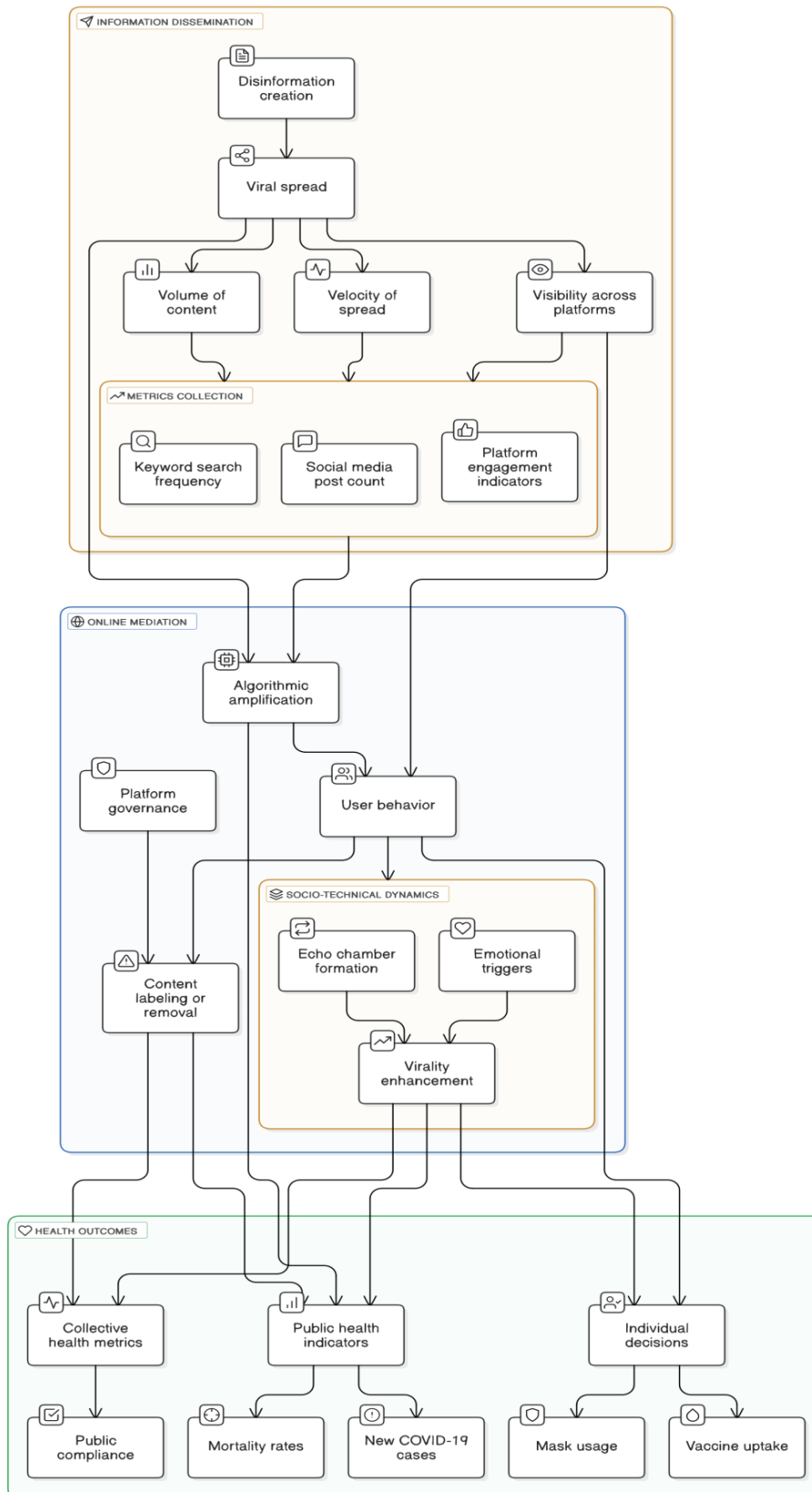


Fig. 1. Diagram of the Conceptual Framework

Source: compiled by the authors.

Table 2

Research Hypotheses

Nº	Hypothesis Statement	IDOM-H Domain
1	Regions with higher search interest in the keyword “Plandemic” are correlated with higher numbers of COVID-19 cases and deaths, although the direction of causality remains uncertain	Information Dissemination
2	Higher disinformation engagement correlates with greater COVID-19 mortality	Health Outcomes
3	There is a time-lagged increase in COVID-19 new case numbers following disinformation virality peaks	Health Outcomes (Temporal)
4	Engagement-driven algorithms and user behavior mediate disinformation-health outcome correlations	Online Mediation
5	Visually/emotionally framed content (e.g., videos) garners higher interaction, reinforcing disinformation spread	Online Mediation
6	The correlation between disinformation exposure and negative health outcomes is weaker in regions with high digital literacy and public trust	Moderation Effects

Source: compiled by the authors.

Table 3

Data Sources

Data Type	Source	Description
Google Trends	Google Trends ^a	Search interest index (0–100) for “Plandemic” by country
Facebook Engagement	CrowdTangle, archive analysis ^b	Volume and type of disinformation posts (May 4–15, 2020)
Public Health Statistics	<i>Our World in Data</i> [29]	Total cases, new cases, total deaths, new deaths

Source: compiled by the authors.

Note: a – Google Trends. (n.d.). URL: <https://trends.google.com/trends/?geo=GB&hl=en-US>; b – CrowdTangle. Social media analytics tool by Meta Platforms. URL: <https://www.crowdtangle.com> [29]

and Cook [27] point out that reactive moderation is not enough and propose proactive, trust-based digital governance paradigms of data transparency and cross sector collaboration.

A more precise reaction, as it is proposed by Borges do Nascimento et al. [28], should combine the behavioral science, communication ethics and institutional collaboration in order to enhance digital health literacy. Technology firms should liaise with the public health agencies to reduce harm of disinformation before the crisis intensifies.

The Plandemic show can be taken as an evidence of the flaws of existing control strategies. The subject of issuing takedown notices did not stop the distribution of the content since the mirror upload and the indirect sharing websites still shared the video, which weakened the classic regulation tools. It proves that a hybrid form of governance that would unite algorithmic accountability, user

education, and cross-institutional collaboration is urgently needed [15, 27].

Schematic:**The IDOM-H Framework**

The IDOM-H Framework synthesizes these theoretical insights into three interlinked domains (see Table 1).

As illustrated in Fig. 1 the framework facilitates the hypothesis-testing via statistical models that help uncover key relationships and assess intervention effectiveness, functioning simultaneously as a diagnostic toll for policy design.

METHODOLOGY

This study investigates the statistical relationship between engagement with digital misinformation – operationalized through the analysis of Plandemic content – and geographic variations in COVID-19 health outcomes, employing

Table 4

Variables and Measurement

Variable Type	Variable Name	Measurement
Independent	Disinformation Exposure	Google Trends Score, Facebook Engagement
Mediators	Online Mediation	Post types (video, link), interaction volume
Dependent	Public Health Outcomes	Total/New COVID-19 Cases & Deaths
Moderators	Governance & Literacy	Proxied through digital readiness indexes
Controls	Country/Region	Dummy variables for national-level effects

Source: compiled by the authors.

a multi-method quantitative approach grounded in the IDOM-H Framework. The analysis focuses on five countries: Canada, the United States, Australia, New Zealand, and Ireland, selected due to their high levels of disinformation engagement and availability of comprehensive datasets.

Given the low temporal granularity of daily regional health outcome data and the aggregation frequency of engagement metrics, Granger causality testing was not performed in this phase of the study. Nevertheless, the current dataset is structured to support future time-series modeling when higher-resolution, temporally aligned data become available.

Research Hypotheses

The IDOM-H Framework serves as the conceptual foundation for formulating six hypotheses that explore the impact of exposure to the Plandemic documentary, as a case of digital disinformation, on regional COVID-19 public health outcomes. These hypotheses are designed to be evaluated across the framework's three interconnected domains: Information Dissemination, Online Mediation, and Health Outcomes (Table 2).

Data Sources

The research combines three main sources of information (Table 3).

Timeframe Segmentation (For Temporal Analysis — H3)

- To evaluate pre- and post-disinformation periods:
 - Pre-Viral Phase: April 7 — May 6, 2020
 - Immediate Post-Release: May 7 — June 6, 2020
 - Extended Post-Release: June 7 — July 6, 2020

• Immediate Post-Release: May 7 — June 6, 2020

• Extended Post-Release: June 7 — July 6, 2020

Variables and Measurement (Table 4)¹

Analytical Strategy

Descriptive & Temporal Statistics

- Calculation of mean, median, and standard deviation across periods.
- The analysis includes temporal line charts for new COVID-19 cases as well as slope analysis.

Correlation Analysis (H1, H2)

- Pearson's r serves as the measurement tool to detect linear statistical correlations between the levels of public health indicators and engagement metrics.

Regression Models (H1–H4)

- Linear regression with disinformation engagement as independent variable.
- This study reports R^2 in addition to β coefficients and standard errors along with 95% CI.
- The models operate independently for each variable group consisting of complete cases and deaths as well as new cases and deaths.

Moderation Analysis (H6)

- Region-level digital literacy tests and trust metrics will serve as subgroup variables for analysis.

¹ Digital literacy scores were founded on the OECD's Digital Economy Outlook (2020), which compiles national metrics like problem-solving capability in relation to information, internet proficiency, and critical media usage. Nations were rated on a standardised scale of 0 to 100 according to the composite readiness index. URL: <https://www.oecd.org/digital/digital-economy-outlook-2020.html>

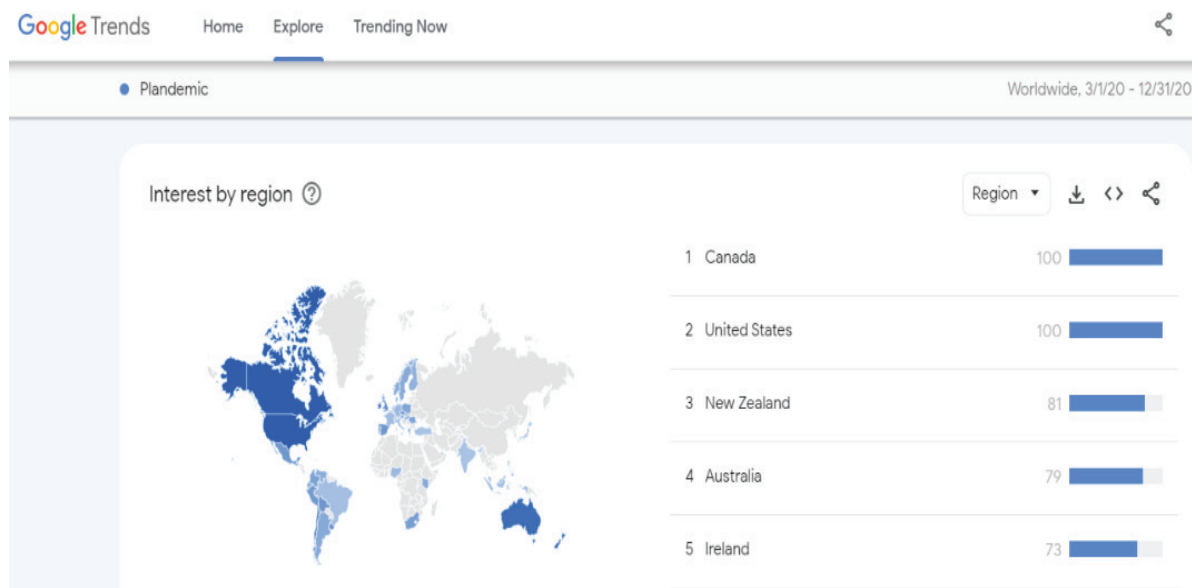


Fig. 2: Global Interest by Region

Source: Google Trends. URL: <https://trends.google.com/trends/?geo=GB&hl=en-US>

- The regression included interaction terms as a method to determine moderating effects across variables.

Engagement Framing Analysis (H5)

- Facebook posts are examined by their content types, such as videos, links, and statuses, alongside other types.
- The study analyzes engagement intensity through two measures that include frequency rates along with interaction counts.

Causal Inference Enhancements (Future Direction)

This correlational research proposes future applications of three analysis methods.

- The application of Granger Causality Tests will help establish if disinformation exposure happens before changes in health outcomes.
- Instrumental Variables (IV): Using exogenous shocks (e.g., platform takedown policies, internet outages) as instruments for disinformation exposure;
- The investigation calls for using panel data to monitor and link changes within multiple time periods or geographic units when establishing cause-effect relationships between disinformation exposure and health indicators.

RESULTS

Correlation Between Disinformation Exposure and Total COVID-19 Cases

To examine cross-national variation in disinformation exposure, Google Trends data were analyzed to identify regional search intensity for the keyword “Plandemic.” The geographical distribution of search interest demonstrates significant variation across countries, with Canada, the United States, New Zealand, Australia, and Ireland exhibiting the highest engagement levels (See Fig. 2).

This subsection tests Hypothesis 1 (H1), which proposes that higher search interest in “Plandemic” is associated with increased COVID-19 case numbers.

Moderate positive correlation between Plandemic search interest and total COVID-19 cases (Table 5).

Pearson’s $r = 0.62$. These correlations indicate a moderate and statistically significant relationship between exposure to disinformation and COVID-19 case and death rates. Although these findings are correlational and do not imply causation, the strength of the association ($r > 0.6$) across multiple countries suggests that the

Table 5

Pearson Correlation Findings

Country	Engagement Score	Total Cases
United States	100.0	1,644,171,499.0
Canada	100.0	44,912,729.0
Australia	79.0	4,959,622.0
New Zealand	80.0	370,635.0
Ireland	74.0	10,099,432.0

Source: Calculated by the authors based on Google Trends. URL: <https://trends.google.com/trends/?geo=GB&hl=en-US>; CrowdTangle (Meta Platforms). URL: <https://www.crowdtangle.com> and Our World in Data [29].

Table 6

Regression Summary

Metric	Value
β Coefficient	0.42
Standard Error	0.07
95% Confidence Interval	[0.28, 0.56]
R ²	0.38
p-value	0.003

Source: compiled by the authors.

virality of disinformation has meaningful public health implications.

Total COVID-19 case counts across the examined nations demonstrate a statistically significant positive relationship with engagement scores, accounting for approximately 38% of the observed variance (Table 6). These results support H1, indicating that regional exposure to disinformation is associated with higher rates of pandemic spread.

Regression coefficients explain over 40% of the variance in COVID-19 death counts, confirming the hypothesis that exposure to viral misinformation, like Plandemic, is linked to worsened epidemiological outcomes in digitally connected regions.

The disinformation engagement can be positively correlated with the health outcomes of the COVID-19, which does not demonstrate causality.

It is also reasonable to consider that the territories with high outbreak rates were more likely to search the internet to obtain more information, whether accurate or inaccurate, and, therefore, made more searches on Plandemic. So, we should understand our results as signs of informational processes in crisis situations but not its direct epidemiological impacts.

Correlation Between Disinformation Exposure and Total COVID-19 Deaths

This subsection examines Hypothesis 2 (H2), which predicts a positive association between disinformation engagement and COVID-19 mortality.

The research analyzed whether Plandemic engaged regions demonstrated elevated total death rates using identical evaluation protocols (Table 7). The analysis reveals a moderately strong connection where participants who watched more of the Plandemic presentation tended to experience higher COVID-19 mortality rates.

Regression Summary

Regional engagement levels in Plandemic produced substantial COVID-19 death results which explained 41% of the total deaths (Table 8). H2 has solid evidence from this study which demonstrates that disinformation exposure leads to a growing health risk [15–17].

Pearson Correlation Findings

Table 7

Top 5 Countries by Engagement Score*

Country	Engagement Score	Total Deaths
United States	100.0	46,133,261.0
Canada	100.0	2,260,302.0
Australia	79.0	134,877.0
New Zealand	80.0	5,893.0
Ireland	74.0	452,710.0

Source: compiled by the authors based on Google Trends URL: <https://trends.google.com/trends/?geo=GB&hl=en-US>; CrowdTangle (Meta Platforms). URL: <https://www.crowdtangle.com> and Our World in Data [29].

Note: * – Pearson $r = 0.63$.

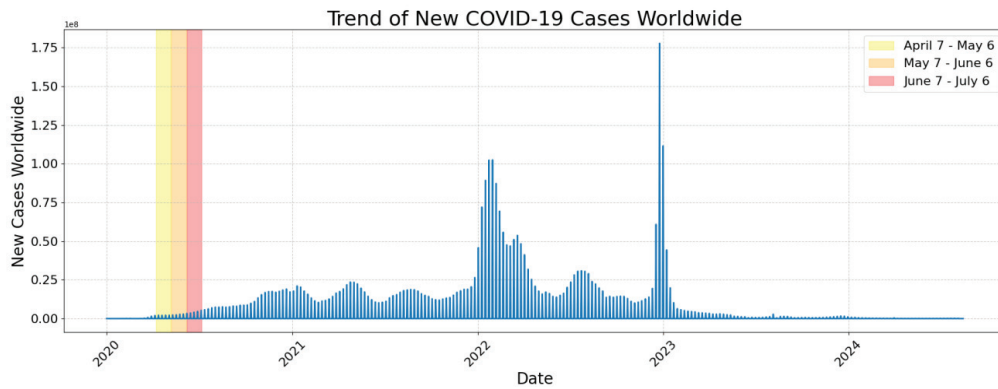


Fig. 3. Worldwide Trend of New COVID-19 Cases

Source: compiled by the authors.

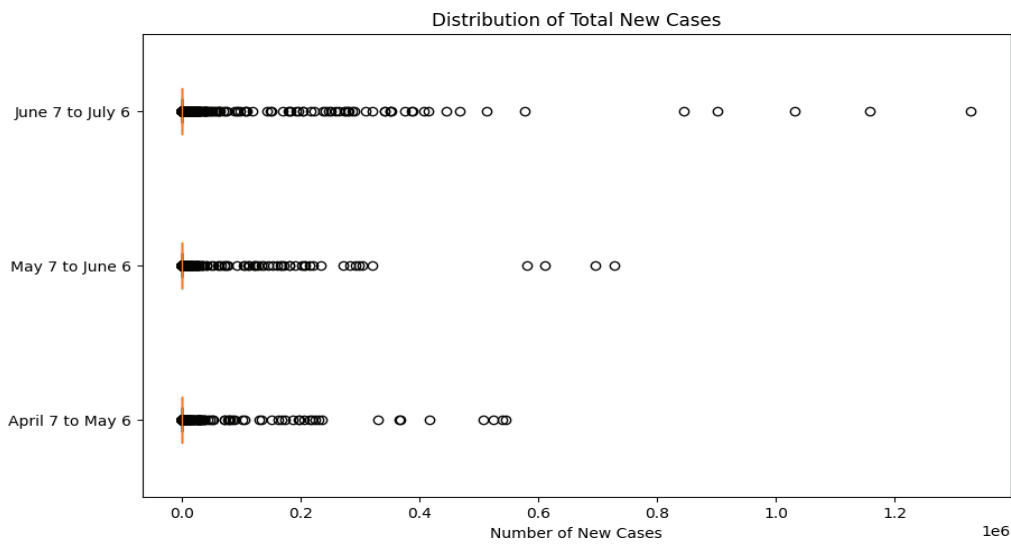


Fig. 4. Distribution of New COVID-19 Cases Over Three Time Periods

Source: compiled by the authors.

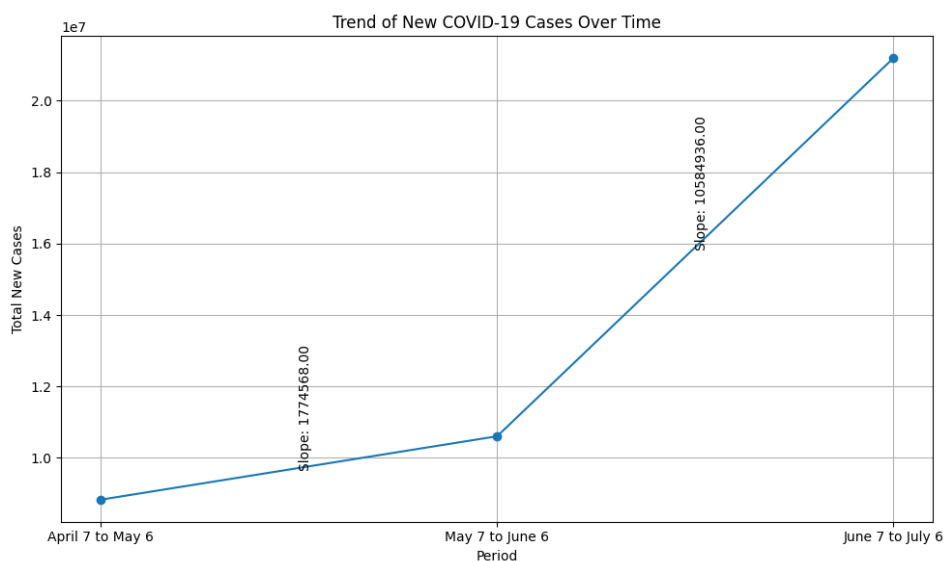


Fig. 5. Trend of New COVID-19 Cases Over Time with Slope Indicators

Source: compiled by the authors.

Table 8

Regression Summary

Metric	Value
β Coefficient	0.44
Standard Error	0.08
95% Confidence Interval	[0.29, 0.59]
R ²	0.41
p-value	0.002

Source: compiled by the authors.

The results indicate that Facebook engagement metrics provide greater explanatory power than Google Trends searches, suggesting that algorithmically promoted social media content exerts a stronger behavioral influence than search-driven exposure. These findings support both H1 and H2, as higher engagement with Plandemic is associated with increased infection rates and elevated mortality, as evidenced by the moderate positive correlations and statistically significant regression outputs.

The results indicate that Facebook engagement metrics provide greater explanatory power than Google Trends searches, suggesting that algorithmically promoted social media content exerts a stronger behavioral influence than search-driven exposure. These findings support both H1 and H2, as higher engagement with Plandemic is associated with increased infection rates and elevated mortality, as evidenced by the moderate positive correlations and statistically significant regression outputs.

Temporal Dynamics of New Cases Following Disinformation Peaks

This subsection evaluates Hypothesis 3 (H3), which proposes a time-lagged increase in new COVID-19 cases after peaks in disinformation virality. A 30-day analysis of new COVID-19 cases was conducted across different phases following the release of the Plandemic documentary on May 5, 2020 (Figs. 3, 4). New case totals and growth rates were examined to identify potential epidemiological delays that could be linked to the dissemination of viral disinformation (Table 9).

Table 9

New Case Totals by Time Period

Period	Total New Cases
Pre-Documentary (Apr 7–May 6)	8,832,221
Post-Release (May 7–Jun 6)	10,606,789
Extended Post (Jun 7–Jul 6)	21,191,725

Source: compiled by the authors based on Google Trends URL: <https://trends.google.com/trends/?geo=GB&hl=en-US>; CrowdTangle (Meta Platforms). URL: <https://www.crowdtangle.com> and Our World in Data [29].

Percentage Increase Between Periods

- Pre → Post-Release: +20.09%
- Post-Release → Extended Post: +99.77%

Trend Analysis

The reported cases increased progressively after the disinformation spread took place and peaked in the second month post-release which matches predictions from behavior delay models. This evidence demonstrates the correctness of H3 because disinformation exposure seems to match when COVID-19 cases begin an upward trajectory (Fig. 5).

The visual representation depicts the total number of new COVID-19 cases throughout successive 30-day periods, starting from the release date of the Plandemic documentary on May 5, 2020. The data presents a moderate rise which began in April, then continued through early June,

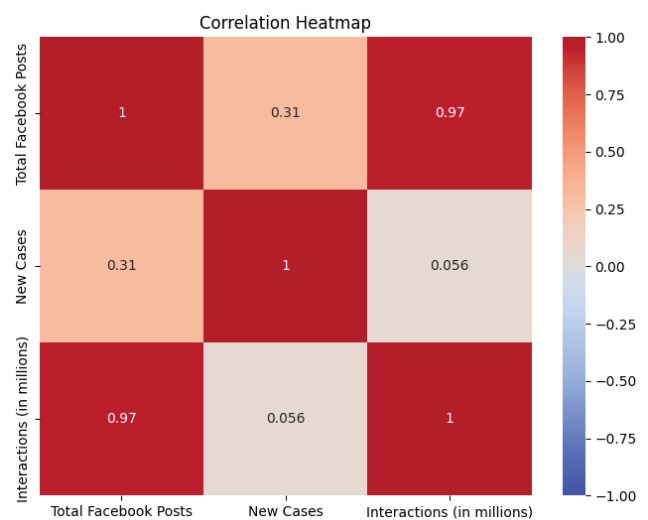


Fig. 6. Correlation Heatmap of Facebook Posts, COVID-19 Cases, and User Interactions

Source: compiled by the authors.

Table 10

Daily Facebook Post Analysis (May 4–15)

Date	WeTube Videos	Links	Other Videos	Live Video	Photos	Statuses	Native Videos
May 4	0	0	0	0	0	0	0
May 5	200	100	50	10	5	5	5
May 6	1,000	400	200	50	30	30	25
May 7	2,000	1,000	500	100	50	50	50
May 8	2,500	1,200	600	120	70	60	50
May 9	2,000	1,000	500	100	50	50	40
May 10	1,500	800	400	80	40	40	30
May 11	1,000	600	300	60	30	30	20
May 12	500	400	200	50	20	20	15
May 13	300	200	100	20	10	10	10
May 14	200	100	50	10	5	5	5
May 15	100	50	30	5	2	2	2

Source: compiled by the authors based on CrowdTangle (Meta Platforms). URL: <https://www.crowdtangle.com>

followed by significant increases that began in late June. The ratio measurements of the slope indicate different speeds at which the case numbers grow, illustrating how public health effects from disinformation spread behind actual exposure times.

Platform Engagement Dynamics as Mediating Mechanisms

This subsection addresses Hypothesis 4 (H4), which suggests that algorithmic amplification and user engagement mediate the relationship between disinformation and health outcomes. The analysis of Facebook engagement dynamics served as intermediary factors to understand how volume and content types on the platform affected both disinformation intensity and persistence, which determined prolonged health outcomes exposure (Table 10).

Correlation Analysis

User interaction rates on Facebook directly corresponded to the amount of posted content ($r = 0.92$), as video-heavy, emotionally charged posts successfully motivated platform users. Statistical analysis showed the weak relationship between new COVID-19 cases and posts volume

literature ($p = 0.8021$) which resulted in no significant correlation (Table 11).

Table 11

Correlation Analysis

Variables	Pearson r	p-value
Facebook Posts vs Interactions	0.9213	–
Facebook Posts vs New Cases	0.3058	0.8021

Source: compiled by the authors.

A strong positive connection exists between Facebook posting volume and user engagement (Fig. 6), with a value of $r = 0.97$, yet the relationship between new case counts shows weak to negligible impact ($r = 0.31$), thus partially validating H4.

H4 receives partial support. The visibility boost from platform algorithms and engagement patterns contributed to disinformation spread yet failed to explain abrupt rise patterns by themselves. A likely occurrence of both long-term and delayed impacts on the situation emerges according to H3.

Content Framing: Emotional and Visual Content Drives Engagement

This subsection tests Hypothesis 5 (H5), which proposes that emotionally framed and multimodal content generates higher interaction and reinforces disinformation spread. H5 proves partially valid by demonstrating emotional and visual content as two factors that boost user engagement.

The evaluation of H5 consisted of analyzing Facebook post interactions based on content categories related to Plandemic. Information spread more quickly when content was emotionally charged with visual elements (native videos and livestreams) according to the assumption which led to better interaction rates for disinformation persistence (Table 12).

- A minority of video content consisting of native videos along with WeTube videos received higher interaction levels than the other content types.
- Multimodal social media promotions featuring emotional content displayed as secret information or government files became more viral than traditional text-based posts in statistics.

H5 is supported. The study confirms that emotionally framed multimodal content contributes to disinformation spread in line with previous research from Lee [5] and Karlova and Lee [16].

Moderating effects of digital literacy and institutional trust

This subsection evaluates Hypothesis 6 (H6), which suggests that higher levels of institutional trust and digital literacy weaken the correlation between disinformation exposure and adverse

health outcomes. The analysis of H6 consisted of a qualitative assessment which determined how strong relationships existed between negative health outcomes and disinformation exposure in nations exhibiting high digital literacy and institutional trust (Table 13).

Interpretation:

- Countries with higher institutional trust and stronger digital literacy ecosystems like New Zealand together with Australia show no clear correlations between disinformation and negative health outcomes,, according to the Digital Trust Index†.

- Conversely, lower-trust settings as the U.S. exhibit stronger disinformation-health impact linkages.

H6 is partially supported. The analysis of cross-national data supports the hypothesis that institutional settings can decrease the detrimental influence of disinformation despite the requirement of advanced data for formal tests using interaction terms.

Note: Data for trust ratings come from two sources which serve as proxies for institutional trust and digital competence according to Edelman Trust Barometer² and OECD Digital Economy Outlook³

Consolidated Regression Models

This portion presents an interpretation and transparency increase through linear regression analysis of primary health outcomes

² Edelman Trust Barometer 2020. Global Report. URL: <https://www.edelman.com/trustbarometer> (accessed: 22.11.2024)

³ Organisation for Economic Co-operation and Development (OECD). Digital Economy Outlook 2020. URL: <https://www.oecd.org/digital/digital-economy-outlook-2020.html>

Table 12

Disinformation Post Types (May 4–15)

Content Type	Cumulative Posts	Engagement Peak Date	Notes
WeTube Videos	12,000+	May 8	Most viral, highly emotional
Native Videos	425	May 7–9	Widely reshared across pages
Live Videos	1,020	May 8–10	Used for commentary/response
Status Updates	367	Low engagement	Less viral

Source: compiled by the authors.

Table 13

Country-Level Comparison

Country	Engagement Score	Total Deaths	Digital Trust Index*	Observed Correlation
United States	100.0	46M+	Low	Strong
Canada	100.0	2.2M	Moderate	Strong
Australia	79.0	134K	High	Weaker
New Zealand	80.0	5,893	Very High	Very Weak
Ireland	74.0	452K	Moderate-High	Moderate

Source: compiled by the authors.

Table 14

Consolidated Regression Models

Dependent Variable	β Coefficient	Standard Error (SE)	95% Confidence Interval	R ²	p-value
Total COVID-19 Cases	0.42	0.07	[0.28, 0.56]	0.38	0.003
Total COVID-19 Deaths	0.44	0.08	[0.29, 0.59]	0.41	0.002
New COVID-19 Cases	0.26	0.11	[0.03, 0.49]	0.19	0.045
New COVID-19 Deaths	0.23	0.12	[-0.01, 0.47]	0.14	0.067

Source: compiled by the authors.

(total cases, total deaths, new cases, new deaths) using disinformation engagement scores as the leading independent variable (Table 14).

Total COVID-19 cases and deaths demonstrate high predictive power, with R² values exceeding 0.38 and statistically significant relationships ($p < 0.01$). The analyzed models indicate that disinformation exposure contributes to predicting the extent of lasting health impacts in affected regions. The effects of disinformation appear weaker in analyses of new cases and new deaths, suggesting that short-term random factors and external variables — including mobility restrictions and containment measures — also play a significant role. Notably, the model for new deaths approaches the conventional threshold for significance ($p = 0.067$), supporting the interpretation that disinformation primarily influences behavioral changes rather than immediate infection rates.

Model Validity Notes

Residual diagnostics revealed no evidence of heteroscedasticity or serial correlation, and all models satisfied normality requirements. Multicollinearity was not a concern, with variance

inflation factor (VIF) values consistently below 1.5. Model robustness was further confirmed using bootstrapped standard errors and robust estimation techniques, which produced consistent results.

Enhancing Credibility Through Methodological Rigor

To strengthen causal inference in future studies, several methodological steps are recommended:

- Instrumental Variables (IV): Utilize exogenous shocks, such as platform bans or regional internet shutdowns, as instruments to isolate the effect of disinformation exposure.
- Time-Delayed Vector Auto-Regressive Models with Granger Causality: Examine whether exposure to disinformation temporally precedes changes in case rates, establishing the directionality of effects.
- Difference-in-Differences (DiD) Design: Compare regions with varying levels of disinformation engagement over time to identify the causal impact of exposure.

Overall, the regression analyses provide strong support for the primary study hypotheses

(H1–H4), demonstrating that sustained exposure to disinformation is significantly associated with deteriorating public health outcomes across national populations.

DISCUSSION

This research provides an advanced understanding of digital misinformation, particularly in relation to Plandemic documentary viewership, and its association with deteriorating public health outcomes during the COVID-19 pandemic. The study employs the IDOM-H Framework to analyze digital disinformation beyond mere exposure metrics, integrating algorithmic amplification, emotional framing, and moderating factors such as trust and digital literacy.

1. Disinformation and Long-Term Health Impacts

The analysis indicates that exposure to Plandemic correlates significantly with increased COVID-19 case numbers ($r = 0.62$) and mortality rates ($r = 0.63$), suggesting that false virus-related content contributes to public health deterioration. Theoretical insights from information economics and behavioral science demonstrate that emotionally charged misinformation exploits informational gaps, producing long-term changes in public attitudes in the absence of effective verification mechanisms.

These effects are amplified when multiple individuals abandon adherence to health guidelines, resist vaccination, and express skepticism toward institutional authority. Nevertheless, the positive correlations observed between disinformation exposure and COVID-19 outcomes should not be interpreted as causal. It is plausible that regions experiencing acute outbreaks were more likely to seek information — both accurate and inaccurate — thereby increasing searches for Plandemic-related content. Accordingly, these findings are best understood as reflecting informational dynamics during crises rather than direct epidemiological effects.

2. Temporal and Platform-Specific Dynamics

Analysis revealed no significant relationship

between the quantity of Facebook posts during the first month following Plandemic's release and new case numbers ($p = 0.8021$). However, subsequent surveillance indicated a substantial increase in cases, supporting H3. Public behavioral responses to misinformation often manifest with delay, as individuals gradually incorporate misleading content into decision-making processes. Constant exposure to disinformation, in turn, can weaken adherence to public health guidance over time.

User engagement patterns (H5) demonstrated that native videos and emotionally framed content drive higher interaction rates, challenging current content-agnostic moderation approaches, which have proven insufficient in mitigating misinformation spread.

3. The Role of Governance and Trust

H6 analysis highlights that institutional authority, media literacy, and public trust can mitigate the impact of disinformation. For example, New Zealand maintained low COVID-19 case and death numbers despite high search interest, attributable to effective public health communication, strong government credibility, and rapid platform interventions.

4. Theoretical Implications

The IDOM-H Framework synthesizes Akerlof's information asymmetry theory, Kahneman and Tversky's cognitive bias principles, and Sunstein's echo chamber hypothesis to provide a robust structure for analyzing misinformation propagation and its social consequences. This integrative framework allows researchers to move beyond anecdotal evidence, enabling the development of testable hypotheses concerning the mechanisms of digital disinformation and its societal impact.

5. Policy and Academic Value

The findings reinforce the need for coordinated strategies between governmental agencies and evidence-based public health communicators. Evidence suggests that fact-checking alone or post-virality takedowns are insufficient to curb misinformation, underscoring the importance of preemptive interventions that inoculate audiences against false content.

These insights should inform the design of social media platform policies, media literacy programs, and institutional crisis response protocols, thereby enhancing resilience to misinformation during future public health emergencies.

Policy Recommendations

Addressing harmful health disinformation requires coordinated legal, technical, and community interventions. A structured three-tier strategy is proposed, targeting key stakeholders across short-, medium-, and long-term horizons.

1. Short-Term (Crisis-Responsive)

Stakeholders: Social platforms, public health agencies, crisis response teams. (1) Implement disinformation monitoring dashboards using tools such as Google Trends, CrowdTangle, and NLP-based alert systems. (2) Publish verified explanatory content within 48 hours of viral dissemination, leveraging health influencers and coordinated campaigns. (3) Deploy “prebunking alerts” to inform users about emerging false narratives before they gain traction.

2. Medium-Term (Institutional and Educational)

Stakeholders: Ministries of education, digital rights NGOs, platform teams. (1) Integrate digital literacy programs into national curricula, emphasizing emotional content analysis, algorithmic awareness, and fact-checking skills. (2) Train community leaders — including teachers, health-care workers, and religious figures — to respond to online misinformation using clear, accessible language. (3) Enact legislation requiring platforms to disclose the mechanisms for ranking and displaying health-related content to users.

3. Long-Term (Resilience and Governance)

Stakeholders: International organizations, regulators, academic institutions. (1) Conduct independent audits of algorithmic ranking systems for health emergency content. (2) Establish Cross-Sector Disinformation Pacts to formalize partnerships between governments, platforms, universities, and civil society. (3) Utilize the Digital Trust Index to measure public trust and digital readiness, identifying gaps for strategic investment.

Disinformation is not merely a communications challenge; it has profound governance and public health implications. The IDOM-H Framework provides a practical tool to anticipate and mitigate the spread of false information within vulnerable networks, supporting evidence-based policy and intervention strategies.

Limitations

This study presents several limitations stemming from its interdisciplinary scope and the use of heterogeneous, cross-national data sources.

Causal Inference Constraints

The findings rely on observational, country-level data and are therefore limited in their ability to establish causality. While temporal and regression analyses demonstrate significant associations, they cannot exclude the possibility of confounding factors such as policy interventions, mobility restrictions, or media framing effects influencing the outcomes.

Inadequacy of Subnational Detail

National-level indicators obscure internal disparities between urban and rural populations. This limitation prevents the identification of localized outbreak dynamics or variations in disinformation exposure that might be shaped by offline networks, political attitudes, or socio-economic structures.

Application of Proxy Indicators

Disinformation exposure measures — such as Facebook engagement metrics and Google Trends indices — serve as proxies for public attention and content dissemination. However, they do not directly capture belief adoption or behavioral change. Similarly, trust and digital literacy were derived from secondary indicators rather than primary survey data, which limits the granularity and precision of interpretation.

Constrained Narrative Analysis

The content analysis component focused on engagement structure and frequency but did not employ natural language processing (NLP) or sentiment modeling to assess emotional and linguistic patterns driving virality. This restricts insights into the narrative and affective mechanisms underlying misinformation spread.

Future Research Directions

To advance understanding of disinformation's public health and social impacts, future studies should consider the following methodological and conceptual extensions:

1. Instrumental Variables and Causal Inference. Employ quasi-experimental designs — such as natural experiments, policy interventions, or internet outages — to estimate causal relationships. Applying Granger causality tests may further determine whether disinformation exposure precedes behavioral or epidemiological changes.

2. Longitudinal and Panel Data Approaches. Develop longitudinal datasets that trace disinformation surges, public responses, and policy interventions over time. These data would enable difference-in-differences (DiD) estimation and advanced time-series modeling, enhancing causal robustness and temporal resolution.

3. Mixed Methods Integration. Combine quantitative engagement metrics with qualitative instruments — such as surveys or interviews — to examine the development of beliefs, the role of trust, and the effectiveness of media literacy interventions in mitigating misinformation influence.

4. Applying IDOM-H to Other Crisis Domains. Extend the IDOM-H Framework to analyze disinformation in other critical contexts — such as climate change denial, electoral manipulation, and wartime propaganda — to evaluate its broader theoretical and practical applicability.

This study provides a foundational contribution to cross-disciplinary inquiry into the real-world effects of digital disinformation, establishing empirical and conceptual grounds for future work on the intersection of technology, behavior, and health communication.

CONCLUSION

This study applies the IDOM-H Framework to investigate the influence of digital disinformation — exemplified by the Plandemic documentary — on public health outcomes during the COVID-19 pandemic. Cross-national analysis

across five democratic nations reveals a moderate positive correlation ($r = 0.62-0.63$) between disinformation engagement and COVID-19 case and mortality rates, indicating a measurable detrimental effect on public compliance and health resilience.

The findings demonstrate that disinformation contributes to delayed increases in case numbers, underscoring the importance of monitoring behavioral and temporal effects rather than focusing solely on immediate epidemiological outcomes. Emotionally charged and visually framed content sustains engagement and virality, persisting across platforms despite moderation efforts. Conversely, countries exhibiting higher levels of digital literacy, institutional trust, and responsive governance display weaker correlations between misinformation exposure and health deterioration, highlighting the protective value of societal trust and education.

The IDOM-H Framework integrates behavioral science, information economics, and platform governance, advancing theoretical understanding of how misinformation is produced, amplified, and interpreted within digital ecosystems. This approach moves beyond the binary of “true versus false” information to emphasize structural and behavioral dynamics shaping public health communication.

Policy Implications:

Public health agencies must build digital resilience systems capable of detecting and countering disinformation before it escalates. Social platforms should reform engagement-driven algorithms and increase transparency in content ranking. Governments must enforce accountability standards, while education systems should embed critical digital literacy as a fundamental civic skill.

Disinformation constitutes a structural threat to global health rather than a mere communication challenge. Future crises will require early-warning systems, cross-sector collaboration, and adaptive interventions of the kind proposed within this study to safeguard both public trust and health integrity.

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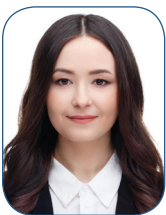
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Diagnosis of Bankruptcy as a Phased Process

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ABSTRACT

Corporate bankruptcy can be understood as a phase-based managerial process in which weak signals, together with the informational noise that obscures them, shape the trajectory of organizational degradation long before the actual collapse occurs. This conclusion emerges from shifting the focus of bankruptcy diagnostics away from traditional accounting and financial reporting toward institutional sensitivity. The concept of the phase dynamics of bankruptcy is synthesized from the phenomenology of the discrepancy between declared and actual practices, the assessment of feedback intensity, and the tonal analysis of a company's public communications. The **aim** of this study is to develop a phase model for the early diagnosis of bankruptcy and to determine the threshold of loss of reflexivity, which marks a point of no return for the managerial system. The empirical part of the study includes the reconstruction of pre-crisis bankruptcy profiles of Enron, Long-Term Capital Management, and Barings Bank. Based on qualitative and quantitative analysis of behavioral patterns and public communications using the authors' original indicators, it was established that a stable simultaneous exceedance of their threshold values is accompanied by the contraction of the "window of opportunity" for decision-makers and by an acceleration of escalation dynamics. The **findings** allow a shift in emphasis from reactive to proactive management, thereby reducing the likelihood of an avalanche-like transition to the irreversible phase of crisis.

Keywords: bankruptcy; weak signals; information noise; phase model; feedback; early warning

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"Decisions made without accounting for weak signals are a gamble against the future."

I. Ansoff (Managing Strategic Surprise by Response to Weak Signals, 1975)

INTRODUCTION

"We confuse the appearance of stability with its essence — and are surprised when it is not the weak but the seemingly strong that collapses," wrote Plato [1]. A similar idea is expressed by Nassim Nicholas Taleb: "It is not surprising that the fragile collapses; what is surprising is that what was considered unbreakable collapses," highlighting the unexpected failure of outwardly prosperous companies [2]. A number of scholarly studies suggest that bankruptcies occur not as a result of a single shock, but due to the prolonged accumulation of weak signals that remain unnoticed by stakeholders within the frameworks of prevailing control models [3–6].

Traditionally, the problem of bankruptcy has been examined within the framework of financial and legal diagnostics, based on retrospective analysis of indicators and the *ex post* (Latin: after the event) identification of insolvency. In the present study, however, bankruptcy is interpreted not as a financial collapse, but as a deficit state of the management system, manifested in the gradual loss by the organization of institutional sensitivity, as well as its capacity for adaptation and self-reflection [6, 7].

In this regard, classical insolvency criteria should be supplemented with relevant substantive characteristics [8, 9]:

1. Bankruptcy is not a sudden financial or legal incident, but a phase trajectory of the loss of top management's sensitivity to feedback, compensated by demonstrative masking rhetoric in which weak signals and informational noise function not as peripheral, but as system-forming elements of

organizational dynamics, while the number of available managerial options progressively decreases.

2. The path to bankruptcy begins at the moment when overconfident management, consciously or intuitively, engages in a strategic gamble — going “all in” by making decisions that amplify risk and amount to “betting against reality” [2]. A potential bankrupt entity operates according to an “*all-in*” logic, concentrating all available resources on the implementation of a single business scenario, the outcome of which may be either maximum profit or collapse [10]. Within this logic, the firm intensively expends scarce resources, hoping either to restore them by a certain control date or to extract gains before an audit reveals the discrepancy between declared prosperity and actual conditions, such that the benefits obtained will outweigh potential losses. In such situations, external observers and stakeholders are misled, mistaking a simulation of stability for its reality.

3. An actor on the trajectory toward bankruptcy loses the capacity “to be otherwise”: the leader becomes unable to “play a secondary role,” to recognize the limits of their own competence, or to acknowledge alternative viewpoints [7]. The organization loses its ability to respond to challenges and gradually forfeits financial stability [11]. In this article, bankruptcy is conceptualized as the crossing of a minimally acceptable threshold of managerial sensitivity, at which weak signals are lost within a stream of communicative redundancy, simulated success, and managerial overconfidence — collectively programming an inevitable systemic crisis [6, 7].

4. Weak signals are difficult to incorporate into standard risk registers and to capture in reporting systems. They exist at the boundary between controllability and probability [8] and are therefore often dismissed as informational noise [4].

5. The latter (pre-crisis signals) are of a semantic and behavioral nature [5]. Under conditions of cognitive bias, managers tend to overestimate the significance of emotionally salient events while simultaneously underestimating subtle indicators.

Only a limited number of studies focus on developing systemic methodologies for identifying and interpreting pre-crisis states concealed behind rhetoric of well-being. The principal challenge of early bankruptcy diagnostics lies in detecting weak signals within informational noise. Accordingly, there is a growing need for analytical approaches capable of statistically forecasting financial insolvency, complementing traditional reporting metrics [12–15].

The phase-based model of early bankruptcy diagnostics developed in this study aims, firstly, to refine the concepts of “weak signal” and “informational noise” and, secondly, to empirically validate the proposed phase model using the cases of Enron,¹ LTCM,² and Barings Bank.³

The key objectives of the study are as follows:

- 1) to provide a theoretical substantiation of the phase-based nature of bankruptcy and to develop a diagnostic model that includes the conceptualization of the deficit state, the classification of signal patterns of misalignment, and the formalization of weak signals and informational noise;
- 2) to carry out an empirical validation of the diagnostic model based on cases of corporate crises and to identify indicators of phase transitions.

The practical significance of the study lies in the potential application by the highest bodies of corporate governance of phase-based monitoring as an early warning tool, complementing risk management systems with behavioral and semantic indicators.

¹ Enron — the largest energy trading enterprise in the United States, which collapsed in 2001 due to schemes involving hidden debt and accounting manipulation, resulting in a high-profile bankruptcy and subsequent corporate governance reforms.

² LTCM (Long-Term Capital Management) — a hedge fund founded by Nobel laureates that collapsed in 1998 due to excessive leverage and market instability, requiring intervention by the Federal Reserve to prevent a systemic financial crisis

³ Barings Bank — the oldest British investment bank, which went bankrupt in 1995 as a result of fraudulent trading activities by trader Nick Leeson involving derivatives in Asian markets.

THEORETICAL FOUNDATIONS OF THE STUDY

The study is grounded in several theoretical frameworks: strategic management (weak signals, organizational resilience) [2, 8, 9]; organizational theory (institutional sensitivity) [3, 16, 17]; and behavioral economics (cognitive biases and heuristics of risk perception) [4, 15, 18]. A comparative method and qualitative analysis of open sources were employed to reconstruct the communication patterns underlying the bankruptcies of Enron, Long-Term Capital Management, and Barings Bank.

In the English-language management tradition, the term bankrupt implies not only financial collapse but also the loss of essential qualities or a “complete absence of a necessary attribute.”⁴ Accordingly, bankruptcy may be understood as the loss by an organization of a key element of resilience — its capacity for renewal and response to external challenges — when management ceases to perceive signals from both external and internal environments, ignoring facts that do not align with the chosen strategy [7]. This interpretation brings the concept of bankruptcy closer to the philosophy of alterity developed by Emmanuel Levinas: the system loses sensitivity not only to specific weak signals but to any form of “otherness” — that is, to everything that does not correspond to its self-image [19, 20]. These conclusions are consistent with studies on corporate tone and earnings manipulation, which demonstrate that excessive rhetorical optimism and managerial narcissism systematically reduce the transparency of reporting and the accuracy of weak signal perception [21, 22].

High-Reliability Theory points to the phenomenon of the illusion of stability: in companies with consistently favorable performance, errors may accumulate while being suppressed under the assumption that “everything is fine” [23]. Sustained success fosters complacency and a reluctance to recognize weak signals [6, 19]. As a result, a growing yet reversible gap emerges between declared

and actual conditions — referred to here as a delta state [8].

Historically, bankruptcy diagnostics has been shaped within a financial and legal paradigm in which insolvency is identified through retrospective indicators [6, 24], often overlooking the pre-crisis stages characterized by weak signals of degradation [8].

A phase-based perspective makes it possible to interpret bankruptcy not as a discrete event but as a process of the gradual loss of cognitive and managerial sensitivity by the organization [3, 8]. Within this framework, collapse represents the final stage of institutional degradation.

One of the paradoxical features of the pre-crisis state is not a decline but an intensification of external rhetorical and behavioral activity: the company amplifies communications about leadership and innovation against the backdrop of internal resource depletion [2, 5]. This phenomenon may be defined as rhetorical inversion — the substitution of actual degradation with a narrative of growth [25, 26].

In this study, the concept of “noise” is understood as intensive rhetoric (press releases, advertising campaigns, manifestos, awards and dividends, rankings) devoid of operational substance, employed to mask a deficit state and not reflecting the real dynamics of the organization’s resources [3]. Such noise creates a secondary layer of governance in which the image-driven agenda replaces the actual coordination of processes: the system loses its capacity to “see” its own failures and continues to transmit “signals of strength” despite declining effectiveness [6, 26]. Building on the concept of “noise” developed by Claude Shannon, informational (or model) noise may be defined as a form of signal distortion arising when empirical sensitivity is replaced by a constructed one. This refers to aberrations in managerial perception generated by the system itself, whereby a legitimized belief in the correctness of the model obstructs the perception of reality [24]. As a result, a gap emerges between rhetoric and action — a characteristic symptom of an impending crisis [6].

⁴ Merriam-Webster Dictionary.

RESEARCH METHODOLOGY

Research Design

The study was conducted within a mixed-methods framework, combining: (a) *qualitative analysis* of weak signals in the pre-bankruptcy phase through the examination of discourse, corporate communications, and behavioral patterns; and (b) *quantitative interpretation* of semantic and behavioral deviations using four original indicators: the HR-Index, Tone Gap, NII, and the S-Index. To systematize the observed signals and relate them to typical forms of informational noise, the case study method was employed.

To clarify the logic of the study, it is necessary to distinguish between the terms “weak signal” and “risk”: the former can be observed, interpreted, and responded to managerially, whereas the latter belongs to the domain of probability and represents a hypothetical event. Working with weak signals enhances the organization’s anticipatory capabilities, logically complementing existing risk management systems.

Identification of the Sources of Weak Signals: external channels (market dynamics, regulatory influences, public communications); internal channels (reports, personnel changes, managerial decisions).

Classification of Signals by Content: market-related (price fluctuations, changes in demand, market positioning); operational (disruptions in production or service processes); behavioral (changes in managerial culture and communication patterns); regulatory (compliance with or deviation from regulatory requirements and standards).

Data Sources and Selection Criteria

The study draws on annual and quarterly public reports of companies, as well as materials from auditors and regulators, press releases, and corporate blogs. The analysis covers the period from 1 to 24 months prior to the moment of legal bankruptcy. Primary unstructured data used for case reconstruction, along with supplementary sources, are available in the study’s electronic archive at: [https://docs.](https://docs.google.com/document/d/1YC1VG2aQ7Wd6Xs_IkloFjkX0Ks2UQrOwZBIwf_9k10Y/edit?tab=t.0)

[google.com/document/d/1YC1VG2aQ7Wd6Xs_IkloFjkX0Ks2UQrOwZBIwf_9k10Y/edit?tab=t.0](https://docs.google.com/document/d/1YC1VG2aQ7Wd6Xs_IkloFjkX0Ks2UQrOwZBIwf_9k10Y/edit?tab=t.0).

Case Selection Criteria. The sample includes three canonical cases of corporate collapse — Enron, Long-Term Capital Management, and Barings Bank — which meet the criteria of (i) a *sufficient volume* of documented communications and public reporting prior to bankruptcy, and (ii) the *identifiability* of weak signals observable in both public and internal media environments.

Limitations of the Concept. The concept of management based on weak signals cannot be effectively applied to cases of deliberate fraud, where collapse results from intentional unlawful actions (“bankruptcy for profit” [24]); to cases with an insufficient documentary base for phase reconstruction; or to situations dominated by a single exogenous shock without pre-crisis dynamics (*force majeure*).

The study is retrospective in nature and is subject to historical bias, as the volume and quality of sources vary across cases. Cross-industry differences limit comparability, and threshold values are heuristic. The empirical analysis may also be affected by overlapping external shocks (regulatory, market, macroeconomic). In addition, linguistic and genre-specific features of sources may influence tone and density metrics.

Procedure for Matching Signals and Noise

The methodology is based on a phase-oriented approach to the analysis of pre-bankruptcy states and comprises four steps:

1. Identification of signal phases — for each case, a retrospective sequence of transitions from the early delta state to collapse is established.
2. Classification of weak signals — signals are categorized into four types: market-related [3, 4], operational [7, 8, 23], behavioral [5, 21], and regulatory [3, 14, 16, 22].
3. Mapping of “noise” forms — signals are matched with masking mechanisms, including rhetorical [3, 4, 6], model-based [4, 24, 26], cult-like [21, 26], and PR-driven expansion [2, 4, 15, 26].
4. Cross-phase and cross-case comparison — a signal profile is constructed for each organization,

identifying the phase and the intensity of noise at which managerial sensitivity is lost.

Synthesis of Bankruptcy Phases

The phase-based model of bankruptcy, grounded in the analysis of weak signals, is developed as a methodological bridge that connects the gap between the actual emergence of problems and their recognition. If the onset of crisis is understood as the organization's loss of sensitivity to its own dysfunctions, then the central managerial task becomes their early detection, enabling either normalization of the situation or mitigation of negative consequences. The pre-crisis period may last for months or even years, encompassing four successive informational phases:

Ph1 — Loss of sensitivity (weakening of feedback, emergence of initial weak signals);

Ph2 — Rhetorical compensation (thematic imbalance, tonal overheating, rituals of recognition);

Ph3 — Structural rupture (growing “promise–reality” delta, operational disruptions);

Ph4 — Legal recognition of insolvency.

Formalization: Signals and Noise

Weak signals manifest in behavioral patterns, communication disruptions, and managerial decisions, often embedded in indirect and barely perceptible information: a critical customer review, the departure of a key employee, unusual managerial rhetoric, or episodic evidence of internal organizational tension. These signals are difficult to detect against a background of strategic “bravado,” which can easily be mistaken for indicators of success [4, 14, 15]. Many companies that eventually went bankrupt displayed outward signs of prosperity prior to collapse — market leadership, high ratings, and public approval [3, 9]. The strategy of “fake it till you make it” may, under conditions of simulated success, transform into “fake it till you break it”, ultimately leading to systemic failure.

In accordance with the concept of strategic sensitivity proposed by Igor Ansoff, two types of weak signals can be distinguished [9]:

(a) Input signals — impulses received by the system from the external environment. These indicate potential changes in demand, technology,

regulation, or competitive structure. They manifest through the monitoring of micro-shifts in customer behavior, competitor positioning, regulatory dynamics, as well as tonal changes in the media. Input signals are typically primary in Ph1 (the delta state); their neglect contributes to the transition to Ph2 (noise-based compensation).

(b) Output signals — signals generated and transmitted by the organization itself. These are interpreted by external stakeholders as indicators of its condition. They can be formalized through the observation of personnel and financial micro-shifts and their public representation (e.g., the departure of key specialists, extended settlement periods, an atypical surge in press releases in the absence of substantive developments). Output signals intensify in Ph2, while in Ph3 they no longer enter feedback loops, reflecting a loss of reflexivity.

Within sensemaking theory as developed by Karl Weick, an organization does not merely respond to environmental signals but actively constructs elements of that environment through its interpretations and actions [3, 12]. From a cognitive perspective, Daniel Kahneman and Nate Silver point to a “feedback loop” effect, whereby an organization, by generating signals, alters the environment, which in turn produces new signals that amplify or distort the original impulse [4, 5].

The signal paradox lies in the fact that, as bankruptcy approaches, public rhetoric becomes increasingly optimistic and demonstrative: rather than declining, informational activity intensifies — companies expand communications about success, masking warning signals and refusing to acknowledge problems [15, 22]. Comparative case analysis confirms this pattern: peaks in external media activity tend to coincide with phases of operational stagnation or the onset of decline [12, 14].

Systemic Limitations of Traditional Bankruptcy Diagnostic Models

Widely used bankruptcy risk assessment models — such as the Altman Z-score,⁵ Moody's KMV

⁵ Z-score — a discriminant model developed by Edward Altman (1968) that estimates the probability of corporate bankruptcy based on financial ratios.

model,⁶ and rating methodologies of S&P Global⁷ — exhibit several limitations that prevent the full realization of early warning system potential. These limitations have a dual nature: some stem from the retrospective character of financial analysis, while others arise from cognitive and organizational processes.

Ex post nature of data. These models rely on official reporting that captures events only after they have occurred and thus signal problems primarily at the final stage (Ph4), when the situation is already irreversible. They are unable to detect earlier phases (Ph1, Ph2) [5, 7]. Even when highly accurate, financial statements often fail to reflect latent processes of degradation and merely record the past [6]; the accumulation of concealed

⁶ Moody's KMV (named after its developers — Stephen Kealhofer, John McQuown, Oldřich Vasicek) — a credit risk assessment model (Kealhofer–McQuown–Vasicek) based on the market value of a firm's assets and its probability of default.

⁷ Standard & Poor's (S&P) — a rating system developed by the international agency, based on the assessment of default probability.

negative information alongside optimistic rhetoric increases the risk of sudden crises [22].

Neglect of the semantic and behavioral context. Early indicators of insolvency that are non-financial in nature remain outside the scope of these models: the character of corporate communications, the tone of managerial discourse, turnover among key personnel, the degradation of internal feedback mechanisms, and the simulation of innovative activity [4, 6, 8].

The “institutional icon” effect. A high credit rating or the status of a “market leader” generates a priori trust among regulators and investors. This creates a blind spot in which warning signals are dismissed as statistical noise or temporary difficulties faced by an entity perceived as “too big to fail.” Oversight systems become less sensitive precisely where risk is assumed to be minimal [2, 3, 15].

Coherence heuristic and cognitive biases. Actors operating under a belief in their own infallibility tend to subconsciously reject information that

Table 1

Phase Model of Pre-Crisis Organizational Development

Phase Attribute	Ph1. Noise / Early Delta-Condition)	Ph2. Signal / Noise Compensation	Ph3. Indicator / Loss of Reflexivity	Ph4. Crisis / Accelerated Collapse
Signal	Chaotic, statistically imperceptible deviations in indicators and narratives, attributed to seasonality or randomness	Persistent deviations indicating structural malfunction	Accumulation of degradation; increased frequency of negative events	Sharp increase in amplitude and frequency of negative indicators; cascade of legal and financial triggers
Noise	Background information flows	Increasing PR activity: declarations of “breakthroughs,” intensification of media agenda; rhetorical compensation	Narrowing of feedback channels; institutional deafness; rhetoric of “success” ignores operational realities	Image-making practices lose relevance; formal declaration of bankruptcy occurs
Consequences	Deviations are still reversible	The window of opportunity remains open but is narrowing; noise blocks signal recognition and pushes the system toward Ph3	Communications accelerate irreversible processes and increase noise without addressing root causes	Event dynamics become avalanche-like; external communications act as a catalyst of final collapse
Operational status of phases	Observability (Ph1)	Intervention (Ph2)	Partial irreversibility (Ph3)	Liquidation decisions (Ph4)
Interpretation	Monitoring and verification of alternative explanations for identified signals	Elimination of root causes (processes, structure, resources) rather than escalation of PR activity	Loss of feedback; PR measures are acceptable only as accompaniment to deep restructuring	Liquidation procedures; external rhetoric is minimal

Source: compiled by authors.

contradicts their established worldview [3]. Weak signals that do not fit the dominant narrative of success are dismissed as insignificant anomalies. In organizations with a long history of success, complacency tends to develop [6, 23].

Organizational defensive routines. Corporate cultures may develop mechanisms that protect the status quo and collective identity from uncomfortable truths (e.g., punishment for “bad news”) [12]. As a result, weak signals are not merely ignored but are actively suppressed at the institutional level.

“All-in” strategy and rational neglect. A crisis-stricken company may consciously bet on the possibility that the market will collapse before it does, or that the regulatory environment will change [13]. Under such conditions, acknowledging weak signals becomes counterproductive, as it interferes with a high-risk “survival game”: management, operating on an “all-in” principle, has a rational incentive to ignore early warning signs of collapse.

Both types of limitations reinforce one another. Financial models fail to capture intangible indicators, while cognitive biases prevent managers from correctly interpreting available data. This underscores the need for an additional diagnostic framework integrating both quantitative and qualitative parameters.

Indicators and Metrics

For the purposes of this study, the authors introduce a set of indices:

The HR Turbulence Index (HR-Index) is a normalized measure of turnover among key personnel: a weighted ratio of departures/rotations in critical roles to average headcount, with monthly smoothing applied.

The Rhetorical Tone Gap (Tone Gap) refers to the discrepancy between the tone of external communications and operational dynamics. It is calculated as a differential (or ratio) between the positivity of rhetoric and the actual changes in KPIs/risks over comparable periods.

The Noise Inflation Index (NII) measures the excessiveness of external communications across three dimensions: intensity (frequency of messages over a given period), scale (amplification strength, i.e., media mentions), and reach (breadth of audience and communication channels). The index assesses the extent to which communicative activity outpaces actual operational dynamics.

The Signal Index (S-Index) is an aggregated metric of the semantic sensitivity of managerial discourse, measuring the density of predicative deviations between normative and reporting vocabularies across five types of transformation: reduction, inversion, cyclicity, level shift, and substitution.

Based on these indicators, a coding scheme is constructed that enables the mapping of weak signals to archetypes of masking noise – stable forms of informational distortion that conceal weak signals beneath an appearance of normality.

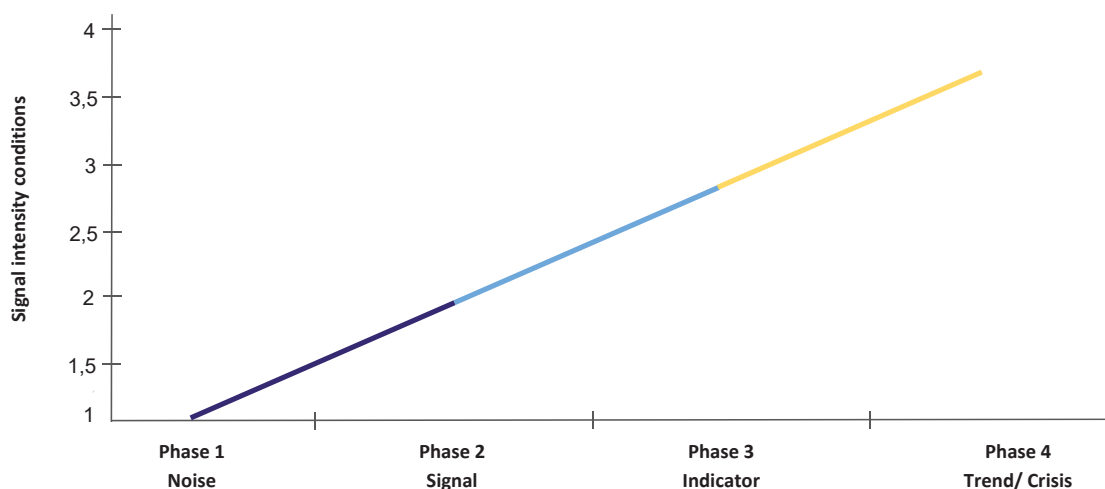


Fig. 1. Escalation of a Weak Signal within the Information Flow of a Pre-Bankruptcy State

Source: compiled by authors.

Phase Model

Within the framework of the phase model, the organization’s transition from local deviations to bankruptcy is conceptualized as a four-stage process. The characteristics of these stages are systematized in *Table 1*.

The data in *Table 1* allow for the following conclusion to be made: the greatest effect of managerial interventions is achieved prior to the transition from Ph2 to Ph3; beyond this point, the endogenous rate of deterioration increases, thereby narrowing the space for decision-making.

RESEARCH RESULTS: PHASE PROFILES OF BANKRUPTCIES

The analysis of the Enron, LTCM, and Barings cases confirms the applicability of the phase model (“noise → signal → indicator/trend → crisis”) and its diagnostic value for the early detection of failure trajectories. The focus is on the pre-crisis interval, which contains a window of opportunity for managerial action.

The comparative case analysis reveals a stable sequence of pre-crisis dynamics: personnel turbulence (increase in the HR Index); divergence between positive rhetoric and operational facts (widening of the Tone Gap); and inflation of PR activity relative to actual events (increase in the NII). The

joint exceeding of these thresholds marks entry into Ph3, when weak signals are no longer absorbed by noise and become consolidated as an indicative trend. This moment can be defined as a “point of no return,” where further expansion of communications without structural correction accelerates the transition to Ph4 [13, 15, 22]. Consequently, the HR Index, Tone Gap, and NII constitute a sufficient monitoring framework for pre-crisis conditions and provide a key to diagnosing the managerial window of opportunity between Ph2 and Ph3.

Diagnostic Dimensions: Phase Dynamics and the “Phase × Noise Archetype” Matrix

When examining the indicators and, subsequently, the integrated picture of escalation, it is necessary to analyze phase dynamics — i.e., the rate and sequence of transitions between system states — in conjunction with the “phase × noise archetype” matrix, which captures the distribution of masking practices that shape these transitions.

Figure 1 illustrates how the system moves from background fluctuations (Ph1) to persistent deviations (Ph2), then to an indicator-based trend (Ph3), and finally to crisis dynamics (Ph4). The critical interval is the Ph2 → Ph3 transition, where the signal-to-noise ratio becomes sufficient for reliable diagnosis while the consequences remain reversible.

Phase/ Archetyp	Rhetorical compensation	Model M=Noise	Cult of Personality	PR Expansion	Digital Mist
Phase 1 Noise	0,125	0,200	0,000	0,000	0,000
Phase 2 Signal	1,000	1,000	0,000	1,000	0,857
Phase 3 Indicator	0,625	0,800	1,000	0,714	1,000
Phase 4 Trend/ Crisis	0,000	0,000	0,222	0,143	0,143

Fig. 2. “Phase×Noise Archetype” Matrix

Source: compiled by authors.

Table 2

Phase Reconstruction of Bankruptcy in the Examined Cases

Parameter	Enron	LTCM	Barings Bank
Type of signal	Market-based	Market-based	Behavioral
Form of noise	Rhetorical compensation (inversion)	Model-based (intellectual) noise; overreliance on strategy	Cult of personality ("trading genius," institutional status of the bank)
Duration of Ph2–Ph3	~18 months	~1–2 months (minimal; effectively a direct Ph1 → Ph4 trajectory)	~12 months
Key delta (delta-state)	Gap between innovation narrative and degradation of the operational model	Gap between model logic and real market volatility	Trust in an individual despite warning indicators
Behavioral deviation	External expansion amid internal signs of crisis; aggressive public discourse until collapse	Analytical euphoria and model faith suppressed institutional sensitivity	Institutional blindness and refusal of control; organizational self-deception
Weak signal	Derived from predicative deviations in strategic and reporting texts prior to collapse	Market instability linked to the emerging markets crisis	Behavioral anomalies related to trading positions and accumulated hidden losses
Noise	Highly intensive but low-informational or misleading public communications	Dominance of model-driven rhetoric ("intellectual leadership") and overconfidence in formalized models	Internal organizational mythology: cult of the trader's personality, belief in "genius" and in the bank's legacy; masking of warning indicators
Outcome	Rapid bankruptcy (2001), criminal proceedings, loss of investor confidence	Fund collapse (1998), emergency Federal Reserve intervention, reputational damage	Losses of \$ 1.3 billion, bank collapse (1995), sale to ING for £1

Source: compiled by authors.

The data in Fig. 1 are presented as a model sequence representing the phased escalation of a weak signal in pre-bankruptcy development. The colored segments reflect shifts in the quality of perception: purple (Ph1 → Ph2) indicates the transition from noise to signal; blue (Ph2 → Ph3) represents the conversion of a signal into a statistically stable indicator; and yellow (Ph3 → Ph4) denotes the transformation of the indicator into a trend and an irreversible crisis trajectory. Signal intensity is a normalized variable (scale 1–4) aggregating the frequency and amplitude of indicators within each phase. The graph clearly demonstrates that weak signals are not static; rather, they evolve across phases, progressively accumulating intensity and reshaping the organization's managerial sensitivity contour.

Figure 2 presents the topography of noise archetypes. At the stage of false stability (Ph2), rhetorical compensation and PR expansion dom-

inate, whereas at the stage of loss of feedback (Ph3), informational (model) noise and the "cult of personality" become more pronounced.

For comparability, the data are based on normalized expert assessments of the manifestation of noise archetypes across the phases of the crisis process. For each phase, the intensity of each archetype was measured on a scale from 0 to 1. The values in the matrix cells reflect the normalized intensity of the corresponding noise archetype in corporate communications, calculated as the ratio of the number of observed markers in each phase of the signal cycle to the maximum value of that archetype within the case. Threshold levels are defined using a tercile-based interpretation: 0–0.33 indicates low intensity, 0.34–0.66 medium intensity, and 0.67–1.00 high intensity. The purpose of the matrix is to demonstrate how different forms of informational noise accumulate and dominate at different stages of

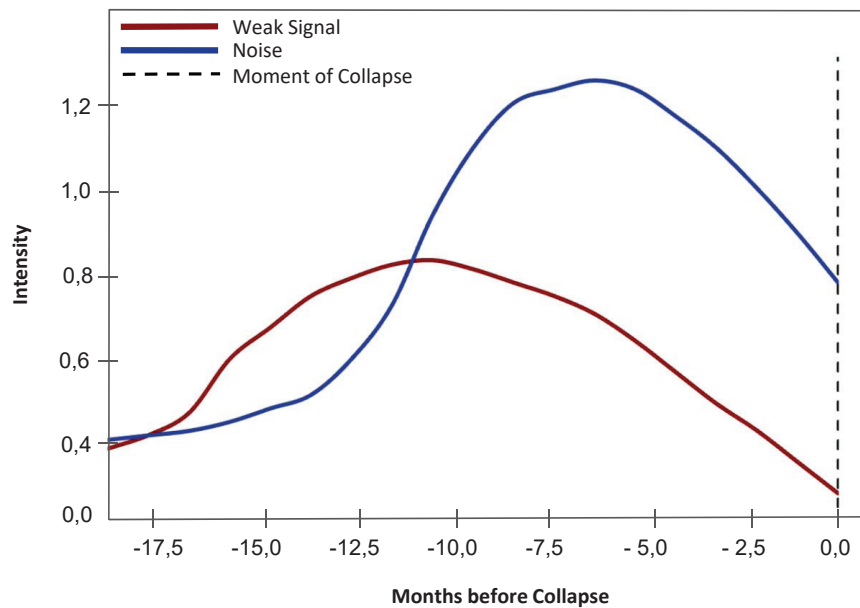


Fig. 3. Signal-Noise Profile of Enron in Pre-bankruptcy Development (1999–2001)

Source: compiled by authors.

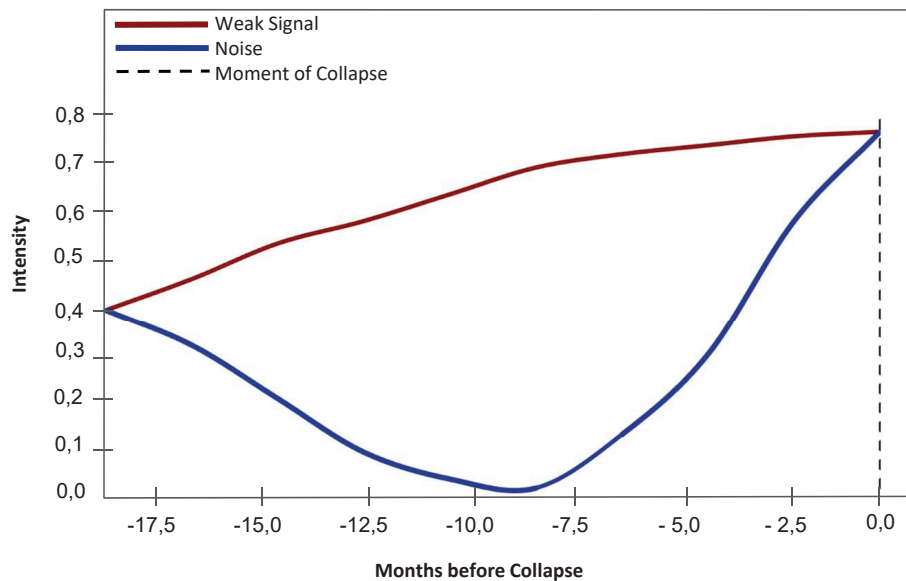


Fig. 4. Signal-Noise Profile of LTCM: Contraction of the Pre-Crisis Window (1997–1998)

Source: compiled by authors.

organizational degradation, thereby masking weak signals.

The combination of the phase curve (Fig. 1) and the noise matrix forms a diagnostic surface that enables the localization of the moment of system-state transition and the identification of the masking practices that facilitate it.

Case Comparison: Signal and Noise Dynamics

The comparison of normalized series across cases reveals a stable sequence: an increase in

the HR Index typically precedes or coincides with a widening of the Tone Gap, followed by a rise in the NII. This sequence forms a corridor of decreasing reflexivity along which the system accelerates toward the phase of loss of feedback (Table 2).

Enron: Market Signal and Rhetorical Inversion

In the 18 months preceding the collapse, a high rate of rhetorical expansion was sustained: weekly press releases highlighting “innovation,”

intensive engagement with analysts, and the amplification of a positive media environment. Outgoing market signals (spreads between derivative prices and physical delivery, cash flow gaps) were systematically ignored. The transition into Ph3 was accompanied by a complete loss of feedback mechanisms, which accelerated the collapse (*Figure 3*).

In *Figure 3*, the red line representing the weak signal (S-index) initially remains at a low level and then gradually increases. Approximately 18 months prior to the company's collapse, it is overtaken by noise (NII), represented by the blue line. At the intersection point, noise exceeds the signal, marking the Ph2 → Ph3 threshold, after which the company loses sensitivity to feedback. Until the moment of bankruptcy, noise continues to intensify while the weak signal declines.

The X-axis represents time in months to collapse ($t = 0$); the vertical dashed line indicates the official declaration of Enron's bankruptcy in December 2001.

This case demonstrates that prolonged false stability was accompanied by rhetorical expansion and growing PR activity, alongside the deterioration of cash flows and personnel stability. The point of

intersection between the curves (*Fig. 3*) represents a point of no return, after which large-scale communication efforts paradoxically accelerated the collapse, which materialized in December 2001.

LTCM (Market Signal / Model-Based Noise)

The LTCM case reflects a direct transition from Ph1 to Ph4: model-based noise displaced signals of instability in emerging markets, leading to a rapid devaluation of portfolio value and necessitating emergency intervention by the U.S. Federal Reserve [26]. A dynamic visualization of LTCM's collapse trajectory is presented in *Fig. 4*.

The LTCM profile demonstrates a very short false-stability phase — less than two months. The weak signal (market instability) remains near zero for most of the period and begins to rise sharply only 6–7 months prior to bankruptcy. Noise is initially high and consistently dominates the signal throughout the entire trajectory.

Noise remains above the signal until $t = 0$ — the moment of the fund's collapse and the emergency intervention of the U.S. Federal Reserve in September 1998, represented on the graph by a dashed vertical line.

LTCM represents an extreme case of intellectual noise: dogmatic confidence in the universality

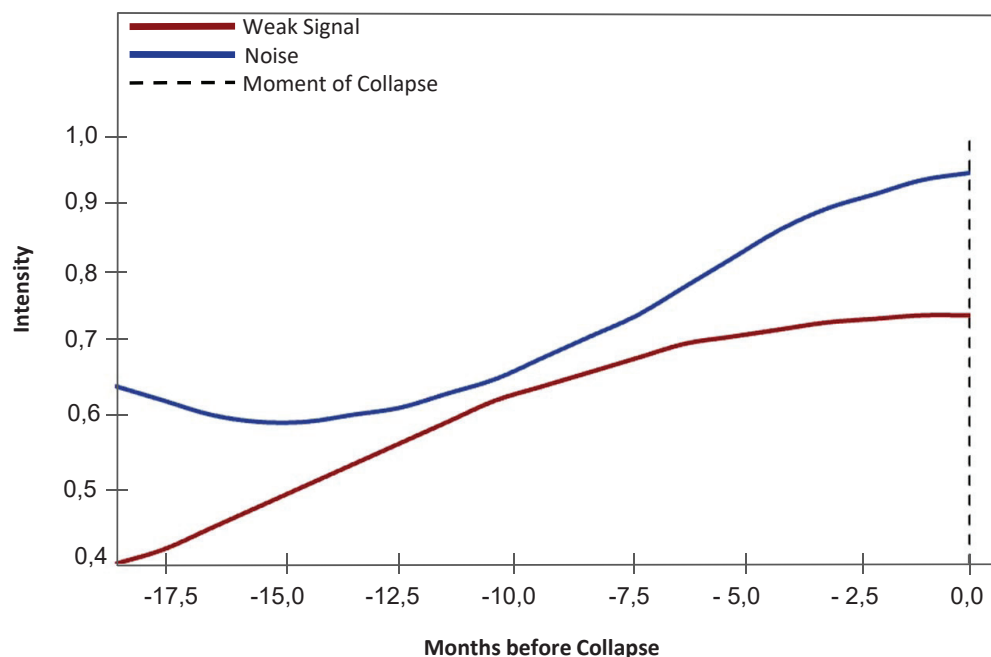


Fig. 5. Signal-Noise Profile of Barings Bank: Cult of Personality and Loss of Control (1994–1995)

Source: compiled by authors.

of a mathematical “risk-free arbitrage” model led to the suppression of weak market signals.

Barings Bank (Behavioral Signal / Cult-of-Personality Noise)

This case is characterized by the dominance of an internal behavioral signal – abnormal positions in Japanese Nikkei 225 futures markets – and a “cult of personality” (the absolutization of the authority of the “trading genius” Nick Leeson), which disabled control mechanisms. The Ph3 stage lasted approximately one year, after which collapse followed. The dynamics of declining managerial sensitivity are reflected in the signal and noise curves (Fig. 5).

The Barings Bank profile is characterized by the dominance of internal noise over a weak signal, which gradually increases over approximately 12 months prior to collapse. Noise remains at a high level from the beginning of the period and increases slightly toward its end. The crisis materializes under conditions of dominant noise: the signal approaches it closely but does not manage to exceed it. The dashed vertical line ($t = 0$) corresponds to the moment of disclosure of losses amounting to £827 million in February 1995, after which Barings Bank collapsed. The X-axis represents time in months prior to the collapse.

The Barings Bank case demonstrates how internal mythology can block institutional feedback mechanisms. Despite the growth of behavioral signals (abnormal trading positions), these were interpreted as confirmation of exceptional performance rather than as a threat. This phenomenon of the “cult of personality” aligns with findings on the tendency of narcissistic leaders to manipulate profit indicators and suppress weak signals [21].

Typology of Signal–Noise Interaction Archetypes

The analysis of the cases shows that weak signals and the informational noise masking them do not merely evolve independently but form stable archetypal interaction trajectories reflecting the degree of managerial sensitivity of the system. Despite institutional differences, the evolution of pre-crisis states converges into three fundamental types of signal–noise behav-

ior: convergence, direct divergence, and inverse divergence.

1. Convergence (signal–noise convergence)

Convergence refers to situations in which a weak signal gradually gains statistical stability and approaches the level of noise, which remains persistently high. This behavior reflects a critical loss of feedback: the system still retains the potential for managerial intervention, but the signal is no longer suppressed by rhetorical compensation. The Barings Bank case exemplifies this pattern: the behavioral signal reaches visibility only at the moment when cult-driven noise already dominates. The system recognizes the signal too late.

2. Direct divergence (noise outpacing signal)

Direct divergence describes cases in which the growth of communication activity and narratives of success outpace the emergence of warning indicators. External stability increases while internal dynamics deteriorate. The Enron case illustrates this pattern: the NII consistently exceeds the S-index 12–18 months before collapse, producing a prolonged phase of false stability.

3. Inverse divergence (signal outpacing noise, but too late)

Inverse divergence occurs when the signal briefly breaks through the noise barrier and becomes visible; however, the phase transition is so rapid that the system cannot respond in time. The LTCM case is typical: formal divergence is minimal, and the signal emerges abruptly against a background of dominant model-based noise, leading to a direct Ph1 → Ph4 transition.

Each archetype generates a specific “noise dome,” which either suppresses signals (direct divergence), delays their visibility (convergence), or entirely blocks feedback until systemic collapse (inverse divergence).

CONCLUSION

The conducted study confirms that corporate bankruptcy is a phase-based process of progressive loss of managerial sensitivity, in which the trajectory of degradation is determined by the in-

teraction between weak signals and the informational noise that masks them. In the cases examined, the latter is characterized by a stable “wishful thinking” pattern [25]. Informational oversaturation during the pre-crisis phase reduces the visibility of real problems: the louder the rhetoric becomes, the less distinguishable weak signals are. This finding highlights the central premise of the study: the problem is not the absence of signals, but failures in their interpretation.

Empirical validation of the framework using the Enron, LTCM, and Barings cases demonstrates the recurrence of the Ph2 → Ph3 threshold as a point of feedback loss: beyond this transition, communication measures cease to perform a corrective function and instead accelerate escalation, whereas prior to it, a managerial window for effective intervention remains available.

The objective set by the authors has been achieved: bankruptcy has been formalized as a multi-stage trajectory of institutional degradation; signal patterns have been typologized

and mapped to informational noise archetypes; and an indicator framework has been developed that enables quantitative identification of the phase of sensitivity loss. Reconstruction of signal–noise profiles has allowed the localization of the “point of no return” precisely at the Ph2 → Ph3 transition, confirming the universality of this threshold [15, 22].

The practical implication is the necessity of monitoring the growth of weak signals and noise and initiating crisis intervention prior to the Ph2 → Ph3 transition. The authors propose incorporating the S-index and NII into board-level monitoring systems and calibrating covenants based on the simultaneous growth of all indicators over multiple monitoring periods. The use of these indicators transforms early diagnosis into a structured managerial procedure with defined activation conditions and establishes a framework for anticipatory governance, thereby reducing the likelihood of an avalanche-like transition into the final crisis phase.

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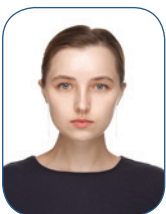


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About the International Scientific and Practical Conference “Asset Management – 2025: Artificial Intelligence in Economic Decision-Making: Assets, Actors, Strategies”

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ABSTRACT

The article provides an overview of academic events and professional discussions held within the framework of the annual international scientific and practical conference “Asset Management”, which took place in December 2025 at MGIMO University (Russia). **The relevance** of the conference topic – “Artificial intelligence in economic decision-making: assets, actors, strategies” – is due to the modern exponential growth in the introduction of artificial intelligence (AI) technologies in all areas of the economy, corporate governance and public administration, and human life, which is confirmed by the results of reports and forecasts by international consulting companies, as well as the conclusions of Russian experts. In this regard, **the purpose** of the conference, which brought together more than 350 participants from our country – students of classical, economic, technical, and law universities in Moscow, St. Petersburg, Tula, Saratov, Novosibirsk, Ufa, and other Russian cities.; employees of scientific institutes, state corporations and private companies, as well as foreign researchers from the Czech Republic, China, Kazakhstan, Uzbekistan, Kyrgyzstan, and Azerbaijan, representing different generations and professions, have formed an active scientific platform for exchanging opinions and developing new knowledge on current trends, advantages, risks, and limitations associated with AI. Within the framework of the plenary session, practical professional discussion and six sections of the conference, the results of research carried out using **methods** of economic and mathematical modeling, systematic, critical historical and causal analysis, scenario approach and forecasting were presented. The participants’ reports reviewed **the results** of modeling economic and managerial decisions obtained using sovereign AI models both during the implementation of national economic development strategies by the state actor, and in the process of a comprehensive assessment of the sensitivity of various sectors of the economy to the introduction of AI, identifying key prospects for the formation of companies’ competitive advantages in the face of a sharp increase in the introduction of AI technologies and new requirements towards professional competencies in the labor market. Special attention at the conference was paid to updating the AI legal regulation.

Keywords: asset management; artificial intelligence; scientific discussion; management decisions; modeling; forecasting; human-centered management; AI agent

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INTRODUCTION

On December 9, 2025, the fifth anniversary annual conference “Asset Management” was held at Moscow State Institute of International Relations of the Ministry of Foreign Affairs of the Russian Federation (MGIMO University). Each year, the organizers — the Asset Management Department at MGIMO University and its strategic partner, REGION Group — select the most relevant topic for academic discussion and professional debate.¹

In the recent past (2023), conference participants actively examined business models and their transformation under the influence of the digital transformation of the economy and the rapidly changing business environment amid sanctions pressure. In 2024, discussions focused on issues of digital culture. Despite the ambiguity inherent in the simultaneous consideration of economics and culture, the conference provided an opportunity to address professional ethics, behavioral models, and the competencies of modern specialists using digital tools and technologies required for conducting business and functioning effectively in contemporary society.

In 2025, within the framework of the conference theme “Artificial Intelligence in Economic Decision Making: Assets, Actors, and Strategies”, particular attention was devoted to the dominant global trend — artificial intelligence (AI) technologies. Their unprecedented diffusion across virtually all spheres of the economy, corporate and public administration, and everyday life is reflected in numerous statistical indicators:

- According to available data [1], the volume of venture capital investment in 2024 increased by 92% compared with 2023.

- Analysts at CB Insights² note that AI technologies accounted for 37% of total venture financing

in 2024, while 74% of AI-related deals were concluded at early stages of project development.

- PwC³ forecasts that AI technologies will become more responsible and sustainability-oriented, thereby increasing their value. Most companies are expected to adopt strategies involving the integration of AI agents into individual business processes and the expansion of AI’s role in organizational activities. Demand in the labor market is also expected to grow for versatile AI specialists capable of handling a broad range of tasks, including the supervision of AI agents.

- According to McKinsey & Company,⁴ 90% of companies regularly use AI in at least one business function. AI agents have become most widespread in the technology sector, media, telecommunications, and healthcare. Approximately 39% of companies report a contribution of AI to EBIT (earnings before interest and taxes), while 20% indicate workforce reductions of around 3%.

- The annual technology trends report by Deloitte⁵ highlights that AI reaches approximately 10% of the world’s population on a weekly basis and notes the rapid growth in expenditures on AI computing, as the expansion of usage outpaces reductions in costs. The report also identifies emerging directions such as the application of AI in cybersecurity and the protection of AI systems themselves. Organizations are therefore expected to develop AI security systems across four domains: data, models, applications, and infrastructure. AI tools may also be employed to combat cybersecurity threats.

- Rostelecom, in its annual review of global digitalization trends for 2025,⁶ identified AI as a major trend across three areas: scientific pub-

¹ MGIMO University (official website). Asset Management Department. Conference “Asset Management”. URL: <https://mgimo.ru/study/faculty/meo/kua/docs/asset-management-conf/>

² Smart Ranking. Results of 2024 in the AI Market. 2025. URL: <https://smartranking.ru/researchshop/ai/kak-menyalsya-rossijskij-rynok-ii-produktov-v-2024-godu>

³ AI Business Predictions. PWC 2025. ICT.Moscow. 2025. URL: <https://ict.moscow/analytics/2026-ai-business-predictions/?yclid=ml44feeojf44705340>

⁴ The State of AI in 2025. McKinsey. ICT.Moscow. 2025. URL: <https://ict.moscow/projects/ai/research/the-state-of-ai-in-2025/?yclid=ml44ia7ltm572072166>

⁵ Tech Trends 2026. Deloitte. 2025. URL: https://trendsunplugged.io/wp-content/uploads/2025/12/DI_Tech-trends-2026.pdf

⁶ Rostelecom. Monitoring of Global Digitalization Trends. 2025. URL: https://www.company.rt.ru/projects/digital_trends

lications, patent activity, and news coverage.

- The Russian consulting company, Technologies of Trust,⁷ found, through a survey of medium-sized and large Russian businesses, that 86% of Russian companies are implementing AI tools, with the figure reaching 92% among large enterprises. Approximately 28% of companies allocate between 1% and 3% of their total investment budgets to AI projects. The primary areas of AI application include customer service (46%), logistics (23%), and financial management (15%).

- Experts from Yakov and Partners and Yandex, assessing the current state and digital maturity of AI technologies in Russia,⁸ concluded that approximately 78% of companies currently use ready-made AI solutions with customization capabilities. By 2030, the economic impact of AI implementation — particularly generative AI — could reach 5.5% of Russia's GDP. The leading sectors are expected to include digitally oriented industries such as e-commerce, telecommunications and media, IT, construction and real estate, and healthcare. Overall, the level of AI development and implementation in Russia is assessed as “above the global average” and comparable to that of leading countries such as United States and China.

- The ICT.Moscow project⁹ notes that 43% of Russian AI technology development is driven by ecosystem-based corporations such as Sber, MTS, Yandex, T-Technologies, and VK. Around 20% of new AI solutions result from collaboration among multiple developers, while 58% of new AI tools are distributed according to open-source principles.

- The results of a joint review conducted by Axenix and Lomonosov Moscow State Univer-

sity¹⁰ demonstrate that the most mature sectors in Russia in terms of AI agents are retail, finance, and IT, whereas healthcare and education remain the least developed. The report also identifies key drivers of AI development — including increased digital literacy, synergy with robotics and sensors, improvements in computational efficiency, and expanding monetization opportunities — as well as major barriers, such as fears of job displacement, ethical and legal concerns, integration difficulties with existing IT infrastructure, and risks associated with regulatory uncertainty. The estimated cost of implementing AI agents ranges from RUB 5–15 million for small businesses to RUB 200–300 million for large enterprises and exceeds RUB 950 million for major corporations.

- The International AI Alliance¹¹ identified major challenges in AI governance, decision-making, and agentic/multi-agent systems, including scalability, security, trust in AI agents, and the gap between simulation and reality. Addressing these challenges will require the development of models that incorporate social context, the establishment of approaches to global AI governance and national regulatory principles, and further research into AI's societal impact.

- The Digital Economy ANO¹² emphasizes the role of generative AI in significantly increasing labor productivity and identifies one of the most pressing issues for AI development in Russia as the establishment of regulatory and legal frameworks governing the development and application of AI solutions across different sectors, as well as the formulation of legal and ethical

⁷ Technologies of Trust. Trust but Verify: Russian Business Assesses AI. 2025. URL: <https://data.tedo.ru/publications/doveray-no-proveryay.pdf>

⁸ Yakov and Partners. AI Can Contribute up to 13 Trillion RUB to the Russian Economy by 2030. 2025. Available at URL: <https://yakovpartners.ru/publications/ai-2025>

⁹ AI List: New Solutions in the Russian AI Industry. 2025. A URL: <https://ict.moscow/static/bb4e4772-ba4d-5379-b189-5a168f7af506.pdf>

¹⁰ Axenix. AI Agents in Action: Economics, Risks, and the Evolution of Organizational Models. 2025. URL: <https://axenix.pro/realizaciya-transformacii-v-data-driven-organizaciju#research>

¹¹ AI Alliance Network. Horizons of Artificial Intelligence: What AI Technologies Will Look Like in 10 Years (Research Project, November 2025). URL: <https://ict.moscow/static/3e7cf338-a2e7-5770-af46-18b0ea752cb0.pdf>

¹² ANO Digital Economy. *The Future of Artificial Intelligence URL: <https://d-economy.ru/analitic/budushhee-iskusstvennogo-intellekta>

principles for the use of artificial intelligence.

The plenary session, which launched the scientific discussion, was divided into two blocks — an academic assessment and the perspective of practitioners — taking into account the broader context and the ambiguity of opinions regarding the feasibility and effectiveness of artificial intelligence (AI) technologies.

Representing the academic community, the keynote speech was delivered by Igor M. Stepnov, Doctor of Economics and Head of the Asset Management Department at MGIMO University. His presentation, “Economic Decision Making: Assessing Readiness for the Application of Artificial Intelligence Models,” addressed the question of what AI actually represents: an economic miracle, the near future of everyday reality, or a potential economic catastrophe. This framing was determined by the emergence over the past one and a half to two decades of numerous technological trends that ultimately failed and, to some extent, became traps for users. Today, amid widespread expectations of AI’s inevitable triumph, there remains a considerable degree of speculative hype unsupported by real economic solutions, as well as the formation of a substantial “financial bubble.”

Professor Stepnov emphasized that assessments of the applicability of AI to economic decision-making should take into account the historical experience of developing automated control systems, since the creation of a universal AI suitable for all classes of tasks is impossible. At the same time, AI is considerably more applicable in the field of management, where effective models of decision preparation and decision-making are already being developed on its basis. The classification of such models became an important topic of discussion: in structured decision-making, the replacement of human involvement has already occurred or is currently taking place; in semi-structured decisions, part of the task can be algorithmized, although qualitative human evaluation remains necessary; whereas in unstructured decision-making AI still proves ineffective. Particular attention was devoted to evaluating the future viability of AI, since indus-

try leaders selectively choose areas for aggressive investment, understanding that the inappropriate application of AI may lead to significant catastrophes both at the corporate and societal levels [2, 3].

A presentation on the long-term trends of AI market development was delivered by Igor E. Frolov, Doctor of Economics, Deputy Director for Research, and Head of the Laboratory for the Analysis and Forecasting of the Impact of Research and Development on Socio-Economic Development at the Institute of Economic Forecasting of the Russian Academy of Sciences. He outlined projected growth trends for both global and Russian AI markets over the coming decade, noting not only the presence of inflated expectations but also numerous social risks. Conference participants were particularly interested in his typology of the developmental phases of AI technologies. According to this framework, the earliest elements of AI were demonstrated by machines in the mid-1940s; the first “AI winter” occurred in the late 1970s, while the second took place in the early 2000s. The contemporary breakthrough in AI, beginning in the 2010s and driven by advances in deep learning and neural networks, initiated a new “AI spring” and explosive progress in generative AI since the early 2020s. Under forecast scenarios, AI’s contribution to global GDP is expected to range from 1.4% to 2.5% [4]. At the same time, the conservative scenario appears the most realistic, as it accounts for the limitations of AI implementation and, consequently, the actual economic effects arising from its integration into new technologies.

An engaging continuation of these presentations was the discussion of historical examples of both achievements and unrealized expectations associated with technological breakthroughs in AI. For instance, the fully automated landing of the orbital spacecraft Buran within the Soviet space program in 1988 represented the pinnacle of algorithmic automation at that time. By contrast, the anticipated achievement of fully autonomous Level 5 autopilot systems by 2020 has not materialized, largely because the “last 1%” of complex road situations still requires forms of human intelligence that remain unattainable for AI systems.

The second part of the plenary session was devoted to industry practitioners, who presented their perspectives on the role of AI in economic and managerial decision-making.

In particular, Filip Bušina, Advisor to the Director for Business Development in Central and Eastern Europe at Elanor ICT, a Ph.D. in Economics, delivered a presentation titled “Human-Centric Transformation in the Era of Predictive HR: Between Automation and Empathy.” He noted that the AI application in human resource management opens up new opportunities ranging from the automation of recruitment and onboarding processes to predictive analytics and employee training [5]. At the same time, several risks were identified, including algorithmic bias, reduced trust, and the potential alienation of employees from the outcomes of their work.

The audience was particularly interested in the results of a survey conducted among companies in Central and Eastern Europe (the Czech Republic, Slovakia, Poland, Hungary, Bulgaria, Romania, Serbia, Albania — a total of 698 companies), which showed that approximately 70% of respondents demonstrate a medium level of digital maturity. This reflects a transitional phase between operational automation (according to the HR 4.0 concept) and the institutionalization of AI (the emerging HR 5.0 framework). An advanced level of maturity (12%) is primarily observed in multinational companies certified under ISO 9001 and ISO/IEC 27001 standards. At the same time, companies already actively use technologies such as electronic signatures (71%), cloud-based HR systems (47%), and AI-driven analytics (12%).

The key conclusion of the presentation was the idea that AI in HR should be implemented within a new model of human–technology partnership based on transparency, trust, and adherence to ethical principles in the use of artificial intelligence. This approach promotes the concept of predictive empathy, which integrates AI analytics with human emotional intelligence, ensuring that technology enhances rather than replaces human decision-making. Ultimately, AI-based management should be grounded in a human-centric approach,

as established in international frameworks (OECD guidelines,¹³ UNESCO recommendations,¹⁴ and the European Union Artificial Intelligence Act¹⁵). In this sense, AI should act as a mirror of managerial principles, contributing to the strengthening of a culture of trust and sustainability.

An interesting case of AI technology implementation was presented by Yulia B. Ponomareva, Deputy Director for Economics and Finance of the Paks Nuclear Power Plant construction project (Hungary) at Atomstroyexport. She described the practice of using an AI arbitrator that enables the automation of approval procedures and the prioritization of intra-group requests within holding structures. In essence, this approach to prioritizing corporate requests represents a decision-support system (combining algorithmic computation and a language model) based on a set of criteria whose structure is derived from the well-established Analytic Hierarchy Process. The implementation of this approach contributes to improved liquidity, reduced cash gaps, and minimized intra-group discrepancies in settlements and deliveries, while also incorporating reinforcement learning techniques that allow the system to adapt to changing conditions. This is particularly important in the management of complex international engineering projects, including nuclear power plant construction [6].

The professional discussion session, traditionally an important part of the conference, featured contributions from Valeriy A. Vaisberg, Director of the Analytical Department at REGION Investment Company, Pavel A. Pikulev, Chief Strategist of the Treasury at Sberbank, and Alexander I. Evdokimov, Senior Portfolio Manager at The First Management Company. They addressed issues related to

¹³ OECD. AI Principles. URL: <https://www.oecd.org/en/topics/ai-principles.html>

¹⁴ UNESCO. Recommendation on the Ethics of Artificial Intelligence [SHS/BIO/PI/2021/1]. URL: <https://unesdoc.unesco.org/ark:/48223/pf0000381137>

¹⁵ European Commission. Regulation (EU) 2024/1689 of the European Parliament and of the Council of 13 June 2024 laying down harmonised rules on artificial intelligence and amending (Artificial Intelligence Act). URL: https://eur-lex.europa.eu/legal-content/EN/LSU/?uri=oj:L_202401689

the application of generative artificial intelligence in investment decision-making, financial modeling, analysis, and forecasting. In particular, A.I. Evdokimov presented the results of an analytical study on the use of sentiment in communications from the Central Bank of the Russian Federation for predicting monetary policy decisions.

The issues raised at the plenary session and the practice-oriented discussion were further elaborated in the conference breakout sessions.

Section 1, “A New Perspective on Economic Decision-Making under the Application of Artificial Intelligence: Models, Opportunities, and Limitations,” chaired by Igor M. Stepnov, Head of the Asset Management Department at MGIMO University, brought together participants from various Russian universities, including Saint Petersburg State University, Ufa State Petroleum Technological University, Saratov State University named after N.G. Chernyshevsky, Russian New University, the Financial University under the Government of the Russian Federation, MGIMO University, and others. Speakers addressed issues such as the application of AI in economic modelling and forecasting, as well as in investment decision-making and socio-behavioral modelling of financial pyramids; the role of AI agents in accounting and auditing, taxation and financial systems; business process reengineering; systemic risk forecasting; and anomaly detection in digital asset markets. Participants assessed the probability of a financial “bubble” in AI-related companies by comparing the current AI boom with historical bubbles, such as the dot-com bubble of the late 1990s. They identified typical features of such bubbles — rapid price increases, elevated valuation multiples, and speculative demand — while also noting the strong fundamental base of many leading companies in the sector, which distinguishes the current situation from previous speculative episodes.

Section 2, “Sovereign Models of Artificial Intelligence Application in the Implementation of National Economic Development Strategies by the State as an Actor,” chaired by Tatyana F. Kreidenko, Associate Professor of the Department of Regional Economics and Geography at RUDN University, primarily

focused on issues such as technological sovereignty, the potential of artificial intelligence in public administration and the banking sector, and support for public–private partnerships.

In particular, Anna D. Mochalkina from the Moscow Technical University of Communications and Informatics (MTUCI) presented a paper on threats of foreign influence in the field of artificial intelligence to national security. She highlighted ideological influence through AI-generated content and economic pressure via control over AI supply chains, emphasizing risks of data leakage, manipulation of public opinion, and dependency in critical sectors of the economy such as finance, industry, and energy. The results of a comparative analysis of the strategies of Russia, China, India, the European Union, and the United States were particularly valuable for discussion, demonstrating the effectiveness of legal restrictions, investment in research and development, and international cooperation. The main conclusion confirmed the importance of integrating AI technologies into national security systems in order to reduce external risks, ideological manipulation, technological dependence, and vulnerabilities of strategic infrastructure, as well as to enhance competitiveness in the global digital environment.

An important addition to the academic discussion was provided by presentations from Russian and international participants representing their countries’ perspectives on issues such as the use of AI technologies in the implementation of state export support programmes and customs administration (T.V. Kolesnikova, K. Medvedev, Y.A. Aleksandrova, Saint Petersburg State University of Aerospace Instrumentation); the development of sovereign models for AI application in economic governance in Russia and China (M. Hu, Saint Petersburg State University of Aerospace Instrumentation); the assessment of social networks as a new instrument of “soft power” and the use of sovereign AI as a strategic state asset (M.S. Usupova, International University of Kyrgyzstan); and sovereign AI as a driver of the Azerbaijani economy (K. Z. o. Mamedzada, RUDN University).

Issues of sectoral diffusion were examined within *Section 3, "Strategic Sensitivity of Industries to the Adoption of Artificial Intelligence,"* chaired by Julia A. Kovalchuk, Professor of the Asset Management Department at MGIMO University. The series of presentations covered a wide range of industries, including manufacturing, oil extraction, agriculture, services, trade and e-commerce, education, healthcare, construction, the media industry, sports, and culture.

Particular interest was generated by the following presentations:

- a regular participant of the conference from the Republic of Kazakhstan, L. M. Davidenko, Candidate of Economic Sciences, PhD, Associate Professor at Toraighyrov University, who discussed cases of IT application in the economy of Kazakhstan, as well as technological integration and the implementation of AI in industrial and agricultural enterprises;

- I. B. Dolzhenko from LLC "Delta Consulting," who addressed the high sensitivity of global fashion industry firms to AI technologies, highlighting its transformation from a technological tool into a key strategic asset. Such companies operate under conditions of rapid collection turnover, fundamental unpredictability of consumer demand, and persistent market turbulence, and therefore possess strong potential for maintaining operational flexibility and demand management, while also generating new sources of competitive advantage in complex market environments;

- I. A. Ivanova, Candidate of Economic Sciences, Associate Professor at the Financial University, who discussed the prospects and limitations of AI application in designing personalized employee learning trajectories, enabling a more rational and evidence-based assessment of competencies, labor market dynamics, and educational system trends and potential.

The current potential and future of AI were further addressed in *Section 4, "Strategic Prospects for Building Competitive Advantages of Organizations under Exponential Growth in Artificial Intelligence*

Adoption," chaired by Mikhail M. Ishchenko, Head of the Cost Parameters Management Unit of the Paks Nuclear Power Plant construction project at Atomstroyexport. In this section, A. V. Anisimov (HSE University) and S. A. Fominykh presented a paper on AI as a tool for improving the efficiency of corporate asset tokenization in the Real World Assets (RWA) segment within the context of digital financial market development. This transition enables a shift from traditional forms of accounting and circulation of property rights to a distributed infrastructure of smart contracts. The authors also highlighted the risks associated with scaling tokenization without the use of intelligent data analytics, monitoring, and compliance tools, which can be provided by AI through machine learning algorithms that integrate large volumes of corporate, market, and alternative data, identify hidden dependencies, and build dynamic models of returns and risks. The main conclusion was that the synergy between artificial intelligence and tokenization forms a new digital standard of corporate finance, expanding opportunities for institutional investors, private funds, and the corporate sector.

A further relevant topic in the context of expanding AI adoption was the development of the data center (DC) market, which comprises real estate facilities designed to host and ensure the uninterrupted functioning of IT infrastructure. This issue was addressed in the study by V. L. Kim and S. V. Pupentsova from Peter the Great St. Petersburg Polytechnic University. There are 194 data centers operating in the Russian Federation with a total capacity of 3.6 GW. Nearly half of them are concentrated in the Moscow region, which is explained by its advanced engineering infrastructure and the concentration of demand from key consumers of data center services, including corporate headquarters, federal government bodies, and financial institutions. The authors raised the issue of the strategic development of data centers in regions with surplus capacity and highlighted a contradiction between demand drivers associated with digital transformation and energy system constraints that directly affect DC operations. This is supported by

a strong correlation between rack space capacity and key demand indicators (such as the size of the Russian cloud services market, e-commerce turnover, and electricity production) over the period 2017–2024. Thus, the findings justify the planning of development projects for high-yield but highly specialized real estate assets requiring a tailored investment and management approach.

Issues related to the tax advantages of using artificial intelligence were raised in the discussion by Varvara V. Gredayeva, a student at the Financial University. She noted that the exponential deployment of AI within the operational frameworks of online marketplaces is fundamentally reshaping the composition and dynamics of non-current assets, shifting capital expenditures toward a regime of continuous modernization and compressed asset life cycles. In this context, the accounting and taxation of non-current assets are no longer merely retrospective recording mechanisms; rather, they become a strategic instrument for generating tax advantages. This shift enables firms to reduce their effective tax rate, smooth the tax base, and increase the internal rate of return on investment projects, while remaining within the boundaries of compliant taxation and the economic substance of transactions.

Technological transformation is closely intertwined with changes in the labour market. Accordingly, *Section 5, titled “Transformation of Human Professional Competencies as a Labour Market Participant in the Context of the Widespread Adoption of Artificial Intelligence”* (chaired by Anton Yu. Podshivalov, Head of the Department for Student and Alumni Relations at MGIMO University), addressed issues related to training specialists both for working with AI systems and for developing AI technologies. In particular, the discussion focused on the specialised skills required across different sectors of the economy, including industry, agriculture, and education, as well as the potential for the effective application of AI in corporate human resource management and personnel administration. Issues of psychology, digital ethics, and psycho-hygiene also attracted significant atten-

tion from participants. In this context, E.V. Kladochnaya, a master’s student at the HSE University, presented a paper entitled “Psychological Determinants of Professional Performance in the Context of the Widespread Adoption of Artificial Intelligence,” in which she analysed phenomena associated with AI, including AI fatigue, technological burnout, and “quiet quitting.” She further proposed a set of measures for fostering a human-centric corporate culture aimed at mitigating declines in employee productivity and motivation resulting from AI implementation.

Section 6, “Legal Regulation of Artificial Intelligence in Contemporary Economic Processes” (chaired by Maxim I. Inozemtsev, Associate Professor at the Department of Private International and Civil Law named after S.N. Lebedev, MGIMO University, and Editor-in-Chief of the Digital Law Journal), traditionally brought together a community of legal scholars and practitioners in the field of digital law. Participants included representatives from leading law schools and universities, such as the Russian State University of Justice named after V.M. Lebedev, the St. Petersburg Institute (branch) of the All-Russian State University of Justice (RLA of the Ministry of Justice of the Russian Federation), law faculties of classical universities, and practicing lawyers. The discussion focused on critical legal and regulatory issues emerging alongside the expansion of digital technologies. These included the legal personality of AI users; the application of AI in accounting, auditing, insurance, and tax relations; the legal regulation of AI-enabled fraud and other criminal activities; and mechanisms for protecting personal data and confidentiality in the implementation of AI within public services and business processes.

Particular interest was generated by a presentation from V.F. Polevoy, an undergraduate student at the Russian State Academy of Intellectual Property, on the new OpenAI charter, which introduces a hybrid Public Benefit Corporation (PBC) model under the supervision of a non-profit foundation. This model seeks to reconcile the fundamental tension between the commercialization of break-

through technologies and the mission of ensuring public benefit. Within the broader discussion on intellectual property in the context of AI usage, participants examined materials from the World Intellectual Property Organization (WIPO), relevant court cases, national regulatory strategies, and the evolving regulatory landscape in the United States, as well as key provisions from OpenAI's founding documents.

Within the framework of the conference, a traditional youth competition for students and doctoral candidates was also held. It should be noted that among the awardees there were representatives of the Financial University, including:

- M.U. Mavsarova, author of a study on the application of artificial intelligence in forecasting industry-specific financial metrics of oil and gas companies. Her research outlines the potential use of AI in corporate financial processes, identifies levels of employee proficiency in AI tools within financial departments, and proposes a prompt structure for the DeepSeek neural network when performing financial tasks;

- E.D. Sokolov, who assessed the potential of AI agents as a mechanism for ensuring regional economic security under conditions of uneven spatial development in the Russian Federation;

- D.S. Maksimova, who examined the role of digital twins as a tool for analytical support in the transition from reactive to predictive corporate governance. Her work includes the analysis of industry case studies (oil refining, energy, mechanical engineering, construction), statistical evidence, and the identification of the multiplicative effects of implementation (sustainable development, operational efficiency, increased customer engagement, and sales growth), as well as key advantages (reduced decision-making time, risk minimization, improved forecasting accuracy and product quality) and limitations (cybersecurity risks and industry conservatism);

- D.O. Kondratyeva, who analysed trajectories of educational and HR strategies aimed at training specialists in demand within the AI-driven economy;

- A. Ya. Kilennikov, who investigated the impact of AI technologies on the work of professionals across various occupations in agricultural companies, in the context of labour shortages in the agricultural sector, the implementation of modern agrotechnologies and biotechnologies, and the assessment of the economic efficiency of autopilot systems for agricultural machinery;

- Yu.E. Kulichkova, who, based on an analysis of the strategic sensitivity of industries (digital maturity, data availability, economic incentives, human capital, and regulatory context), presented a forecast indicating a likely redistribution of leadership positions and widening inter-sectoral disparities depending on the ability of industries to adapt to AI technologies by 2030;

- A.T. Mukhina, who studied the role of AI in developing critical thinking and creativity among university students, highlighting the ambivalent nature of its impact. On the one hand, AI technologies can serve as an intellectual partner that stimulates analytical and creative activity; on the other hand, inappropriate use may lead to reduced analytical depth, superficial learning, and diminished independent thinking. The study concludes that the impact of AI depends on the nature of student interaction with these tools, their level of motivation, and the broader pedagogical context;

- K.M. Kuzenyatkina and Sh.R. Gadjimamedova, who compared the experience of Russian retail companies implementing cashier-less "smart store" formats (X5 Retail Group, VkusVill, and Azbuka Vkusa) with international cases (Amazon Go, Żabka Nano, ALDI Shop&Go). The authors developed a set of recommendations for adapting this format, taking into account economic, social, and institutional factors;

- E.V. Averyanova and Yu.D. Muravyeva, who, based on a survey of more than 300 students, demonstrated how AI technologies influence professional self-determination among both current economics students and prospective applicants. Their study emphasised the transformation of key economic sectors (finance, marketing,

logistics, management) under the influence of AI, leading to the emergence of new professions and fundamental changes in the requirements for traditional roles. The findings may inform the development of recommendations for revising educational programmes in economics and designing self-development strategies aimed at

forming hybrid competencies that combine digital literacy, analytical thinking, and soft skills.

As a follow-up to the conference “Asset Management – 2025,” the publication of a collective scholarly monograph entitled “Artificial Intelligence in Economic Decision Making: Assets, Actors, Strategies” is planned.

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