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A New Management Paradigm in the Digital Economy

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ABSTRACT

The aim of this study was to identify the key focal points in the formation of a new management paradigm amid the exponential growth of digital technologies and the digital economy. The primary objectives included determining the conditions, development directions, levels, and contradictions of the emerging paradigm. This research employed general scientific methods such as analysis, synthesis, and grouping. A review of existing theoretical and practical studies on new management principles and managerial thinking was conducted, using a rhizomatic approach to identify trends and connections, as well as alternative structuring through a development matrix based on various focal points. The study revealed that development trends are multidirectional, societal changes occur asynchronously and in a differentiated manner, and their effects can be both positive and negative. In an era of high turbulence and exponential growth, localized patterns and models emerge instead of universally accepted ones, making flexible management and systems thinking crucial. The findings suggest that rather than establishing a rigid management paradigm, decision-makers at all levels should navigate a turbulent environment by employing different focal points. The proposed management development matrix serves as a tool for fostering systemic thinking among leaders, allowing them to consider existing contradictions and prioritize values. The scientific novelty of this study lies in the application of contemporary approaches for systematizing current trends, drawing on post-structuralist philosophy and alternative cognitive tools. These results may be useful for managers at all levels, professionals in corporate development sectors, government administration, and researchers.
Keywords: management paradigm; algorithmic management; business models; ecosystems; managerial thinking; rhizomatic assemblages; flexible management

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INTRODUCTION

Surveys related to the necessity of finding and using new management approaches, which are caused, in particular, by the rapid development of the digital economy, are not only relevant but sometimes "painful" for companies, regions, and even individual people. At the same time, deep-rooted problems related to the change of value orientations and the formation of a new mindset reveal diametrically opposed views on global processes occurring in society. All this indicates the need to form a new worldview — a "paradigm" of management, to use T. Kuhn's terminology.[1]

The management paradigm can also be viewed as part of ideology, under which D. North understands subjective models of perception of the surrounding world within the framework of institutional economics [1]. In this context, ideology and shifts in the structure of relative prices are the main sources of institutional changes. Technological progress and the associated digital transformation of the economy, the formation of new markets, and population growth, leading to relative price changes, make previous forms of interaction (both organizational and institutional) unprofitable. According to North, the change in the perception model is also subject to economic factors, as the more profitable opportunities are blocked by a subjective worldview, the stronger the incentives to change it.

The digital component of the modern economy inevitably has a radical impact on management methods, if only because its subjects and objects, as well as the environment, have changed significantly. Thus, according to Rosstat, the number of fixed and mobile Internet access subscribers per 100 people (aged 15 and older) increased from 12.2 and 47.8 to 25.1 and 115.9 subscribers, respectively, from 2011 to 2023.[2] According to the International Telecommunication Union (ITU), in 2023, 5.4 billion people (67% of the world's population) used the Internet, whereas in 2005, this figure was at 1 billion (16% of the world's population).[3] The share of companies with their own websites in Russia increased to 46.5% in 2023, while the percentage of organizations that used electronic data exchange between their own and external information systems rose to 56%. An even more significant circumstance is that, according to Statista data in 2023, the largest companies in the world with a market capitalization of over 1 trillion dollars — Microsoft, Apple, NVIDIA, Alphabet (the parent company of Google), Amazon, Meta Platforms —are primarily part of the digital sector.[4] The only exception is Saudi Aramco (the National Oil Company of Saudi Arabia). Such corporations not only actively and successfully shape the new digital environment but also permanently participate in experiments to transform management approaches.

RESEARCH METHODOLOGY

The analysis of recent papers on management theory and practice shows the presence of significant anomalies that contradict the paradigm, which was still "working" well at the beginning of the century, as well as a large number of new ideas and implemented technologies, as well as management principles. Despite the obvious modern trends, it is not possible to determine unified values, principles, and approaches to solving current tasks, to identify and clearly delineate the emerging new management paradigm. This is caused by a whole range of reasons, among which are significant asynchrony in the development of technologies, society, institutions, geographical and sectoral differentiation

[1] T. S. Kuhn is an American historian of science and philosopher, one of the leaders of the historical-evolutionary direction in the philosophy of science.

[2] Rosstat (official webcite). URL: https://rosstat.gov.ru/statistics/infocommunity/publications/

[3] Statistics. ITU. URL: https://www.itu.int/en/ITU-D/Statistics/Pages/stat/default.aspx

[4] The 100 largest companies in the world by market capitalization in 2023 (in billion U.S. dollars). Statista. URL: https://www.statista.com/statistics/263264/top-companies-in-the-world-by-market-capitalization/

of the processes of transforming industries and territories, as well as a low level of connections between the directions of technological improvement (including managerial) and the development of human society, the absence of a commonly accepted and shared ideology, and values.

Undoubtedly, attempts to outline the general contours of the emerging paradigm [2], as well as to identify new challenges for management in the 21st century, have already been made [3–6]. However, the observed trends often have non-obvious nonlinear connections and are sometimes contradictory, yet they coexist in management practice and are quite effective. To obtain a comprehensive picture — the so-called "disciplinary matrix of management"— we consider that a rhizomatic approach, formed within the framework of poststructuralism and postmodernism, can be used. G. Deleuze and F. Guattari oppose the rhizome to a tree-like, hierarchical structure, as it has neither an end, nor a beginning, nor a centering principle [7]. Interpretation in rhizomatic research allows for a non-hierarchical multitude of entry and exit points. The rhizome consists of lines of flight (along which movement occurs), and their connections form a temporary zone of stability.

For visual representation and structuring of the new vision in management, classic pyramidal forms, Ishikawa cause-and-effect diagrams, or flowcharts are not suitable. In a rhizomatic approach, it is more convenient, in our opinion, to use an alternative tool — the coach's compass or development matrix. The focus of attention in it varies from narrow to broad, outward and inward. Thus, four sectors can be distinguished: a broad outward focus can conditionally be called "Attention", inward — "Values"; a narrow inward focus — "Thinking", outward — "Action" (see *Figure*).

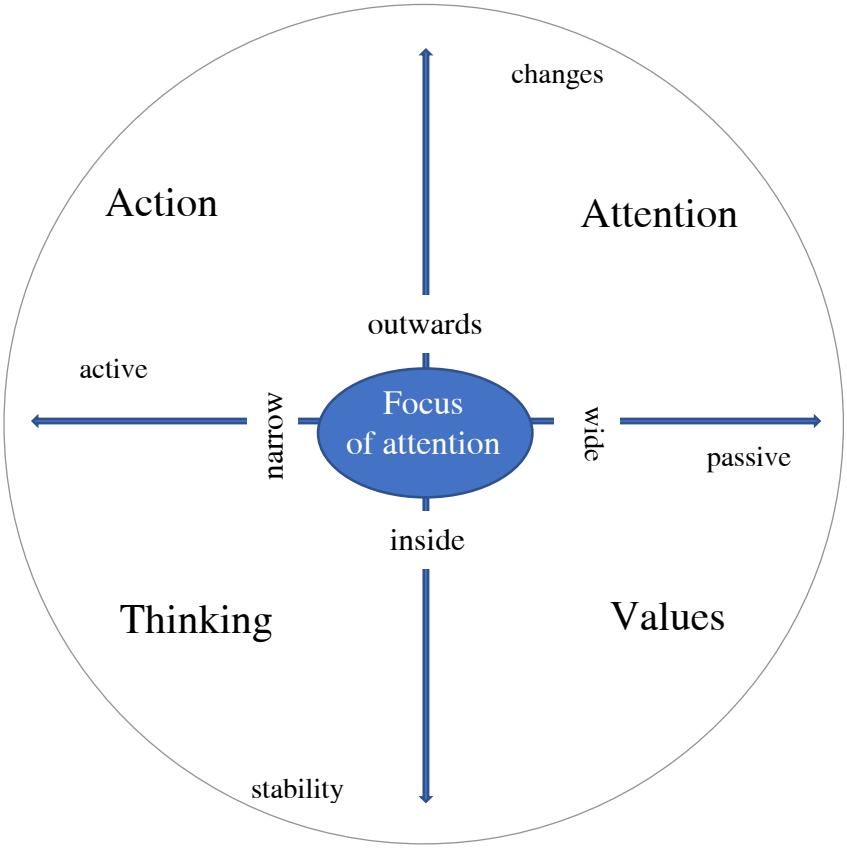

Fig. **The matrix of management paradigm development**

Source: Compiled by the author.

RESEARCH RESULTS

ATTENTION. A broad external focus from a management perspective addresses the conditions and trends that influence changes in theory and practice. The most significant factor has been technological changes attributed to the sixth technological paradigm or "Industry 4.0", the latter being a popular term (including in academic circles) that gained wide recognition thanks to a German public-private program.[5] At the core of the Fourth Industrial Revolution, according to a number of scholars and practitioners, are data in digital form, which are becoming a new source of value. In turn, key technologies that serve as a source of innovative impulse are formed through the operations of collecting, transmitting, processing, and storing digital information [8]. Such technologies include: the industrial Internet of Things (IoT); fifth-generation internet communication (5G); quantum data transmission; big data; artificial intelligence (AI); quantum computing; and distributed ledger systems (Blockchain).

A significant difference between the aforementioned digital technologies and others, including those that became the core of previous technological structures, is the speed of dissemination and transformational impact on all other spheres, which is often characterized as exponential. The part of the economy associated with digital data, identified as the "digital economy", is developing at the same pace. Scholars and practitioners define this concept in both narrow and broad senses; however, there is no consistency in the content of these two contextual meanings.

Nevertheless, the foundation of the digital economy lies in the Internet and related technologies, which are shaping new principles of organizing the economic system, business (increasing the efficiency of business processes), society, and even simultaneously transforming human consciousness. Initially, the digital economy emerged in response to the challenge associated with the growth of economic activity, population, and, consequently, the need for the economical use of all types of resources [9].

The evolution of the digital economy since the late 20th century is characterized by a series of stages [4]. At each of these stages, new challenges arise, which, overlapping with one another, give rise to profound transformations in the economic system. These include changes in the role of IT (from a tool for optimization and automation to a source of innovation); shifts in consumer behavior (including the mobile and sharing economy, on-demand economy, and high-tech gift economy); increased liquidity of data; monetization of algorithms; and a focus on business models that, through transformation, lead to the emergence of digital platforms and digital ecosystems.

The latter concept is also interpreted differently. E. Chang and M. West interpret the digital ecosystem most broadly (by analogy with its definition in biology) [10]. They describe it as an open self-organizing environment of agents, weakly connected, clustering by domains, and demand-oriented; each type of which is proactive and acts for its own benefit. The digital ecosystem includes biological, economic, and digital agents, as well as technologies and services. The self-organization of agents to solve problems without centralized control is a trend that also reflects the relevance of the rhizomatic approach.

The most important characteristic and challenge of the digital economy is the turbulence of the digital environment, which is expressed in high complexity, dynamism, and uncertainty. It has arisen due to a whole range of factors, including insufficient understanding of the

[5] The term "Industry 4.0" (fourth industrial revolution) was popularized by Klaus Schwab, based on the 2011 initiative of one of the projects of Germany's national HI-Tech strategy, which describes the concept of smart manufacturing by 2020 based on the active implementation of cyber-physical systems in industry and subsequently in other areas of societal life.

nature of digital products and platforms, the maturity and infrastructural limitations of digital technologies, rapid changes in consumer behavior, the shortening of the life cycle of any innovations, cybersecurity issues, and more. Undoubtedly, the objectively changed pace and number of ongoing transformations, the increase in the level of uncertainty, as well as events and changes in other areas of social life, are forming a new worldview.

Over the past decade, the speed and multidirectionality of changes have prompted researchers from various fields to formulate a generalized descriptive model of the world, presented in the form of an acronym, and the resulting model has already been revised multiple times. Such a model reflects not so much the nature of what is happening as the peculiarities of human perception of reality. If before 2016 (or even before the COVID-19 pandemic) the world was already perceived as VUCA (Volatility, Uncertainty, Complexity, Ambiguity), later it began to be characterized as BANI (Brittle, Anxious, Nonlinear, Incomprehensible). There were also other options. In recent years, some Russian practitioners have introduced the terms SHIVA (Split, Horrible, Inconceivable, Vicious, and Arising) and TACI (Turbulent, Accidental, Chaotic, Inimical).[6]

As we can see, along with flexibility, speed, high technological advancement, economy, and customer orientation, the economy and the surrounding reality are characterized by a high level of uncertainty, non-linearity, psychological discomfort, instability, and the complexity of awareness and logical definition. At the same time, the sector of broad external focus can be attributed to the lag in the transformation of labor market institutions, upbringing, and education compared to the changes in the organizational structures of the economy.

Labor relations have gone through stages such as the classic version of the industrial era, a multilateral format, then project-based work, self-employment, and ultimately "on-demand" employment, or gig work (temporary, often provided by digital platforms). However, the increase in labor productivity and business efficiency with new forms of labor relations is accompanied by social costs affecting individuals and society as a whole. This is due to the reduction and even absence of collective responsibility for the social welfare of workers in critical situations. At the same time, labor market institutions are inertial and oriented towards labor legislation norms developed mainly in the pre-digital era. Moreover, the change in technological paradigms and the rotation of generations in the economy are currently occurring asynchronously. All this leads to increased social tension [9].

The systems of education and upbringing require separate consideration, as well as very deep rethinking and restructuring. Currently, in many areas (particularly in the case of domestic systems), they are lagging behind in transformation. Nevertheless, the missing relevant elements of education and upbringing emerge sporadically in the rhizomatic temporal zone of stability, both due to the numerous opportunities provided by alternative sources of knowledge through the Internet and thanks to the actively developing and self-learning organizations, as well as the emergence of the lifelong learning trend, which is supported at the individual level.

Also, the broad external focus in studying the management paradigm touches upon the environmental aspect, or rather the crisis. It is worth noting that many efforts declared in light of sustainable development principles, such as the implementation of the "green growth" strategy, which is supposed to allow GDP growth without an increase in greenhouse gas emissions, have not led to the desired results in

[6] Life after BANI. The rise of new worlds. BITOBE Blog. URL: https://blog.bitobe.ru/article/zhizn-posle-bani-voshod-novyh-mirov/.

the developed countries following this agenda. This conclusion was reached by scientists who found that the slight reduction in emissions, called "green growth", is a lie [11]. Another trend, which serves as some compensation for ineffective state and supranational activities, is related to the spread of the trend towards eco-friendly consumer behavior.

VALUES. Let's consider the broad internal focus in the "Values" sector. In our opinion, the main value dilemma at present lies in the priority choice between human and algorithm. For management, the most important thing is the representation of the company within which management functions are carried out. If previously the most comprehensive metaphors for it were "machine", "organism", "brain", now the most relevant one is "algorithm" [12]. There is also a slightly different interpretation of the organization — through the mechanical, biological, and finally, social model of a multi-intelligent system. [2].

If we prioritize a humanistic approach to management, it primarily pertains to the main value — people and the company as a comfortable environment for personal development. The vision of the future organization by F. Laloux most closely aligns with this approach — he called it "teal". Notably, this concept has developed in management practice, and various elements and principles of "teal organizations" are being implemented in corporate culture and strategy [13]. On the other hand, the emphasis on management effectiveness and the broad opportunities that have emerged in the era of Big Data and algorithmic decision-making allow for the use of the metaphor of an organization as an "algorithm".

This relevant vision is based on the rhizomatic approach and represents the organization/management/activity as a kind of "assemblage" distributed across a network of socio-technical mechanisms, i.e., the interaction of various sets of data, decisions, procedures, and actors [12]. The complexity of making algorithmic decisions is also related to the fact that free will (i.e., the ability and possibility to influence events) is primarily characteristic of collectives (rather than individuals, algorithms, or data), and it can be realized by switching between several assemblies.

The management approach based on the dichotomy of "tree" and rhizomatic structures in an organization— "assembly", where the first type is responsible for hierarchical connections and the second implies a non-hierarchical network, is becoming increasingly relevant as AI tools expand. In such a situation, in our opinion, the values embedded by algorithm creators are more important than ever, as algorithms, as parts of "assemblies", provide stricter control aimed at maximizing utility and increasing employee productivity. In this process, the interests and value of each individual employee either take a back seat or are completely disregarded. According to one possible scenario (in the spirit of dystopias), when algorithms are created by AI and the concept of responsibility becomes blurred, it may turn out that human society will face degradation and collapse, as the variability of algorithms is limited by the lack of irrational flexibility in human value choices.

In the sector of awareness or "Values", it is worth considering those that are not only declared in society but also truly serve as activators of ongoing processes. For example, during the pandemic, V. Mau wrote: "Solidarity and trust are the key value orientations of the new era, defining a new paradigm of human social life" [14]. However, the current development of events, with the escalation of various levels of conflicts, including on the international stage, shows a sharp confrontation of values in the developing digital age society.

THINKING. Let's move on to the internal narrow focus — the "Thinking" sector, which is also characterized by a diversity of trends. The transition from analytical thinking to holistic

thinking, which can help shape a vision in an unstable and anxious era (whether VUCA, BANI, or even SHIVA), has allowed for the formation of a lean production system, the development of culture, and corporate values. The tool for holistic perception of the company becomes the use of a business model, which helps navigate the real market situation and respond flexibly to changes [2].

Such thinking is also proposed to be developed to the level of understanding and measuring the value created by the organization for all stakeholders. In addition to the existence of a gift economy, including a high-tech one (Hi-Tech Gift Economy), there are several commercial companies (such as Google, Airbnb) that create much greater value for society as a whole than for their owners or shareholders.

The mindset in the field of labor organization is also undergoing radical changes. Even at the end of the 20th century, P. Drucker wrote that many employees of an organization are no longer employees in the traditional sense: they do not work full-time, know more than other employees in their field, exhibit significant mobility, and have considerable non-monetary motivation, and therefore need to be managed as "partners" [3]. Such equality makes management more akin to "marketing activity" rather than "administration". The further transformation of the economy and thinking with the emergence of the platform model is interesting. As noted by D. Stark and I. Pais, the market regime is a contract, hierarchy is command, networks are cooperation, and the platform regime is cooptation [15]. The process of cooptation in relation to platforms has a very peculiar nature — nominally independent contractors ultimately come to a new form of dependence.

There are also other interesting trends in the field of "Thinking". Market and political criteria for filtering search engines, the ambiguity of the right to anonymity in the Internet space have given rise to various forms of anti-digital alarmism. The discussion about "digital slavery", the feasibility of informatization, as well as the difficulties of implementing effective management in the digital age, according to researchers, are related to the lack of a universally accepted ideology of the information society. Existing quite effective models for training managers and convenient software products do not solve the problem of the unpreparedness of modern social sciences to offer a value-conceptual basis for developing algorithms for managing economic and social processes both in a comprehensive manner and at individual levels and directions.

A critical view of the digital component of human existence [16], in particular, shows that digitized elements of human life turn the individual into a form of capital, both financial and speculative in nature [17]. This well-noted trend leads to an exacerbation of feelings of guilt, insecurity, and increased anxiety among people.

In the "Thinking" sector, there is a vast field for discussing development vectors. Take, for example, the issue of evaluating a company's efficiency or success. Previously, organizational efficiency was assessed in terms of the ratio of results to costs (indicators such as financial, R&D, or product-related were used), but recently it has increasingly been proposed to define it through the relationship between results and goals. After all, success is achieving goals, which are now suggested to be structured into a system dependent on the type of organization, a wide range of stakeholders (not just shareholders), and increased interest in environmental and social factors. At the same time, comparing the performance of different companies without considering the specifics of their goals makes no sense. A deep analysis of success based on goal achievement should encompass micro-, meso-, macro-, and chrono-contextual factors, as well as specific target

indicators set by the organization and individuals [18].

The complexity and diversity of what is happening in the external management environment, partially discussed in the "Attention" section, necessitate the development of strategic systemic thinking in managers. This is important for reliable business environment analysis and long-term strategy development, especially given the relevance of data distortion issues.

ACTION. The "Action" sector of the management development matrix represents the concrete implementation of management functions. First of all, it should be noted that the term "digital management" is encountered in modern research, i.e., digitalization should allow for the calculation of management decisions. Such calculations for forming strategies and action plans can be done even today; however, this practice is not widely adopted for a number of reasons. There are quite a few programs that allow for the control and planning of various processes, such as CRM, ERP, PLM, SCM, BPM, etc., however, most of them are essentially informational, allowing for the organization of primary data collection. The mere presence of a large amount of data does not guarantee the making of an adequate decision. Moreover, the abundance of information arrays available thanks to modern technologies does not mean that there is actually the necessary information for making managerial decisions.

Some researchers propose developing a sufficiently complex mathematical model (reflecting the interconnections between resources, the behavior of corporate relationship participants, and the company's performance outcomes [19]), which should increase the organization's transparency for the manager and automate their work at the level of synthesizing simple management decisions. Unfortunately, information on how successfully the created model is being tested is not available. Nevertheless, in the business sector, simulation modeling is already quite widespread [20]. The most in-demand tools in management are system dynamics, discrete, and agent-based modeling.

A particular interest lies in the transformation of management within the platform model of business organization. Engagement (or co-optation) is presented as a Möbius organizational principle, i.e., the use of assets and activities by platforms that are not part of the firm and represent a space that is neither inside nor outside [15]. Platforms utilize the physical and intangible assets of the attracted participants, having virtually none of their own, and also organize the work of nominally independent contractors (drivers, craftsmen, sellers, etc.). In this sense, users also become part of the platform to a certain extent.

In comparison with other forms of business, platforms are fundamentally different due to the specifics of algorithmic management — their managerial task is related to finding matches, and management and control are carried out through multilateral relationships, with the main subjects being platform owners, suppliers, and users. The former involves the latter two in solving managerial tasks, but without delegating authority to them. That is, their behavior is algorithmically translated through ratings via intricate three-sided feedback loops to achieve certain results.

Algorithmic governance is a source of non-bureaucratic control that is decentralized and distributed. At the same time, there is an asymmetry of power, where platform owners and investors in coalition with consumers dominate over the seller (worker). Moreover, the creation of uncertainty by platforms through instability and opacity (which constitutes a source of non-bureaucratic control and monopoly power) generates feelings of anxiety and vulnerability.

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In the "Actions" field, under the conditions of modern environmental and thinking trends, the following become strategically important: the implementation of relevant business models [21]; the construction of new ecosystems, and ultimately — systemic digital transformation, which implies the development and implementation of a growth strategy. Nevertheless, the development of generative artificial intelligence and, in particular, the release of ChatGPT Open AI[7] in the fall of 2022 (a "super-disruptor", i.e., one that disrupts established rules not only in one industry but across all others) further accelerates speeds, presents new challenges, and, alongside colossal opportunities, brings threats and real problems.

Serious issues related to the need for regulating artificial intelligence require consideration and are actively discussed at the level of developers, business leaders, governments, and various associations [22]. For a specific organization, waiting for the formation of a legislative framework affecting this area is impractical. Therefore, there is an opinion that it is necessary to develop its own evaluation standards for purchasing trustworthy AI products and services.

Ambiguous, controversial, and complex aspects in the "Action" sector concern the requirements, competencies, and training system for managers.

On the one hand, in addition to the need to meet the requirements associated with the implementation of traditional professional functions of these specialists, it is necessary to develop online communication competencies and related skills for managing remote employees and utilizing gig employment. Entrepreneurial abilities, which help to respond flexibly to environmental turbulence, as well as competencies in the field of digital technologies, from data handling to a systemic vision in the area of digitalization of production processes, are becoming relevant [2]. To all of the above, it should be added that staff, in general, are recommended to maintain a high level of their physical, mental, and emotional well-being, develop systemic and strategic thinking, communication skills, and the ability to act in stressful situations. At the same time, the manager should constantly develop themselves and support the creative and critical thinking of employees [23].

On the other hand, how can we ensure the training of such highly qualified managers? Knowledge of management, engineering, information technology, psychology, and other applied fields is necessary here. Moreover, given the high turbulence and the reduction in the time available for making managerial decisions, traditional training for managers (i.e., acquiring decision-making skills after meticulous analysis of available data) is unproductive [4]. Furthermore, the technological capabilities and the pace of generative AI dissemination will lead to a significant reduction in the economy's need for a number of professions (and jobs), including managerial positions, in the near future.

If earlier the direction of scientific management was shaped by industrial engineers, and later marketers and partially HR specialists had significant weight, now software engineers and big data specialists play a special role. Researchers note that managers cannot guarantee a certain effectiveness of digital technologies, as there are currently no standards and bodies of knowledge to help managers understand

[7] ChatGPT Open AI — a chatbot with generative artificial intelligence developed by OpenAI.ChatGPT Open AI is a chatbot with generative artificial intelligence developed by OpenAI. It is capable of operating in dialogue mode and handling requests in natural languages.

the potential of these technologies [24]. Thus, the majority of international ISO standards in this area are developed for IT specialists. In this situation, it is proposed to identify the key areas for which management will be responsible in a specific company and to develop a set of knowledge and standards for their development. Such areas have been identified, for example, by the international consulting firm McKinsey. This includes data management, process automation, relevant flexible internal infrastructure, advanced analytics, decision-making automation, intelligent visualization and interfaces, external ecosystem, organizational culture, and HR policies focused on digital competencies and employee flexibility.

Against the backdrop of the reduction of many job positions [25], recommendations are emerging to help ensure career prospects in the era of artificial intelligence [26], such as avoiding predictability, since AI cannot generate entirely new ideas. It's more of a forecasting mechanism based on the highest probability and popularity. It is also necessary to hone the skills that machines strive to emulate, and here genuine emotions and creativity take precedence, along with a focus on the diminishing volume of communication in the real (not virtual) world. Developing a personal brand and striving for the highest professional echelon is necessary because AI tools can destroy both the lower and upper segments of the market in many professions. It is important to become an expert of such a level that you have the authority to verify answers generated by artificial intelligence.

All the above-mentioned current and prospective requirements for personnel (including managers) necessitate the continuous engagement of representatives from various helping professions. This raises numerous questions about the feasibility, sufficiency, and necessity of the non-stop process of improvement and training. As is well known, the capabilities of the human body, intellectual, and emotional components as a whole do not expand at the same pace as the development of the digital economy. As a result, the syndrome of "burnout" emerges and spreads widely, leading to decreased efficiency, layoffs, and possibly downshifting. Even within companies, certain trends of slowdown are emerging. Thus, in the analytical reports of the research and consulting company Gartner, which specializes in IT markets, the expression "IT directors' fatigue from changes" has appeared. This state leads to resistance to constant changes and a growing "pessimism among IT technology buyers".[8]

Despite the rhizomatic nature of existing trends, a scientific approach requires the creation of a certain model, systematization (even if temporary), and formulation of conclusions. The urgent need for the formation of new thinking also arises among practitioners. For example, according to hh.ru (the largest Russian internet recruitment company), with the approaching moderate competition for jobs in the average market, the hh.index (the ratio of the average number of active resumes to the average number of active vacancies) for the category of senior and middle management was 19.9 in October 2024.[9] This indicates an extremely high level of competition for jobs in this market, i.e., the level of requirements for managerial competencies will increase. At the same time, research by Accenture (a global company specializing in IT services and management consulting), which included a survey of 3,450 senior executives across 21 industries in 20

[8] Gartner Identifies Top Trends Impacting Technology Providers in 2024. February 5, 2024 URL: https://www.gartner.com/en/newsroom/press-releases/2024–02–05-gartner-identifies-top-trends-impacting-technology-providers-in-2024. Gartner Forecasts Worldwide IT Spending to Grow 6.8% in 2024. January 17, 2024 URL: https://www.gartner.com/en/newsroom/press-releases/01–17–2024-gartner-forecasts-worldwide-it-spending-to-grow-six-point-eight-percent-in-2024

[9] Brief overview of the labor market. Hh.ru URL: https://hhcdn.ru/icms/10322411.pdf

countries in 2023, showed the following: 95% of executives believe that generative artificial intelligence will force their organizations to modernize their technological infrastructure, and 96% agree that the use of AI agents in ecosystems is a significant opportunity for their companies in the next three years.[10] All this indicates the urgent need for a radical change in management approaches and thinking.

The four areas of management development identified by us in this article "Attention", "Action", "Values", and "Thinking" — have allowed us to focus on different levels of forming its new paradigm. Undoubtedly, the presented content of the matrix parts is not exhaustive — it is merely a foundation that can be used in further work.

The resulting picture can be interpreted differently by each researcher. Let's present our vision:

the coexistence of different, sometimes contradictory, trends in each sector of the development matrix. For example, on one hand, the exponential speed of development of digital technologies and new organizational forms of the economy, and on the other hand, the increase in tension (individual, social, and international); the lag in the transformation of labor, upbringing, and education institutions. Or the increase in production volumes and simultaneously the deterioration of the environment. The conflict of values between the complex, convenient, and fail-safe algorithm of organization and the irrational flexibility of human values. In the formation of thinking through the business model, the increase in the independence of organizational elements, the capitalization of digitized components of reality, the trend of increasing dependence on algorithm-creating platforms, and the urgent need for the development of strategic systemic thinking come into play. A wide range of new requirements for the formation of managerial competencies and relevant management tasks coexist with trends of decreasing demand for managers and professional "burnout".

it is time to transition from analysis that helps model reality within individual fields/sciences to the integration of various areas, including economics, psychology, sociology, management, production organization, philosophy, computer science, data science, and others;

for research and practical management tasks, there is no current need to build fundamental systems and models, but there is a task of maneuvering based on available capabilities, technologies, data, specific temporal conditions, and individuals — rhizomatic mobile (flexible) management;

the author's opinion in the study is that a new management paradigm does not exist as such — there is a permanent process of transformation and the search for an optimal and relevant management system that adapts to prevailing values, digital capabilities, and constant turbulence.

CONCLUSION

The conclusions presented below are more about not the directions of the development of the management paradigm, but they help the organization and the individual making management decisions in the era of the digital economy to orient themselves. In our opinion, when forming organizational culture and business models, it is more important to place the person at the center of the development matrix and the deep focus of attention. Then the potential collapse of technologies driven by algorithms will not be destructive from the perspective of the system of set goals. At the same time, it is worth perceiving the person as an element of an ecosystem much larger in scale than the digital one.

Overcoming crisis and conflict phenomena at both local and international levels, where digital technologies are also applied, is possible only through spiritual and cultural development, through the lens of values. The rhizomatic matrix (at any level of focus) allows one to choose

[10] Technology Vision 2024. URL: https://www.accenture.com/us-en/insights/technology/technology-trends-2024

the appropriate option from the multitude of existing ones. The more diverse and frequent the choices, the easier it is for a person or company to find what contributes to the maximum satisfaction of the need for self-realization and allows the organization to achieve its goals — of various levels, not just financial.

Researchers can further supplement and structure the management development matrix. It can serve as a "compass" for managers at any level, allowing them to focus on the necessary directions during strategic choices or operational management decisions, keeping in mind the interconnectedness of all attention focuses. When a broad focus allows navigating the external environment and basic values (personal and company-wide), a narrow internal focus presents options for building algorithms, models, and their modifications, while a narrow external focus concentrates on specific actions and continuous practice.

Creating decision-making tools based on the proposed matrix requires flexible technology development for each management entity, and comparing the results (both considering the proposed focuses and without taking them into account) will allow for the evaluation of the recommendations' effectiveness.

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Determinants of China's GDP Growth: An Empirical Analysis of Macroeconomic Variables

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ABSTRACT

This study examines the impact of foreign direct investment (FDI), trade, and various macroeconomic factors on GDP growth in China over the period 1982–2022. By Employing the Autoregressive Distributed Lag (ARDL) model, the research investigates the dynamic interplay between GDP growth and fifteen independent variables, including FDI, exports, trade, total debt, and real interest rates. The Augmented Dickey-Fuller (ADF) test confirms the stationarity of the data at first difference. The ARDL model results indicate significant long-term impacts of some variables, particularly the current account balance, exports, and merchandise trade. Short-run dynamics revealed that increased FDI and real interest rates positively affect GDP growth, while increased debt, exports, and final consumption have negative effects. The ARDL bounds test confirms a long-run relationship among the variables. Diagnostic checks show no issues with normality, heteroskedasticity, or serial correlation. This comprehensive analysis provides valuable evidence for policymakers to formulate effective economic policies, promoting sustained growth and stability in China's rapidly evolving economy.

***Keywords**:* GDP growth; foreign direct investment (FDI); Trade; macroeconomic factors; China; ARDL model; economic policy; time series analysis

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INTRODUCTION

China's economic growth trajectory over the past four decades has garnered significant attention in economic literature, largely due to its rapid transformation from a low-income to an upper-middle-income nation. Key drivers of China's growth are foreign direct investment (FDI), trade liberalization, and fiscal policies that have fostered an environment conducive to sustained economic development. While economic reforms initiated in 1978 created a framework for market-oriented growth, the subsequent influx of FDI and expansion in exports solidified China's role in the global economy. This introduction synthesizes the findings of recent studies to contextualize the linkages between FDI, trade, and various economic indicators in China, establishing the basis for this study's research problem and questions.

Research by [1] highlighted that FDI integrates host economies into global markets and improves resource allocation efficiency, thereby fostering sustained economic development despite challenges such as the pandemic. [2] reinforces this finding by illustrating that FDI contributed significantly to income growth in China, especially in coastal regions where trade and infrastructure facilities are more developed. Such regional disparities in FDI effects underscore the need for nuanced policy approaches that address both immediate and long-term growth requirements.

China's reliance on international trade is another crucial element influencing its growth. The study [3] confirms a bidirectional long-term relationship between economic growth and exports and between economic growth and imports, thereby validating the "export-led growth" and "growth-led imports" hypotheses. These results demonstrate China's deep integration into global trade networks, wherein both exports and imports are instrumental to economic expansion. Similarly, Xing and [4] observe that FDI and exports constituted up to 49% of China's GDP growth during specific periods, reflecting a dependency on external demand. This finding reinforces the importance of trade and foreign investment in China's economic framework, albeit raising concerns about the sustainability of such an externally driven growth model.

In addition to FDI and trade, various macroeconomic policies have played pivotal roles. According to [5], China's strategic focus on high-tech exports has not only enhanced trade volume but also improved productivity across regions, thus reinforcing the positive correlation between international trade and regional economic performance. Likewise, the findings of [6] indicate that trade openness significantly contributes to economic growth, both in the short and long term, substantiating the critical role of liberalized trade policies in economic expansion. In a similar vein, [7] argues that China's provincial debt has contributed to economic growth, albeit with regional variations in impact, pointing to a nonlinear, inverted "U-shaped" relationship between debt and growth.

The accumulation of foreign exchange reserves, as [8] demonstrates, also has implications for China's economic resilience and growth stability. Reserves enable China to manage external shocks and maintain economic stability, even as they underscore the country's dependence on international markets. Conversely, [9] suggest that government debt can potentially limit economic growth when the debt-to-GDP ratio exceeds a critical threshold, which aligns with concerns regarding sustainability in debt accumulation. [10] comparative study indicates that China's reserve accumulation strategy reflects a broader trend among emerging markets, which has reinforced stability within an international monetary framework but has also generated significant economic costs.

While the relationship between FDI, trade, and economic growth is well-documented, questions remain regarding the precise dynamics of these interactions. For example, [11] find that financial liberalization may influence interest rates and bond market development, further affecting lending patterns and economic growth. In a related context, [12] suggest that short-term capital inflows impact real exchange rates more than demographic forces, pointing to the intricate effects of financial capital

on economic performance. [13] add that savings patterns are intrinsically tied to economic growth, with savings-growth causality varying by region. These findings underscore the multi-dimensional influences of trade, capital, and financial policies on economic performance. The primary research problem addressed in this study is the exploration of how FDI, trade policies, and fiscal strategies collectively drive China's economic growth. Existing literature highlights the contributions of FDI and trade to GDP growth but does not comprehensively explain their interdependence with debt levels, financial liberalization, and regional disparities. Given China's evolving economic landscape, it is critical to understand how these factors interact within the broader framework of sustainable growth

This research addresses critical gaps in understanding the complex dynamics shaping China's GDP growth by conducting a comprehensive analysis of trade structure, foreign direct investment (FDI), government expenditure, and socio-economic factors. By leveraging recent empirical findings and advanced econometric techniques, this study aims to deepen insights for policymakers, economists, and scholars into the drivers of China's economic trajectory.

Moreover, it contributes to ongoing discussions on sustainable economic development strategies, incorporating environmental impact considerations and long-term economic stability. The primary objectives of this study are manifold: Evaluate the short-term dynamics and assess the immediate impacts of Foreign Direct Investment (FDI), exports, trade, real interest rates, and government final consumption expenditure on GDP growth. Understanding these short-term dynamics is crucial for identifying immediate policy levers that can effectively stimulate economic activity and manage economic fluctuations. Examine long-term relationships: Investigate the persistent effects of merchandise trade, current account balance, total debt, and domestic interest rates on GDP growth over an extended period. By analyzing these long-term relationships, the study seeks to uncover structural factors that contribute to sustained economic growth or pose challenges that need to be addressed for achieving economic stability and resilience. Provide policy recommendations: Offer actionable policy recommendations based on empirical findings to enhance economic growth sustainability. This includes strategies to foster a positive current account balance, manage debt levels effectively, optimize the impact of FDI and trade, and address structural inefficiencies in export and consumption patterns. These insights aim to guide policymakers in formulating strategies that promote sustainable economic development and resilience in the face of global economic uncertainties. The novelty of this study lies in its integrated approach, examining not only FDI and trade but also the impacts of regional disparity, debt, and financial reserves on China's economic performance. By combining macroeconomic variables with region-specific data, this research aims to provide a nuanced understanding of how economic growth is sustained across varying contexts within China. Additionally, the study addresses gaps in the literature concerning debt sustainability and reserve accumulation, thus offering policy recommendations that balance external dependence with fiscal autonomy.

The findings of this study will pave the way for future research on optimizing FDI allocation strategies to balance regional economic disparities in China. Future studies could explore the elasticity of China's trade dependency amidst changing global demand by focusing on the bidirectional relationships between GDP growth, exports, and imports. Additionally, as financial liberalization progresses, further research on the effects of interest rate adjustments and bond market developments could provide insights into China's economic stability.

LITERATURE REVIEW

The Solow-Swan Growth Model, developed by R. Solow and T. Swan in the 1950s, is a neoclassical framework analyzing long-term economic growth through capital accumulation, labor growth, and technological progress. It posits that sustained growth is driven primarily by technological advancements. This model, relevant to the study of China's eco-

nomic growth, helps understand the roles of FDI, government expenditure, and trade structure in economic development. Key assumptions include constant returns to scale, diminishing marginal returns, and exogenous technological progress. However, it has limitations, such as treating technological progress as external, assuming a closed economy, and initially neglecting human capital's role. Despite these limitations, the model provides valuable insights into the mechanisms driving economic growth and informs policy measures for sustaining growth. [14] investigated the effects of FDI and trade openness on the economic growth of BRICS countries from 1990 to 2018. The study aims to elucidate the causal relationships between FDI, trade openness, and GDP in these nations. Employing the Auto Regressive Distributed Lag (ARDL) model for cointegration and Dumitrescu and Hurlin Granger causality tests, the research evaluates both short-term and long-term interactions among the variables. The empirical findings indicate that both FDI and trade openness significantly contribute to long-term economic growth in the BRICS countries. Furthermore, the study establishes a long-run relationship between the real effective exchange rate and gross capital formation with economic growth. The causality analysis uncovers several critical relationships: there is bidirectional causality between FDI and economic growth, as well as between trade openness and economic growth. Additionally, the analysis reveals unidirectional causality from trade openness to FDI. This study provides empirical evidence supporting the positive impact of FDI and trade openness on growth in emerging economies, utilizing advanced econometric techniques. It specifically focuses on BRICS nations, though it does not consider economic changes occurring post. [15] examined the relationship between FDI, trade, and economic growth in East Asian countries using an augmented production function model and panel data from 1980 to 2006. The findings indicate that FDI and trade positively impact economic growth in China, Korea, and Thailand, while the effects are negative in Malaysia and the Philippines. The labor force's impact on growth is statistically insignificant across all countries. Gross fixed capital formation positively influences economic growth in all countries, especially in China and Korea. This research highlights the importance of country-specific factors in understanding the relationship between FDI, trade, and economic growth. However, it does not consider other factors such as government expenditure, debt service, and socio-economic indicators. [16] investigated the factors influencing China's current account surplus from 1994 to 2016. The study examines the relationships between the current account surplus and factors such as the balance of trade, foreign direct investment (FDI), and gross domestic product (GDP). Using factor analysis, multiple regression modeling, and a corrected model, the research assesses the impact of these factors on China's current account surplus. The findings highlight that the balance of trade and foreign direct investment are the primary determinants influencing China's current account surplus. The study concludes by suggesting that the government should closely monitor fluctuations in the current account and implement measures to adjust factors contributing to these fluctuations. [17] examined the primary drivers of Chinese GDP growth from 1998 to 2013, focusing on consumption, investment, exports, and imports. Using factor analysis, multiple regressions, and hierarchical clustering on data from 31 provinces, the study assesses the quantitative relationships between these factors. The findings reveal that consumption is the largest contributor to GDP growth, followed by investment and exports, with imports showing minimal impact. The study underscores the importance of bolstering consumption and maintaining investment for sustainable economic development in China. This research provides empirical evidence on the significant influence of these factors on GDP growth, emphasizing their graded quantitative relationships. [18] investigated the role of international trade in China's economic growth, focusing on how increased participation in global trade and trade structure impact economic productivity. Using both econometric and non-parametric approaches,

the study analyzes a balanced panel dataset from 31 Chinese provinces spanning 2002 to 2007. The econometric approach employs a stochastic frontier production function to estimate province-specific inefficiencies in trade, while the non-parametric approach uses the Divisia index as a benchmark. The findings indicate that China's integration into global trade significantly enhances economic growth, primarily driven by increased trade volume and high-tech exports. The study emphasizes that the eastern region has experienced the most rapid development, while central and western provinces lag in both economic growth and international trade participation. This research contributes to the literature by providing empirical evidence on the positive effects of international trade on China's regional productivity and economic growth. [19] explored the impact of China's integration into the global economy, emphasizing its effects on other Asian countries. It identifies differential impacts based on economic development, industrial specialization, and geographical proximity to China. Countries specializing in components, capital goods, and raw materials benefit from China's economic growth, whereas those focusing on consumer goods may experience negative impacts. The study underscores the importance of supply chain relationships in influencing FDI flows, highlighting those countries near China benefit from geographical proximity and lower production costs. This research provides insights into how China's economic expansion affects regional economies and the dynamics of global trade relationships. [20] investigated the effects of government debt, economic policy uncertainty (EPU), and government spending on institutional quality in BRIC nations from 1990 to 2020. Employing econometric techniques including Augmented ARDL, nonlinear ARDL, and Fourier Toda-Yamamoto causality tests, the research finds that government debt and EPU negatively impact institutional quality, whereas government spending has a positive effect. The study identifies bidirectional causality between government

Table 1

Variable and Indicator Description

Variable Name	Indicator Description
Gross Domestic Product (GDP) Growth Rate	Annual percentage growth rate of GDP
Foreign Direct Investment (FDI)	Net inflows of foreign direct investment (% of GDP)
Exports	Exports of goods and services as a percentage of GDP
Trade	Trade volume as a percentage of GDP
Total Debt (T-DEBT)	Total debt as a percentage of GDP
Merchandise Trade (MERCHANDISE TRADE)	Merchandise trade as a percentage of GDP
Total Reserves (T-RESERVE)	Total reserves, including foreign exchange (% of GDP)
Real Interest Rate (REAL INTEREST)	Inflation-adjusted real interest rates (% of GDP)
Final Consumption Expenditure (F-CONSUMPTION)	Household and government final consumption (% of GDP)
Gross Capital Formation (G-CAPITAL)	Investment in fixed assets as a percentage of GDP
Gross Savings (G-SAVINGS)	Savings as a percentage of GDP
Government Final Consumption Expenditure (GGFCE)	General government spending as a percentage of GDP
Agriculture and Fisheries (A&F)	Value added from agriculture, forestry, and fishing (% of GDP)
Personal Remittances (P-REMITT)	Personal remittances received as a percentage of GDP
Current Account Balance (C-ACC)	Balance of current account transactions (% of GDP)
Domestic Interest Rate (D-INTEREST)	Nominal domestic interest rate

Source: compiled by the authors.

debt and institutional quality, with mixed causal relationships observed for EPU and government spending. These findings contribute to understanding the complex interactions between fiscal policy, economic uncertainty, government expenditure, and institutional quality in emerging economies. [21] emphasize that final consumption expenditure is a major component of GDP, directly affecting economic growth by increasing production and employment. Real interest rates influence investment decisions, balancing investment incentives and controlling inflation. [22] suggest that appropriate real interest rates can foster economic growth by encouraging investment and managing economic activity effectively. Foreign trade plays a pivotal role in GDP growth by facilitating technology transfer, increasing productivity, and expanding market access. [22] highlighted that China's rapid growth in merchandise trade has been a key driver of its economic expansion. Furthermore, he demonstrated that both exports and imports positively impact GDP growth, with foreign trade being a significant factor in long-term economic development. Managing debt levels is crucial for maintaining economic stability and sustainable growth. [23] and [24] indicate that while some debt can stimulate growth through increased investment, excessive debt can lead to financial instability and hinder economic performance. Foreign-invested enterprises (FIEs) have played a substantial role in China's exports and imports, significantly contributing to GDP growth. [4] provided evidence for export-led growth in various Chinese regions, indicating that exports, along with FDI, significantly contribute to regional GDP growth. The dynamic interplay of macroeconomic factors significantly influences GDP growth in China. FDI, interest rates, current account balance, remittances, agriculture, fiscal policy, savings, consumption, real interest rates, foreign trade, debt levels, and exports are crucial in shaping the economic landscape. Understanding these relationships is essential for formulating effective economic policies that promote sustained growth and stability in China's rapidly evolving economy.

METHODOLOGY

Model specification

Model Description and Hypothesis

This study employs a quantitative research design, utilizing time-series econometric techniques to analyze determinants of China's GDP growth over the period 1982–2022. The methodology integrates both descriptive and inferential statistical approaches, focusing on dynamic relationships between macroeconomic indicators through the Autoregressive Distributed Lag (ARDL) model. This model is particularly suitable for examining short-term dynamics and long-term equilibrium relationships among variables, even when exhibit different levels of stationarity. following similar empirical model utilized in numerous prior studies, including those by [4, 7, 25–27]. The dataset comprises annual data for 15 macroeconomic indicators from 1982 to 2022, sourced from reliable secondary databases, including World Development Indicators (WDI).

Table 1 above variables include GDP growth rate, Foreign Direct Investment (FDI), exports, trade, total debt, merchandise trade, total reserves, real interest rates, government final consumption expenditure, agriculture and fisheries, personal remittances, gross savings, gross capital formation, and current account balance. Inclusion of these variables ensures comprehensive examination of the multifaceted factors influencing economic growth.

Model specification follows a framework commonly employed in empirical studies. The dependent variable, GDP growth, is modeled as a function of its own lagged values and those of independent variables. The ARDL model is expressed as follows:

$$GDPt=\beta_0+\beta_1 FDIt+\beta_2 Export_t+\beta_3 Trade_t+\beta_4 RealInterest_t+$$
$$+\beta_5 MerchandTrade_t+\beta_6 Dinterest_t+\beta_7 Tresevre_t+$$
$$+\beta_8 Fconsumption_t+\beta_9 Gcapital_t+\beta_{10} Gsavings_t+$$
$$+\beta_{11} GGFCE_t+\beta_{12} A\&F_t+\beta_{13} Premitt_t+$$
$$+\beta_{14} Tdebt_t+\beta_{15} CACC_t+\varepsilon_{it}$$

$$GPD_t=\alpha+\sum_{i=1}^{p}\beta_i GPD_{t-i}+\sum_{j=0}^{q}\gamma_j X_{t-j}+\varepsilon_t$$

Here GDP_t represents GDP growth; X_t denotes the vector of independent variables; α is the intercept

term; β_i and γ_j are coefficients of lagged and current values, respectively; ε_t is the error term.

Lag lengths were selected based on the Akaike Information Criterion (AIC), ensuring the model's efficiency. The Augmented Dickey-Fuller (ADF) test was employed to verify the stationarity of variables. Results revealed that most variables were stationary at the first difference (I[1]), while a few, such as agriculture and fisheries, government final consumption expenditure, and real interest rates, were stationary at the level (I[0]). This confirmed the appropriateness of the ARDL framework, which accommodates variables of mixed stationarity levels. The ARDL bounds testing approach was utilized to examine the existence of a long-run equilibrium relationship among the variables. The F-statistic of 4.89 exceeded the upper critical bound at a 5% significance level, indicating a significant long-term relationship between the dependent and independent variables. To capture short-term dynamics and the speed of adjustment toward equilibrium, an error correction model (ECM) was derived from the ARDL results. The error correction term was negative and highly significant, suggesting a rapid adjustment of approximately 115.85% per period to restore equilibrium after a short-term shock. The diagnostic checks confirmed the robustness of the model. The Jarque-Bera test indicated that residuals were normally distributed, while the Breusch-Pagan-Godfrey test confirmed homoskedasticity. Additionally, the Breusch-Godfrey LM test revealed no evidence of serial correlation, ensuring the reliability of the estimates. In the short-term analysis, FDI and real interest rates were found to positively and significantly impact GDP growth, while exports and final consumption expenditure exhibited negative effects. Long-term analysis revealed that a positive current account balance and merchandise trade significantly boosted GDP growth, while exports and domestic interest rates had negative impacts in the long run.

This comprehensive methodological framework ensures robust and reliable findings. By combining rigorous econometric modeling with thorough diagnostic testing, the study provides

Table 2

Results of Descriptive Statistics

Variables & Statistics	Mean	Median	Std. Dev	Maximum	Minimum	Observations
GDP	9.228	9.237	3.013	15.192	2.239	41
D-INTEREST	4.533	3.000	3.158	11.340	1.500	41
FDI	2.621	2.569	1.602	5.987	0.151	41
T-DEBT	1.456	1.501	0.554	2.462	0.721	41
C-ACC	2.130	1.802	2.704	9.948	–3.685	41
P-REMITT	0.163	0.152	0.903v	0.477	0.033	41
A& F	4.443	3.961	2.250	12.881	1.844	41
GGFCE	14.937	14.798	1.219	17.130	12.498	41
G SAVINGS	42.238	41.773	5.391	51.548	32.971	41
G-CAPITAL	39.849	39.910	4.294	46.660	31.926	41
F-CONSUMPTION	57.848	58.179	5.304	67.451	48.913	41
EXPORTS	19.553	19.493	7.809	36.035	7.205	41
REAL INTEREST	2.023	2.638	3.1276	7.356	–7.989	41
T-RESERVE	181.894	152.443	124.675	539.697	31.766	41
TRADE	36.887	37.482	13.695	64.479	13.566	41
MERCHANDISE TRADE	37.035	33.815	12.245	63.967	14.312	41

Source: compiled by the authors.

nuanced insights into the dynamic interplay of macroeconomic variables shaping China's GDP growth. These results offer valuable guidance for policymakers to design strategies fostering sustainable economic development.

Data analysis

Table 2 shows the statistical summary of the factors used in the study with a total of 41 observations for each variable. The results show that the mean of **GDP growth** rate is 9.23%, with a standard deviation of 3.01, maximum 15.19%, and the minimum is 2.24%.The mean of **Domestic Interest Rate (D-INTEREST)** is 4.53%, with a high standard deviation of 3.16, with ranges from 1.5% to 11.34%. **Foreign Direct Investment (FDI)** averages

Table 3

ADF Unit Root Rest

Variables	P-value, At level	P-value 1st Difference	Level of integration
GDP GROWTH RATE	0.0843	0.0000	1(1)
A&F	0.0000	–	1(0)
D.INTERSTR	0.7118	0.0001	1(1)
FDI	0.4515	0.0004	1(1)
T. DEBT.S	0.5416	0.0000	1(1)
TRADE	0.4238	0.0002	1(1)
C.ACC.B	0.2229	0.0000	1(1)
P. REMITT	0.0016	0.0000	1(1)
GGFCE	0.0193	–	1(0)
G. SAVING	0.3159	0.0036	1(1)
G. CAPITAL.F	0.1293	0.0006	1(1)
F. CONSUMPTION	0.2856	0.0060	1(1)
EXPORTS	0.5008	0.0001	1(1)
REAL INTEREST	0.0031	–	1(0)
T. RESERVE R	0.3304	0.0119	1(1)
MRCHANDAIS TRADE	0.3242	0.0004	1(1)

Source: compiled by the authors.

Table 4

Short-run output results

Variable	Coefficient	Std. Error	t-Statistic	Probability Value
D(C_ACC_B)	8.509029	0.672629	12.65041	0.0000
D(DEBT)	–2.162139	0.628301	–3.441247	0.0036
D(EXP0RTS)	–18.73335	1.462102	–12.81262	0.0000
D(F_CONCUMPTION)	–13.07277	0.966036	–13.53239	0.0000
D(FDI)	1.331729	0.300623	4.429899	0.0005
D(MERCHAND_TRADE)	–0.942539	0.146433	–6.436681	0.0000
D(REAL_INTEREST)	0.249986	0.076441	3.270312	0.0052
COINTEQ (–1)	–1.158475	0.088340	–13.11378	0.0000

Source: compiled by the authors.

2.62%, with Std. Dev. 1.60 and ranges from a low of 0.15% to a high of 5.99%. **Total Debt (T-DEBT)** mean is 1.46 with standard deviation of 0.55 and minimum of 0.72, and the maximum of 2.46. **The current Account Balance (C-ACC)** mean is 2.13, with standard deviation 2.70, with minumum of –3.69 and maximum of 9.95.Mean of **Personal Remittances (P-REMITT)** is 0.16, with Std. Dev. of 0.09) and minimum of 0.03 with maximum of 0.48. **Agriculture & Fisheries (A&F)** mean value is 4.44 with Std. Dev. 2.25 and ranges from 1.84 to 12.88.

Government Final Consumption Expenditure (GGFCE) mean is 14.94, with a standard deviation of 1.22 with minimum of 12.50 and maximum of 17.13. Mean of **Gross Savings (G SAVINGS)** is 42.24, with Std. Dev. Of 5.39, and minimum of 32.97 and maximum of 51.55. **Gross Capital Formation (G-CAPITAL)** average is 39.85, with Std. Dev. of 4.29, minimum of 31.93 and maximum of 46.66. **The final Consumption (F-CONSUMPTION)** mean is 57.85 with a standard deviation of 5.30, minimum of 48.91 and maximum of 67.45. **Exports** mean is 19.55 with a Std. Dev. Of 7.81 and minimum of 7.20 and miximum of 36.04. **The real Interest Rate (REAL INTEREST)**

Table 5

Long-run output results

Variable	Coefficient	Std. Error	t-Statistic	P-Value
GDP (–1)	–0.158475	0.206291	–0.768213	0.4543
A_F	0.113655	0.215910	0.526398	0.6063
C_ACC_B	8.509029	5.204466	1.634948	0.1229
C_ACC_B (–1)	2.130773	0.481617	4.424211	0.0005
D_INTERSTR	0.163787	0.479241	0.341763	0.7373
D_INTERSTR (–1)	–1.352161	0.444573	–3.041485	0.0082
DEBT	–2.162139	1.627987	–1.328106	0.2040
DEBT (–1)	–2.639068	1.351411	–1.952824	0.0698
EXPORTS	–18.73335	10.67423	–1.755007	0.0997
EXPORTS (–1)	–3.421516	0.979287	–3.493885	0.0033
F_CONCUMPTION	–13.07277	8.750179	–1.494000	0.1559
F_CONCUMPTION (–1)	0.569167	0.406753	1.399292	0.1821
FDI	1.331729	0.664649	2.003659	0.0635
FDI (–1)	0.826343	0.767949	1.076038	0.2989
G_SAVING	–11.81616	8.750580	–1.350329	0.1969
GGFCE	–0.337053	0.993886	–0.339127	0.7392
MERCHAND_TRADE	–0.942539	0.476463	–1.978201	0.0666
MERCHAND_TRADE (–1)	1.300542	0.408202	3.186028	0.0061
P_REMITT	4.698772	3.939156	1.192837	0.2515
REAL_INTEREST	0.249986	0.238661	1.047454	0.3115
REAL_INTEREST (–1)	–0.415077	0.207412	–2.001220	0.0638
T_RESERVE	–0.013424	0.009335	–1.438029	0.1710
TRADE	10.58369	5.354044	1.976765	0.0668
C	1295.815	872.6752	1.484877	0.1583

Source: compiled by authors.

average is 2.02, with a standard deviation of 3.13, minimum of –7.99 and maximum of 7.36. **Total Reserves (T-RESERVE)** average is 181.89, with Std. Dev. 124.67), minimum of 31.77 and maximum of 539.70. The mean of **Merchandise Trade (MERCHANDISE TRADE)** is 37.03, with moderate variability (Std. Dev. 12.24), showing fluctuations from 14.31 to 63.97. TRADE reveals a central tendency with a mean of 36.887 a median of 37.482 and standard deviation of 13.695, a minimum of 13.566 to a maximum of 64.479.

Unit Root Test

To avoid spurious results, the Augmented Dickey-Fuller unit root test is commonly used [28]. For checking stationarity, we used the ADF unit root test as shown in *Table 3*. A& F, GGFCE, and Real interest rate are stationary at level but the rest are stationary at first difference. The significance level used to test the hypothesis is 5%.

Short-run output results

Considering data in *Table 4*, The error correction term is negative and highly significant, indicating that any short-run disequilibrium is corrected at a speed of approximately 115.85% per period. This suggests a strong tendency to return to the long-run equilibrium. The differenced current account balance has a positive and highly significant effect in the short run, suggesting that an increase in D(C_ACC_B) by one unit increases the DGP growth by approximately 8.51 units. The differenced debt has a negative and significant effect in the short run, indicating that an increase in D(DEBT) by one unit decreases the DGP growth by approximately 2.16 units. The differenced exports have a highly significant negative effect in the short run, suggesting that an increase in D(EXP0RTS) by one unit decreases the DGP growth by approximately 18.73 units. The differenced final consumption has a significant negative effect, indicating that an increase in D(F_CONCUMPTION) by one unit decreases the GDP growth by approximately 13.07 units. The differenced foreign direct investment has a positive and significant effect, suggesting that an increase in D(FDI) by one unit increases the GDP growth by approximately 1.33 units. The differenced merchandise trade has a negative and significant effect, indicating that an increase in D(MERCHAND_TRADE) by one unit decreases the GDP growth by approximately 0.94 units. The differenced real interest rate has a positive and significant effect, suggesting that an increase in D(REAL_INTEREST) by one unit increases the GDP growth by approximately 0.25 units. All variables have a short-run impact on GDP growth except the D-Interest rate. The lagged value of MERCHAND_TRADE has a positive and significant effect, indicating that a unit increase in MERCHAND_TRADE (–1) increases the GDP growth by approximately 1.30 units in the long run. The lagged value of C_ACC_B has a positive and highly significant effect on the dependent variable, indicating that a unit increase in C_ACC_B (–1) increases the GDP growth by approximately 2.13 units in the long run. The lagged value

Table 6

ARDL Bound test (Null Hypothesis of No long-run relationships exist)

Test Statistics	Value	K
F-statistics	4.894816	15
Critical value bound		
Significance	10 Bound	11 Bound
10%	1.76	2.77
5%	1.98	3.04
2.5%	2.18	3.28
1%	2.41	3.61

Source: compiled by authors.

of EXP0RTS has a negative and significant effect on the dependent variable, suggesting that a unit increase in EXP0RTS (–1) decreases the GDP growth by approximately 3.42 units in the long run. The ARDL model results suggest that certain lagged variables, particularly C_ACC_B (–1), D-INTEREST (–1), EXP0RTS (–1), and MERCHAND_TRADE (–1), have significant long-term impacts on the dependent variable. In contrast, other variables either do not have a statistically significant effect or their significance is marginal.

Long-run output results

According to *Table 5*, the lagged value of the current account balance (C_ACC_B) has a significant positive effect on the long-run output. A one-unit increase in the lagged current account balance leads to an increase of approximately 2.13 units in the long-run output, holding other variables constant. The lagged value of the domestic interest rate (D_INTERSTR) has a significant negative effect on the long-run output. A one-unit increase in the lagged interest rate results in a decrease of approximately 1.35 units in the long-run output, indicating that higher past interest rates may dampen economic output over time. The lagged value of exports has a significant negative effect on the long-run output. A one-unit increase in lagged exports leads to a decrease of approximately 3.42 units in long-run output. This counterintuitive result could suggest that past exports might be associated with a crowding-out effect or other structural issues in the economy. The lagged value of merchandise trade has a significant positive effect on the long-run output. A one-unit increase in lagged merchandise trade leads to an increase of approximately 1.30 units in the long-run out-

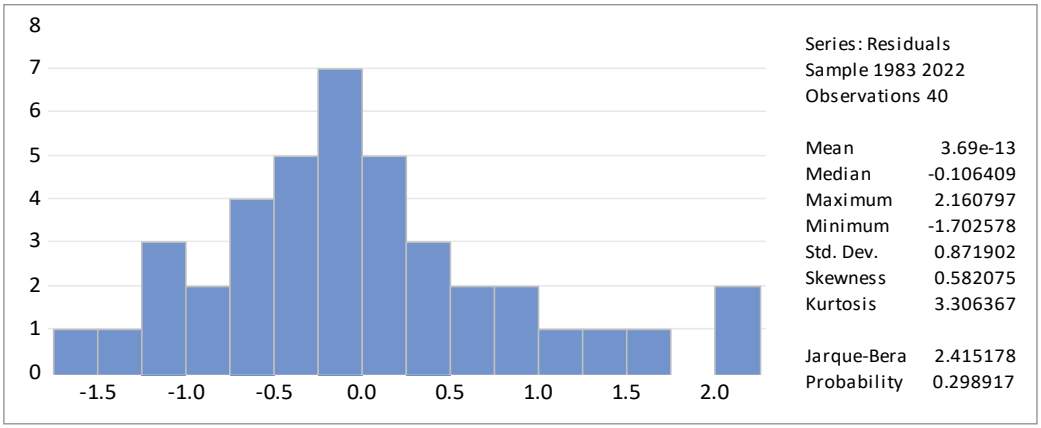

Fig. **Normality test**

Source: compiled by the authors.

Table 7

Heteroskedasticity Test

F-statistic	1.194622	Probability value F (24,15)	0.3676
R-squared	26.26088	Probability value of Chi-Square (24)	0.3401
Scaled explained SS	4.258634	Probability value of Chi-Square (24)	1.0000

Source: compiled by the authors.

Table 8

Serial correlation test

F-statistic	0.019619	Probability value F (1,10)	0.8914
R-squared	0.060700	Probability value of Chi-Square (24)	0.8054

Source: Author's compilation from EViews output

put, highlighting the importance of trade in driving economic growth.

ARDL Bound test

The results of the ARDL bound test (*Table 6*) above shows that there is a long-run relationship exists because the value of the F-statistic is 4.894816, which is more than the upper bound test. *Table 6* shows the existence of a long-run relationship among variables.

Diagnostic check

Normality Test

As we can see in *Figure, the P-value is 0.298917, which is greater than 0.05, and the Jarque-Bera test statistic has a high p-value of 0.299817, which is greater than 0.05. Thus,* we cannot reject the null hypothesis that the residuals are normally distributed.

Heteroskedasticity

Breusch-Pagan-Godfrey: Null hypothesis indicates the availability of Homoskedasticity (*Table 7*).

Since prob, chi-Square is 0.3401 which is greater at 5%, therefore, we fail to reject the null hypothesis of homoskedasticity. There is no evidence of heteroskedasticity, as indicated by the Breusch-Pagan-Godfrey test.

Serial correlation test

Breusch-Godfrey Serial Correlation LM Test: Null hypothesis (no serial correlation at up to 1 lag).

Since the Probability Value of Chi-square is **0.8054** (*Table 8*), which is greater than 0.05, so we can conclude that there are no serial correlations.

RESULTS AND DISCUSSION

This study has found a direct relationship between Foreign Direct Investment (FDI) and Gross Domestic Product (GDP). This is in line with [29] who conducted an extensive analysis from 1987 to 2013 by utilizing multiple regression models and T-statistics, which confirmed a positive and significant relationship between FDI and GDP growth in China. The study has discovered an inverse relationship between Domestic interest rate and Gross Domestic Product (GDP). This is in tandem with the study conducted by [30] who emphasized that lower domestic interest rates generally stimulate economic activity by encouraging borrowing and investment.[31] found that remittances help reduce poverty and stimulate economic activity, providing an important source of financing for development. [32] further demonstrate that remittances support investments in education, health, and small businesses, fostering economic growth. This aligns with the results of this study, which disclosed the direct link between personal remittances and Gross Domestic Product. Many studies found a positive relationship between Exports and GDP and one of them is [33] who used a sample of developing and developed countries, this study found strong evidence that export growth leads to GDP growth, particularly in developing countries. This study also found a direct relationship between exports and GDP in the short-run. As well as [34] found that trade openness is widely regarded as a catalyst for economic growth. It facilitates access to larger markets, encourages competition, and allows for the efficient allocation of resources. This study confirmed that indeed trade contributes positively to GDP. [22] found out that real interest rate affects investment decisions and consumer spending, thereby influencing GDP. Higher real interest rates can lead to reduced investment and consumption, while lower rates can stimulate economic activity thereby confirming our results. [35] said that Merchandise trade, which includes the import and export of goods, directly affects GDP through its impact on net exports. Higher merchandise trade can indicate robust economic activity. This study got the same results showing a direct relationship between merchandise trade and GDP. discovered that total reserves, including foreign exchange and gold, provide a buffer for economic stability and can influence GDP by supporting confidence in a country's financial stability. This opposes the results of this study which it has found an inverse relationship. [36] found that Final consumption expenditure, which includes household and government spending, is a major component of GDP. It reflects the demand side of the economy. This study is here to confirm the positive relationship between consumption and GDP. Gross savings provide the

funds necessary for investment in an economy. Higher savings rates can lead to higher investments and, consequently, higher GDP. This is the opposite of the results from this study. This study found an inverse relationship between savings and GDP. [37] examined the relationship between government expenditure and economic growth in Sweden and found that higher government consumption expenditure is associated with lower GDP growth. This study has also confirmed that result. Agriculture and fisheries sector is vital for many economies, especially in developing countries. Its contribution to GDP reflects the importance of these sectors in providing food security and employment. This study has also found a direct link between Agriculture & Fisheries and the GDP of China. The study found that a positive current account has a positive relationship with GDP, thereby confirming what [38] found. The current account balance, which includes trade balance, net income from abroad, and net current transfers, reflects the economic transactions of a country with the rest of the world and can affect GDP. [23] discovered that Total debt, particularly public debt, can influence GDP through its impact on fiscal sustainability and interest rates. High debt levels can constrain economic growth if not managed properly. The study also found a negative link between total debt and GDP. C_ACC, Exports, and Merchandise trade had short-run and long-run impacts on GDP whilst Domestic interest had a long-run impact on GDP but not on the short-run. Debt, consumption, FDI, and real interest rate and short-run impacts on GDP but they had no impact in the long run.

CONCLUSION

This study investigates the impact of multiple economic indicators on GDP growth in a longitudinal analysis spanning from 1982 to 2022. By Utilizing an empirical model consistent with prior studies, we explored the relationships between GDP growth and fifteen independent variables: Foreign Direct Investment (FDI), exports, trade, real interest rate, merchandise trade, domestic interest rate, total reserves, final consumption expenditure, gross capital formation, gross savings, government final consumption expenditure, agriculture and fisheries, personal remittances, total debt, and current account balance. The data were sourced from the World Development Indicators (WDI), ensuring a comprehensive and robust dataset. The analysis reveals several critical insights. Descriptive statistics indicate that GDP growth has shown resilience and variability, with an average growth rate of 9.23% and a range from 2.24% to 15.19%. This variability estimates the dynamic nature of the economic environment over the study period. Key indicators such as domestic interest rates, FDI, total debt, trade, and the current account balance also displayed significant variability, reflecting their key roles in economic performance. The Augmented Dickey-Fuller (ADF) test results ensured the stationarity of variables, preventing spurious regression results. Most variables were stationary at the first difference, while a few, such as agriculture and fisheries, government final consumption expenditure, and real interest rates, were stationary at the level. This foundational step validated the integrity of our subsequent econometric analyses. In the short-run analysis, the (ECM) error correction model indicates a strong adjustment mechanism, with the error correction term being negative and highly significant. This suggests that any deviations from the long-run equilibrium are corrected swiftly, with an adjustment speed of approximately 115.85% per period. Short-run dynamics reveal that the differenced current account balance positively impacts GDP growth significantly, indicating that improvements in the current account balance can substantially boost economic growth. Conversely, increases in debt and exports have significant negative impacts on GDP growth in the short run. The negative impact of exports may seem counterintuitive; however, it can be indicative of structural issues within the economy or the presence of re-export activities that do not add substantial value domestically. Final consumption expenditure also negatively affects GDP growth, highlighting potential inefficiencies or consumption patterns that do not translate into productive

economic activity. Foreign direct investment and real interest rates positively impact GDP growth in the short run. The positive effect of FDI underscores its role as a critical driver of economic growth through capital inflows, technology transfer, and job creation. The positive impact of real interest rates suggests that higher real returns on savings might stimulate investment and economic activity. Long-run analysis through the ARDL model provides deeper insights into persistent economic relationships. Notably, the lagged value of merchandise trade positively and significantly affects GDP growth, emphasizing the long-term benefits of trade in driving economic performance. Similarly, the lagged current account balance continues to positively impact GDP growth, reinforcing the importance of a healthy external balance for sustained economic development. However, lagged exports and domestic interest rates shows negative long-term effects on GDP growth, which may indicate structural inefficiencies or over-reliance on volatile sectors. The ARDL bound test confirms the existence of a long-run relationship among the variables, further validating the robustness of our econometric model. Diagnostic checks affirm that our model is well-specified, with normally distributed residuals, no evidence of heteroskedasticity, and no serial correlation. This study highlights the dynamic interactions between various economic indicators and GDP growth. Policy implications are profound: fostering a positive current account balance, managing debt levels, and strategically leveraging FDI and trade can significantly enhance economic growth. Conversely, addressing structural inefficiencies related to exports and consumption patterns is crucial. Future research could extend this analysis by exploring sector-specific impacts and incorporating more granular data to refine our understanding of these complex economic relationships. This comprehensive analysis provides a robust foundation for policymakers to formulate strategies that promote sustainable economic growth.

To sustain and enhance China's economic growth, it is essential to adopt a multifaceted approach. This includes enhancing FDI through favorable policies and infrastructure improvements, fostering a positive current account balance by diversifying exports and adding value to raw materials, and managing domestic interest rates to balance savings and investment. Optimizing government expenditure by prioritizing high-impact projects and encouraging public-private partnerships is crucial, alongside addressing structural inefficiencies in exports and consumption. Effective debt management, promoting gross capital formation through incentives and innovation, and improving trade infrastructure and policies are vital. Long-term economic planning and continuous monitoring of policies, complemented by future research and sector-specific analysis, will ensure a resilient and sustainable economic landscape. These strategies collectively aim to bolster China's economic sustainability and long-term growth prospects.

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Resource Potential as a Key Element in Effective Management of a Charitable Foundation

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ABSTRACT

The quantity and quality of resources available to a charitable foundation (CF) are indicators of the range of services it can provide to beneficiaries within its operational area. Therefore, the potential for stable development of a CF is determined by the adequacy of its resource potential. Investigating and establishing relationships between the elements of the foundation aims to enhance the theoretical framework necessary for analyzing management mechanisms of non-profit organizations, thereby facilitating the achievement of the CF's statutory goals and its effective development through resource provision. The purpose of this study is to expand the conceptual framework in the field of charitable activities and to substantiate the impact of resource potential on the effectiveness of foundation management. As a result of the research, the authors define the concepts of "resources" and "resource potential" of a CF; they identify and justify both its composition (i.e., the combination of internal and external resources involved in the production and delivery of charitable services) and its structure, graphically represented as production resources and intangible assets with stable economic ties among themselves and with external environmental elements. The obtained results can be utilized in academic and educational processes and may be of interest to representatives of charitable organizations.

Keywords: resource potential; charitable foundation; resources of a charitable foundation; non-profit organization management

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INTRODUCTION

The interest in improving the mechanisms of management of public charitable foundations (non-profit organisations, or NPOs), ensuring the sufficiency of their resource potential and their stable development, is present in the State policy of modern Russia. In particular, it was reflected in the Concept of Support for the Development of Charitable Activities in the Russian Federation for the period up to 2025.[1] The main reason for the increased attention of the State and society to the activities of NPOs is that, currently, NPOs have a significant impact on the macroeconomic situation not only in the country, but also worldwide. NPOs represent the "non-profit third sector of the economy", as providers of socially significant charitable services. If their resource potential is sufficient, such foundations are able to act as employers offering competitive jobs. From the Government's point of view, the tendency to increase the number of permanently functioning charitable foundations allows the development of non-profit areas of the economy, which are of no interest for commercial activities.

The study of effectiveness of charitable foundation's management is based on determination of interrelations between the structural elements of its resource potential, which reflect the ability of charity foundations to achieve their statutory objectives.

The study solved consistently the following tasks:

1. The research of theoretical approaches and scientific theories, which make the basis for the analysis of the resource potential of NPOs.

2. The development of classification of the NPOs' resources.

3. The substantiation of composition and structure of the NPOs'resource potential.

4. The substantiation of the impact of the resource potential on the effectiveness of the NPOs' management.

In the process of research, the authors of the article used methods of analysis, synthesis, generalisation and systematisation of the results of scientific research work. Statistical data from open information sources, contemporary domestic and foreign scientific publications, the authors' own research data and their development within this article on the subject served as an information and empirical base.

LITERARY REVIEW

A resource potential of any charitable foundation is a key factor in determining the foundation's ability to effectively fulfill its mission and help those in need. The academic literature and the professional community of social sector representatives usually include financial resources, volunteers, partnerships, expertise and access to information and communication technologies in the notion of the potential of a charitable foundation. Diversity and optimal use of resources allow the foundation to implement projects and programmes for the benefit of society. Sufficiency of resource potential contributes to optimal NPOs' activities and ensures their development in the social services market.

Nowadays, the conceptual basis for the study of resource potential is the theory of management, the theory of resource approach and the theory of social capital.

The authors of the first theory (J. Barney, M. Porter, R. Kaplan, D. Norton, etc.) assume that resource potential is an important factor influencing the success of an organisational system [1, p. 115–117; 2, p. 233–247; 3, p. 87–91].

The second theory emphasies, that such resources as knowledge, information and experience are important for the achievement of individual and organisational goals and it also suggests, that access to and control over resources can lead to competitive advantage. The resource-

[1] Order of the Government of the Russian Federation dated 15.11.2019 No. 2705-R "On Approval of the Concept of Supporting the Development of Charitable Activities in the Russian Federation until 2025". URL: https://docs.cntd.ru/document/563813237

based view (RBV) of a commercial organisation, developed in the 1980s by academics D. Barney, B. Wenerfelt and others [1, p.116], assumes that such resources as valuable, rare, unique and irreplaceable assets and capabilities of a company are the main factors of its competitive advantages and productivity.

Contemporary researchers have not studied the prospects of applying the theory of resource approach to non-profit organisations, however, it is important to note the relevance and requirements for such a research. In fact, it is quite necessary to identify which resources of a charitable foundation are considered valuable, rare, unique and irreplaceable in order to understand how to obtain and control them.

Indeed, access to resources and control over them will mean for a charity foundation to achieve sustainability in the market of social services, provide decent working conditions and competitive salaries to its employees, which will directly influence the quality and quantity of charitable services it provides to the population.

On the other hand, the theory of social capital, developed by various authors including P. Bourdieu, J.S. Coleman and R.D. Putnam, focuses on the value derived from relationships and social networks [4, pp. 32–48; 5, p. 26; 6, p. 177–181]. This theory suggests that social ties and the resulting trust, norms and obligations may generate valuable resources for individuals and entities.

For example, P. Bourdieu stated, that social structures of the economy are related to distribution of resources, power and opportunities, which are influenced by such factors as social class, cultural capital and regulated norms. His book *Social Structures of the Economy* about the influence of social and cultural factors on economic systems, states that economic practice is shaped by social relations and cultural forces [4, p. 36].

P. Bourdieu emphasised the role of symbolic power in shaping economic behaviour and resource allocation, arguing how social and cultural capital, as well as habitus,[2] influence economic outcomes. The scholar's work is a critical analysis of interaction between social structures and economic processes with special emphasis of the importance of understanding the wider context in which economic activities operate [4, p. 48].

As to the field of charitable services, the theory of social capital explains the success of formation of financial resources by individual charitable foundations, which run active social campaigns. In other words, if a charitable foundation has an informative, constantly updated with new content and convenient-for-users website, and if the foundation communicates to share information through social networks and actively participates in public life via the Internet, it usually has no difficulty in attracting financial resources for its charitable services. This generates recognition and trust towards such charity foundations, their brands and activities by potential donors and representatives of the local community.

SUBSTANTIATING THE COMPOSITION OF RESOURCE POTENTIAL OF A CHARITABLE FOUNDATIONS

The analysis of the scientific literature on management theory reveals different interpretations of the concept of "resource potential" however, due to a very specific functioning it is impossible to use correctly not a single definition in relationship towards charitable foundations.

In management theory, it is common to distinguish between labour, production and material resources, the totality of which characterises the potential of an economic entity [7, p. 43]. However, due to the non-commercial nature of activities of charitable foundation's, the classical structure of resources does not reflect the economic basis of its functioning. For instance, this regards the use

[2] Habitus — a system of acquired perceptions that function in practice as categories of understanding and evaluation, or as a principle of class distribution, at the same time, it is an organisational principle of action. [5, p. 148].

of free-of-charge volunteer labour, which does not fall under the category of labour resources, or collection donations by means of virtual platforms, which are not related to either production or material resources.

In scientific works on management theory, the authors [8, p. 18] offer interpretation of resources as the aggregation of elements that directly or indirectly participate in the creation of a product. In this study, it is the charitable service. Consequently, the basic characteristic of resources is their relation to the production process. Therefore, such authors as K. McConnell and S. Brue determine land, capital, labour and entrepreneurial skills as resources of the organisational system [9, p. 12–14]. This definition is also inapplicable to charitable foundation, as land as a resource is not a fundamental element for the production of non-profit services. For example, the latter can be created, on the Internet and transferred to the territory of the customer (recipient).

Yu.V. Vertakova [10, p. 71] suggested to consider resources from the perspective of internal links between the components of the organisational system, linking resources directly to the production process. The scientist suggests a part of them transformed into a material form to be to regarded as the product output by the organisation, meanwhile the other part is immaterial: services.

Meanwhile working with open sources, the authors of this article did not find any scientifically substantiated information related to the composition of the resource potential of NPOs. Even more so, no data on the resources of charitable foundations. Nevertheless, using the classical economic works of the above-mentioned authors, including Yu.E. Klishina [11, p. 29] with resources assumed not only as funds, stocks and sources available to an economic entity, but also as those elements that can potentially be used in the future, we have developed a classification of resources of the charitable foundation (*Fig. 1*).

In this study, they are understood as material and intangible, labour, financial and other assets available to charitable foundations to achieve its statutory objectives.

In accordance to the *factor of affiliation to the charitable foundation*, the resources are subdivided into the following groups:

1. Resources in the external environment. Potential resources in the possession of potential donors: financial, labour, material, etc., which can be transferred to the foundation under certain conditions [12, p. 42].

2. Resources in the internal environment of the foundation. Available tangible, intangible, labour and other resources to the foundation and distributed by it in various directions of use [13, p. 206].

According to the degree of involvement in the process of providing services, the resources of the charitable foundations fall into the following types:

1. Permanent resources. They include the resources necessary for the provision of a charitable service (without these resources, the service cannot be provided).

2. Reserve resources. They are necessary for the functioning of the foundation: remuneration of employees, payment of utilities and rent, etc. These funds belong to the category of reserve funds, since in the course of the foundation's activity there may be a need for specific donations, and, in this case, the money for its own needs cannot be withheld from such donations. If so, the foundation will not be able to operate without reserve resources.

3. Potential resources. They are needed for the foundation to allocate for growth using the investment instrument.

In accordance with purpose of their use, there are the following types of resources:

1. Resources intended for transfer to the external environment, namely, for the purpose of rendering charitable services to recipients.

2. Resources intended for its own consumption, both for servicing current administrative and economic activities and for investment in order to increase the resource potential.

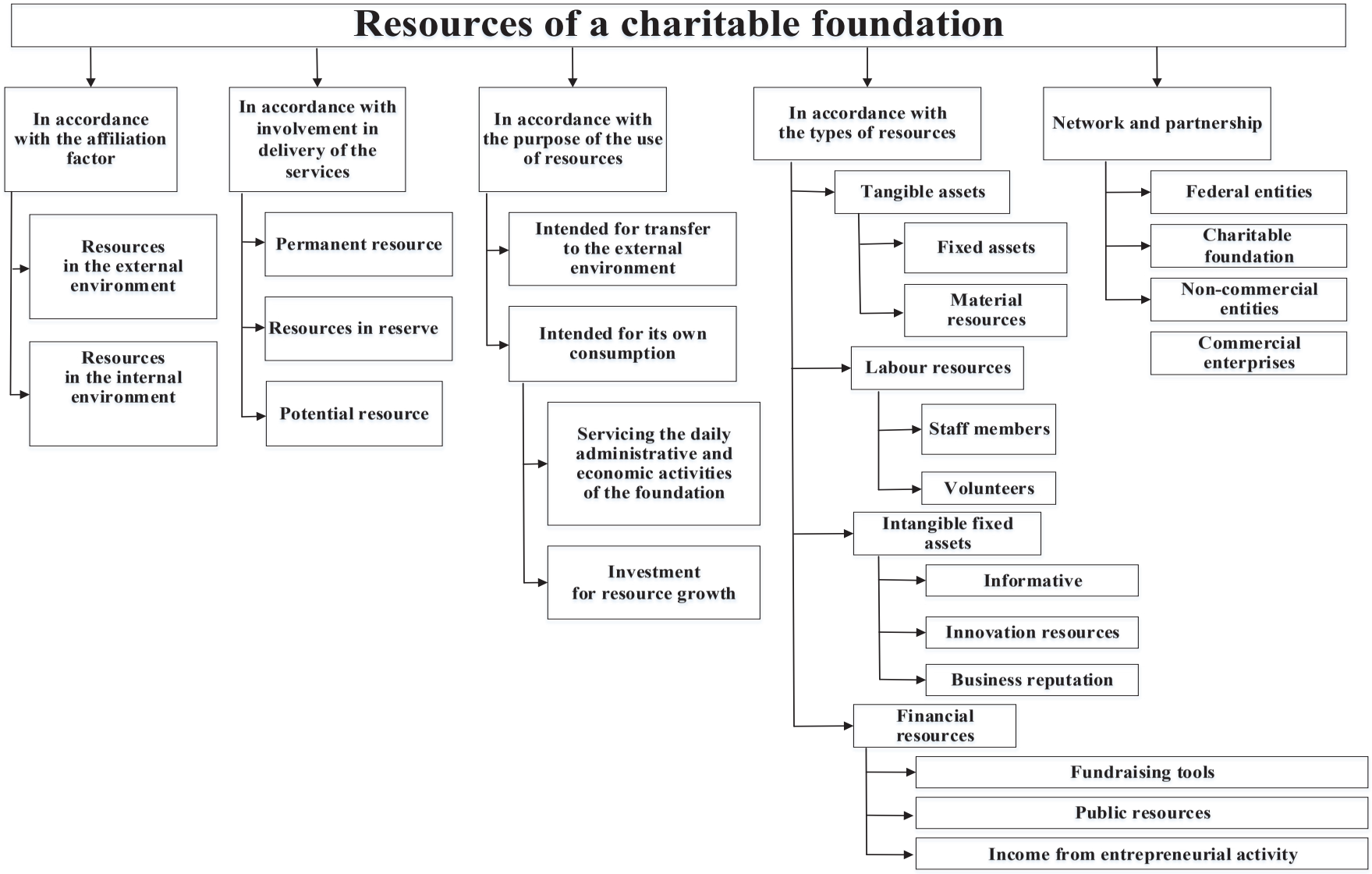

Fig. 1. **Classification of the resources of a charitable foundation**

Source: compiled by the authors.

The resources of a charitable foundation fall into *the following types*:

1. Tangible assets, expressed in total by means and items of work. It is important to understand that there are two methods to form this type of asset base: (A) through the acquisition of a material resource by the managed subsystem of the charitable foundation at the expense of its own funds, (B) as a donation — the asset arrives on the balance sheet of the foundation through direct transfer by the donor.

2. Labour resources are full-time employees and volunteers operating in the process of a charitable service.

3. Intangible assets of the BF include the following:

• Information resources including online and offline platforms, where the managed subsystem of the foundation implements charitable projects — the foundation's website, pages and adverts in social networks, banners in shopping centres, etc.

• Innovative resources, which is an organised set of interrelated conditions and results that ensure, on the one hand, the preservation and increase of resource potential and, on the other hand, the possibility of developing and applying new methods and tools of interaction with donors and recipients in the practical activities of the foundation. Innovative resources also include expertise and knowledge that the foundation can make available free of charge to other organisations and associations (educational institutions, health institutions, environmental companies and communities, etc.).

• Databases required by the foundation's management subsystem to automate the processes of interaction with donors (legal entities) and recipients. The databases can operate as a customer-related management (CRM) system. It contains the information on the history of relations and activity with participants of charitable services, in the form of personal cards reporting the detailed chronology of interaction starting from the phone calls and the first meeting to the provision of services. By analysing the information on donors or legal entities available in the databases, the foundation can improve the efficiency of the managed subsystem in receiving resources. By studying the information on recipients, it can improve the quality of using the elements of resource potential, when providing them with a charitable service.

• Business reputation is a resource in its own right, the creation and maintenance of which to a large extent determines the success of cooperation with both donors and recipients.

4. Financial resources of the non-profit foundation are formed by means of donations from donors, individuals or legal entities, entrepreneurial activities of the foundation and investments [14, p. 115].

Thus, the resources accumulated in any reserves are of paramount importance for any entity, including a charitable foundation. Based on the teachings of P. Drucker [15, p. 63], who confirms that a natural resource acquires its value only after a person determines its useful economic properties, and then it is possible to justify the growing importance of intangible assets in the structure of foundation's resources.

SUBSTANTIATION OF RESOURCE POTENTIAL STRUCTURE OF A CHARITABLE FOUNDATION

When discussing resource potential of a charitable foundation, it is necessary to study the etymology of the term under consideration. In French, the word "resources" means funds, stocks, income, etc., and the word "potential" (*potentia* in Latin) means power, opportunity, authority.

For non-profit foundations in general and for a charitable foundation in particular, resource potential means the existence of real and potential opportunities that determine the achievement of statutory objectives from the point of view of the charitable foundation and the efficiency of

economic activity from the point of view of non-commercial companies.

A. N. Chaplina and E. A. Gerasimova [16, p. 89–95] interpreted resource potential as a set of labour and production resources of an entity capable to ensuring its continuous and effective activity. V. M. Ramzaev [17, p. 16–17] estimated resource potential as the ability of an organisational system to carry out planned technological process and reach the required results.

S. G. Ryzhuk, E. I. Ovachuk [18, p. 116–117] propose to consider the concept of "resource potential of an organization" from the point of view of multiple characteristics and to include in its structure production with labour and material resources, fixed assets, as well as financial, innovative, information resources and entrepreneurial ability, which reflect an independent category.

However, the concept of "entrepreneurial ability" cannot be applied to the activities of a charitable foundation, as the purpose of such an organisation is not to make a profit or distribute it to its participants. However, it is important for a non-profit entity to organise its activities in such a way, that the amount of actual, incoming, and potential resources is always higher than the amount of resources consumed, which means transferred to the external environment or distributed within the foundation, taking into account the requests for assistance that could theoretically happen.

Non-profit foundations can meet such a requirement by applying evidence-based approaches to the management of the organisational system. In the charitable sector, there are two ways to react: project-based and process-based approaches.

In the first case, receiving requests for assistance from beneficiaries and working with resource providers (donors) is a sequential process, i.e. donor resources are raised for a specific charitable project; all incoming funds are earmarked and cannot be used by the foundation to finance its own needs, like payment of salaries, utilities, etc.

In the process approach to management, the activity becomes a repetitive cycle with practically unchanged technology to achieve the result.

Both approaches abovementioned are not contradictory at all, they are rather complementary. Therefore, this study recommends to the management of charitable foundations an optimal way: a process-project approach, in which the two activities — accumulation of funds by resource providers and their distribution to potential recipients are independently fulfilled of each other.

In this case, the main objective of the structure of the foundation's management is to have an effective system of relationships with resource providers among partners, meanwhile its managing subsystem needs to ensure the targeted delivery of high-quality charitable services.

In other words, this research work assumes *the resource potential of a charitable foundation* as the ability of the foundation to provide services to new recipients, who could theoretically apply for help, taking into account both existing obligations to existing clients and the costs of current administrative and economic activities and investments.

The resource potential is generated when the managed subsystem organises works on receiving resources from donors and is used to provide charitable services to transfer a part of resources received from donors to the people in need.

Besides, the direct formation of elements of resource potential, intended for use in the internal subsystem of the foundation and for transfer to the external environment, is carried out by establishing and maintaining economic relations with donors.

As for the indirect formation of intangible assets and labour resources, it happens when the charitable foundation provides proper charitable services to distribute resources to the external environment. The activity of the foundation in providing services to recipients promotes empathy on the part of representatives of the territorial community, so that new volunteers join this activity willing to work in the fund as the labour

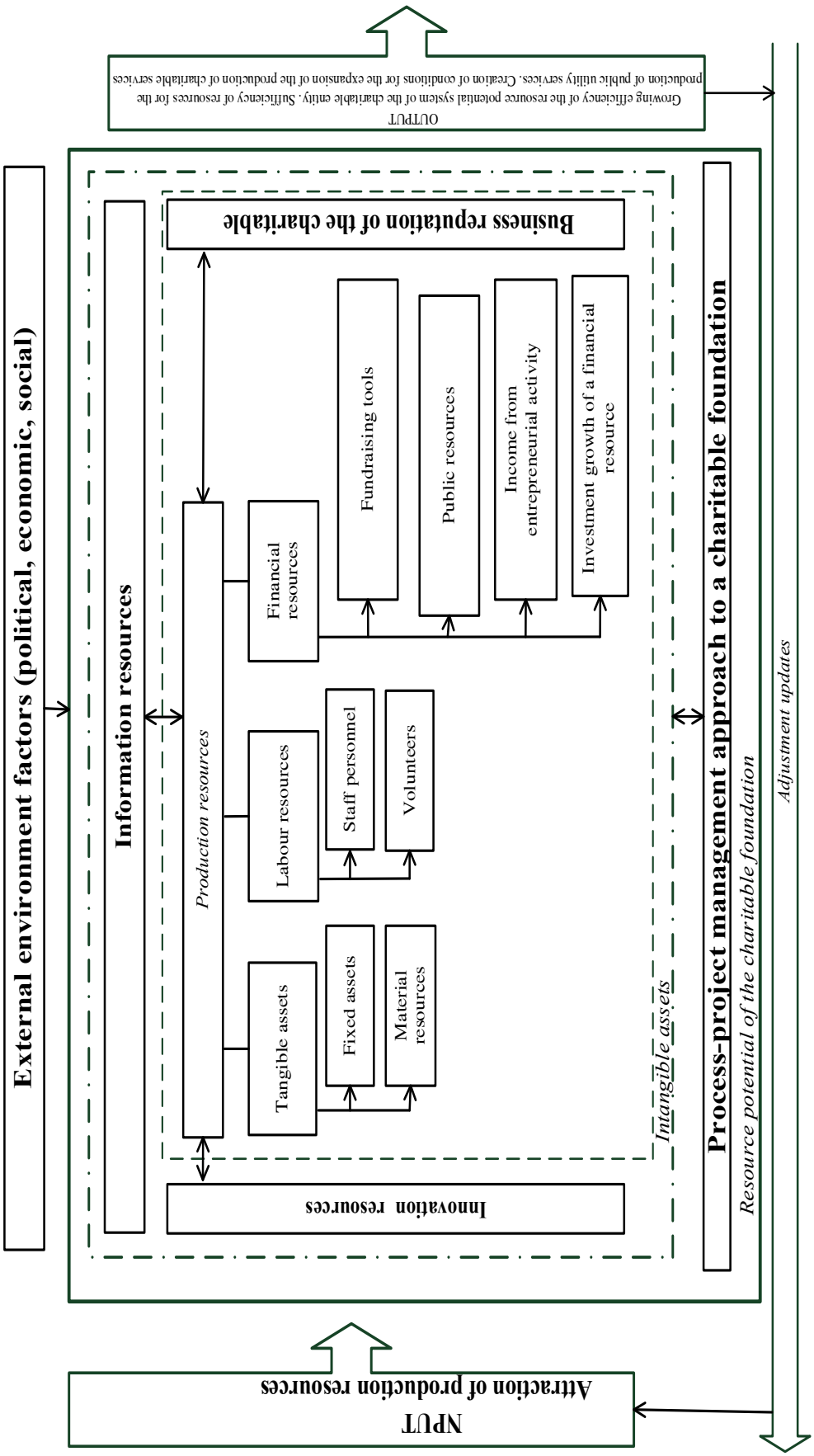

Fig. 2. **The structure of the charitable foundation's resource potential**

Source: compiled by the authors.

resource. This also leads to emergence of more modern technologies, as the regression analysis of the implemented charity campaign indicated, and generates intangible assets, such as information platforms, etc.

As a result of theoretical analysis on the basis of the definition of the resource potential of a charitable foundation, the study has identified the following: the resource potential can be represented as a complex system, which consists of different elements, or resources. They are all economically interrelated to each other: the level of growth of one of them depends on the quality and efficiency of the use of the others (*Fig. 2*).

Thus, the resource potential system in the input on the activity of the charitable foundation allow the collected production resources interact with each other and with intangible assets in the external and internal environment of the fund. Then, they are transformed under the impact of control actions based on the process-project approach to fund management, and at the output they are transformed into a charitable services provided in the following way:

1. Growing efficiency of the resource potential system of the charitable entity

2. Sufficiency of resources for the production of public utility services.

3. Creation of conditions for the expansion of the production of charitable services.

Since the system of resource potentials of the charitable foundation is not isolated from the conditions of the outside world, a variety of political, macroeconomic and other environmental factors make an impact on its activities. Therefore, despite the non-commercial nature of its activities, their services are noticeably sensitive to various changes in the market environment and to a high degree of their differentiation.

The factor, which stimulates the charitable foundation's activity in the process of interaction and transformation of elements of the resource potential, is the process-project approach to fundation management. It consists in dividing the functioning of managed subsystems for the receipt and distribution of resources, which allows to form a stable financial flow of donations. Therefore, this approach is presented in the *Fig. 2* as a key factor ensuring the creation and effective use of the charitable foundation's resource potential.

The process-project approach to management occurs under the following conditions, when:

- Formation (accumulation) of resources attracted from donors. This means the increase and subsequent sufficiency of resource potential.
- Distribution of resources to recipients. This determines the quality of charitable services, the level of satisfaction of their recipients and the strengthening of the charitable foundation's brand, which furthermore directly influences the ability of the foundation to attract resources.

Consequently, in accordance with the resource-based approach and management theories, the process-project approach to management, as a set of service delivery techniques, is a fundamental asset for developing the resource potential of a charitable foundation regarded an organisational system.

The resource potential of a charitable foundation, based on the above, serves as a deciding factor of the foundation's success and it determines the effectiveness of the charitable foundation's management. Sufficient and balanced resource potential, including financial resources, human resources, material and technical base as well as information technology, makes a direct impact on the foundation's ability to achieve its goals.

RESEARCH FINDINGS

In the course of this research work, the authors fulfilled the following:

1. The study of theories of management, resource approach and social capital, which are the principal materials for the analysis of the resource potential of the foundations.

2. On the basis of the research conducted, the authors made a conclusion that it is neces-

sary to identify the element of the structure of the resource potential of the fund, which has a significant impact on the overall increase of the resources of the charitable foundation. The process-project approach for funding management turned out to be such a valuable resource related to intangible assets.

3. The authors developed the classification of resources of charitable foundations, which reflects the composition of their resource potential and represents a set of internal and external assets involved in the process of production and accomplishment of charitable services.

4. The authors defined the concept of "resource potential", which means the capability of a charitable foundation to provide services to new recipients who could theoretically apply for help. At the same time, a charitable entity should take into account current obligations to existing recipients of the foundation's services, as well as the costs of current administrative and economic activities and investments.

5. On the basis of the formulated definition, the authors substantiated the structure of the resource potential of the public benefit foundation, as a complex system consisting of various elements, namely, resources, with certain economic relations between them. This cause the dependence of the rate of growth of one resource on the quality and efficiency of the use of another resource.

CONCLUSIONS AND RECOMMENDATIONS

Resource potential plays an important role in a stable functioning of charitable foundations and the provision of quality charitable services to the needed population. Effective resource management allows foundations to plan their activities competently and to focus on the most important areas in need of support.

First, an adequate understanding of resource potential contributes to determine the financial capacity of the foundation. As fundraising is the main mechanism to provide the funds for charity, a resource capacity analysis helps to assess its financial capacity, identify sources of income and develop a fundraising strategy. This in turn contributes to both the stability of the charitable foundation and its ability to provide reliable support to the needed community.

Secondly, taking in account of resource capacity helps to optimise the use of material resources. Charitable foundations often provide not only financial support, but also material goods (services and resources). A resource analysis allows for an assessment of the availability and accessibility of necessary assets, as well as their effective management.

Thirdly, the analysis of the composition and structure of resource capacity helps to identify the categories of support that foundations can provide. In addition to financial and material resources, expertise and knowledge is of help too. Charitable foundations can make significant contributions in such areas, as education, healthcare, social protection and the environment. Understanding resource capacity helps charitable foundations identify their opportunities and priorities in providing assistance.

Finally, considering resource capacity allows planning a future development and growth of the fund. Understanding its resources also allows a foundation to define its goals and mission, and to draft strategy and development plans in line with its capacity. Resource analysis also helps to assess the effectiveness of the assistance provided and to adjust the charity foundation's activities to achieve the best results.

In general, the availability and sufficiency of resource potential is a key component of the stable functioning of charitable foundations and ensuring the high quality of their services, thanks to which these community foundations are able to better and more effectively fulfill their social mission.

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Program-Targeted Management in the Public Administration System: Features and Prospects

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ABSTRACT

The **objective** of this study, the results of which are presented in this article, is to analyze the fundamental principles and mechanisms of program-targeted management (PTM) that shape modern public administration practices in the Russian Federation. The author highlights that a key advantage of the program-targeted approach is the close alignment of planned activities with financial resources, ensuring targeted, prioritized, and efficient expenditures at every stage. The study examines the key features of PTM implementation, ranging from regulatory and legal frameworks and budget coordination to the introduction of a project-based approach and interdepartmental cooperation. The article provides a detailed discussion of common issues, including formalistic planning, insufficient coordination between levels of government, and challenges in monitoring results. The author concludes that the combination of PTM principles ensures its coherence, transparency, and effectiveness, enabling public authorities to achieve their socio-economic objectives and respond promptly to emerging challenges. A significant part of the research focuses on prospects for improvement, which include enhancing digitalization, transparency, and accountability for achieved outcomes. As **a result of the study**, a set of measures is proposed to improve PTM efficiency, including updated planning standards, the development of a unified digital platform, and greater involvement of expert communities. These measures can serve as a guideline for modernizing state programs and successfully implementing long-term national priorities.

Keywords: budget; public administration; program-targeted approach; results; target program; efficiency; budget expenditures; monitoring; national project; effectiveness; resources

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INTRODUCTION

Programme-targeted management (PTM) has gradually become one of the key tools of public administration in Russia. Its current role is strategic orientation. By means of PTM, the priorities of the National Security Strategy,[1] presidential decrees, federal laws and other documents are incorporated into state programmes and national projects. They become a "road map" for the implementation of long-term development objectives and providing a clearer strategic focus. At the same time, the superior advantage of PTM is the close linkage of planned activities with budget financing, which allows for the targeted allocation of resources based on priorities and target indicators, as well as the each-stage monitoring of cost-effectiveness. Twenty years of experience with the introduction of results-based budgeting (implemented through PTM) in Russia suggests the definition of measurable objectives and indicators to be achieved within the framework of relevant programmes and projects. Usually, the latter are the responsibility of a few ministries and levels of the Government, which helps to increase the responsibility of both managers and implementers highly accountable.

Nowadays, the programme-based approach is a tool for coordination and inter-agency interaction, so that the joined efforts and resources should become the basis for synergy.

LITERATURE REVIEW

To substantiate the prerequisites of goal setting and budgeting, which have become the key elements of programme-targeted management in modern Russia, allow the basics of the formation of programme-based planning [1–4]. The characteristics of domestic legal and regulatory framework of programme-targeted management are considered in the context of strategic public administration in the research works [4, 5]. The issues of practical implementation of PTM and national projects (their peculiarities and impact on the socio-economic development of our country, as well as methods of improving the effectiveness of programmes and projects are thoroughly analysed by Russian scientists [6–10]. Some of these studies focus on methods of assessing the social impact of government programmes and optimization of financial management to sophisticate it [11–14]. The international experience with results-targeted management and budgeting serves as a basis for the development of PCS in various countries, including Russia [15–20]. Studies on the impact of the digital economy on transformation of public administration, as well as on the importance of big data and digital technologies, prove the existence of examples of successful implementation of the latest technological developments into PTM [21]. Therefore, ongoing scientific research and the introduction of innovative approaches are key factors for the further development of programme-targeted management.

STAGES AND PRINCIPLES OF PROGRAMME-TARGETED MANAGEMENT

At the current stage in Russia, programme-targeted management is regulated by a few normative and legislative acts, namely: the Constitution of the Russian Federation, the Budgetary Code of the Russian Federation (BC RF), federal laws and presidential decrees, methodological recommendations of various agencies. Altogether, they provide the structure, processes and mechanisms necessary for effective planning, implementation and control of state programmes. Based on these documents, we sum up the main principles of

[1] The Decree of the President of the Russian Federation of 02.07.2021 No. 40 "On the National Security Strategy of the Russian Federation". URL: http://www.kremlin.ru/acts/bank/47046 (accessed on 20.01.2025).

programme-targeted management in the following way at *Table 1*.

Let us consider the main stages of the introduction and application of programme-targeted management (from the early 2000s to 2025), also reflecting the political, economic and social changes in our country.

At the beginning of the 21st century, Russia had to reform PTM, and by 2000–2025, it has become one of the key instruments of public administration.

This was necessary to improve the efficiency of budget spending and the quality of public services. In the 2000s, the concept of programme-targeted management began to emerge. Foreign experience and international best practices inspired domestic founders of PTM. Conventionally, the year of 2001 was the starting point, when this concept of programme-targeted management was implemented at the federal level to increase transparency and accountability in public administration. However, by 2003–2004, the first legal acts adopted to regulate the principles and mechanisms of PTM included presidential instructions and Government resolutions.

From 2005 to early 2010, there was a period of an active development and adoption of normative documents defining the structure, processes and tools of the PTM. The legislative basis with the norms of the Budgetary Code of the Russian Federation introduced in 2004 set out the principles of the budget process and its link with programme-targeted management. The adoption of the Federal Law No. 172-FZ "On Strategic Planning in the Russian Federation"[2] consolidated the basic principles of PTM and the mechanisms for planning and implementing state programmes.

In 2006–2010, the first national projects in such areas as health care, education, infrastructure, etc. became the basis for the practical application of PTM at the federal and regional levels.

The expansion of the State's strategic objectives in 2010–2015 led to the active performance of PTM and improvement of its tools on a solid methodological level. The launch of several national projects, including dozens of programmes financed by the federal budget and aimed to solve national priority tasks, as well as strengthening of the role of regional programme-based projects, contributed to a closer integration of federal and local initiatives.

In 2016–2020, introduction of digital technologies and increased transparency laid the foundation both for improved monitoring and reporting, as well as for assessing the effectiveness of projects targeted by the programme, based on the established Unified Digital Platform (UDP) specially for monitoring the implementation of Government programmes. The UDP ensured data availability and transparency of processes. Electronic reports and online systems to monitor the progress of programme implementation contributed to increasing the accountability of State entities and strengthening the role of independent audit and public control over the implementation of programme-targeted projects.

Sophistication of PTM mechanisms and their adaptation to new challenges in the years of 2021–2025 has become a factor in shifting the focus to optimise processes and increase flexibility and adaptability to external and internal changes. This has also facilitated the introduction of "accountability for results" mechanisms, with the personal assignment and responsibility of managers to specific programmes and projects. Therefore, at the current stage, it is required to actively develop inter-ministerial coordination, improve the quality of data for monitoring and assessment, and furthermore digitalise the processes of programme-targeted management. Special attention is neces-

[2] Federal Law No. 172-FZ "On Strategic Planning in the Russian Federation dated 28.06.2014. URL: https://www.consultant.ru/document/cons_doc_LAW_164841/?ysclid=m7diu4tzg5460757793 (accessed on 20.01.2025).

Table 1

Basic principles of program-targeted management

No.	Principle	Content
1.	Unity of regulatory and methodological framework	The use of uniform standards, methods and regulations in the development, implementation and evaluation of State programmes; ensuring comparability of data and targets at different (federal, regional, local) levels of management
2.	Clear goal setting, result-orientation	Formulation of specific and measurable objectives to achieve them within a defined timeframe, focusing on achieving results and measuring impact, not just on the process of implementation
3.	Systemic and integrated character	Considering problems and objectives in a broad context, taking into account interrelationships between different directions and levels; seeking integrated consideration of all factors (economic, social, technological, etc.) in planning process
4.	Resource alignment	Linking strategic priorities to specific funding sources determined in the budget cycle. Ensuring balance between strategic priorities, available resources and expected socio-economic impacts
5.	Transparency and accountability	Open reporting on the use of budget funds and on the results achieved, with mandatory control by the supervisory bodies, such as Court of Audit, Federal Treasury, and by the public
6.	Inter-agency coordination	Establishing interaction between different agencies, ministries, regional and local authorities meanwhile avoiding duplication of functions and resources
7.	Flexibility and adaptability	Ability to timely adapt the purpose and mechanisms of programme implementation for changing external conditions (economic, political, social), combined with project management mechanisms to respond rapidly to emerging challenges
8.	Non-stop monitoring and evaluation of performance	Systematic tracking of intermediate and final results using defined indicators, analysing the reasons for deviations from the plan and making the necessary adjustments to improve performance

Source: compiled by the author.

sary to pay not only to the sustainability of programmes, but also to their ability to react quickly to changes and integration of innovative technologies.

CHARACTERISTICS OF PROGRAMME-TARGETED MANAGEMENT

Over the past two decades, the Russian experience related to the application of programme-targeted management allows us to identify and summarise its characteristics.

Firstly, it is a complex multi-level system, which determines the goal-setting interrelationship at all levels of public administration. State and federal target programmes, national projects and departmental plans are implemented at the federal, regional and municipal levels and they complement each other. However, in some cases, the interaction between their levels remains fragmented.

Secondly, formal regulation, and, consequently rigid frameworks originated, as well as a large

number of regulatory documents, become a constraint: all this makes impossible to provide a flexible approach to programme implementation. Particularly, because this complicates the procedure for making changes and adjustments. The tasks of programme-targeted management are strictly related to budgeting: project funding is determined within the budget cycle. A shift is declared towards a results-oriented approach: each programme should have clearly defined objectives and targets.

Thirdly, in line with the priorities of the State policy, national projects regarded as "locomotives" of development have a tangible impact on the socio-economic development of the country and they cover strategically important areas: health, education, infrastructure, etc. Special attention is paid to vertical responsibility for the implementation of national projects and the involvement of the top-level officials of the Government.

Fourthly, the symbiosis of project-based and programme-based approaches makes it viable to increase the number of objectives for solution in the public administration system. Thus, public administration uses increasingly project offices and project management methodologies, including those based on digital instruments. Their aim is to increase flexibility and speed of implementation of tasks, while maintaining transparency and controllability of all processes.

Finally, developed information systems lead to better real-time monitoring of the progress of projects and public programmes. A united digital platform able to consolidate data at all levels will ensure a long-shot focus on inter-agency cooperation. Collaboration between different agencies, ministries and regional authorities is important to achieve significant results. Individual State programmes provide for the integrated solution of "cross-cutting" tasks in digital transformation, ecology, etc. including further introduction of the "responsibility-for-results" mechanism and simultaneous preservation of elements of "traditional" bureaucracy.

Therefore, the aim of PTM development should be to achieve a balance between flexibility and sustainability. On the one hand, it is necessary to respond quickly to economic, social and technological changes, meanwhile, on the other hand, stability of programme objectives and predictability of budgetary commitments are important.

Thus, the current Russian model of programme-targeted management is a combination of a rather complex organisational structure: a rigid regulatory framework and a desire to focus on results in combination. At the same time, challenges remain in terms of cross-sectoral coordination, the need to make timely adjustments and the development of an effective monitoring system. However, the trend towards digitisation, strengthening of project methodologies and involvement of independent experts generate positive conditions for further improvement of PCS in Russia.

PROGRAMME-TARGETED MANAGEMENT: DIRECTIONS OF DEVELOPMENT

One of the current trends in the development of programme-targeted management have been the introduction of principles and technologies of modern management, such as project management. The development of the latter, as well as digital monitoring tools, lead to elevate the role of the PTM and reach a new level: from formal planning to dynamic and transparent management. Digitalised processes, involving a single monitoring platform, use big data and online reporting, simplify implementation control and improve the quality of analysis. Besides, the development of the programme-based approach occurs via increased involvement of public participants and experts. The PTM increasingly involves the public in discussion of its objectives, indicators and results, while independent experts make a qualitative assessment of project

design and implementation. Such openness strengthens trust in public institutions and facilitates the formation of a feedback loop in adaptation of programmes.

It is important to point out the significance of the target and programmatic approaches in building the mechanism of adaptation to meet new challenges in the system of public administration. Currently, as external economic, technological, and geopolitical factors turn out to be more and more changeable, programme-targeted management allows flexible revision of the State's goals and priorities, so that the State, subject to an effectively built system of monitoring and adjustment, is able to promptly direct resources to any new or more vulnerable areas.

The above point of view confirms the thesis that the role of PTM in the Russian public administration system continues to grow: it becomes an essential central element in the processes of planning and implementation of strategic priorities. At the same time, in order to increase efficiency, it is necessary to maintain a balance between formal regulations and the ability of the State system to respond quickly to current challenges, as well as to strengthen transparency, coordination and responsibility of all participants in State programmes.

At the same time, due to federal relations, it is necessary to distinguish the institutional specific aspects of the Russian model of programme-targeted management. As was mentioned above, PTM involves the interaction of different levels of federal, regional and municipal Government aiming to achieve common socio-economic goals. However, one of the major problems is the disconnection between the indicators of the target programmes implemented at these levels. This hampers effective planning and implementation of programmes, impedes monitoring of these processes and reduces all-round performance.

First of all, since each Governmental level develops and uses only its own indicators, such an approach leads to inconsistency of goals and objectives: in this case, federal-level programmes are more often not continued partially, or in full in regional and in local programmes, which makes it more difficult to achieve national goals.

Secondly, if different methods used to assess the effectiveness of similar projects, the same results may be evaluated differently at each level of the Government and it makes difficult to run comparative analysis and generalisation of data.

Thirdly, due to different indicator systems, there is practically no exchange of information between the different levels of government involved in decision-making. This reduces the transparency and accountability of management processes and makes it difficult to coordinate resources: disparity in parameters and criteria leads to lack of balance between the priorities in resource allocation, which, in turn, can lead to competition for budget funds and inefficient use of them. It seems to be, that the reason for the disparity of indicators is the lack of a single standard and, consequently, the use of different approaches to assess the effectiveness of programmes.

Fourthly, one cannot ignore the significance of the recommendatory nature of PTM guidelines and regulations at different levels, depending on local conditions and priorities.

The disparity of indicators make it difficult to assess the all-round project performance and sometimes it leads to underestimation, which hinders well-based management decisions.

Finally, introduction and maintenance of consistent indicator systems is hampered by insufficient expertise and limited technical capacity at regional and local levels. The lack of criteria makes it difficult to monitor the progress of activities and identify problem areas. It also causes delays and deviations from the implementation of project plans, as well as it reduces the transparency of management processes and complicates public and supervisory control.

In view of the abovementioned, it is important to point out that the main problem of the PTM is the deficient allocation of resources, particularly, the uneven distribution of budgetary funds, which leads to a disproportion in the development of different regions and municipalities. For example, the federal level often focuses on strategic and large-scale projects in the field of defence, health and education. Regional authorities focus on the specific requirements in their territories, including the development of local infrastructure, support for agriculture, industry or tourism. Local authorities bear responsibility for specific urban or rural issues such as housing, public services, local health care and education. Disparate indicators make it complicated to develop common strategies and to coordinate activity between independently operating levels of Government.

As a result, it triggers competition for budgetary funds and resources, so that their unequal distribution undermines stability and efficiency of public administration and leads to widening economic disparities. More developed regions receive more resources for further growth, while others tend to stagnation or even deterioration economically. Investments flow to large cities and areas with modern infrastructure, which increases centralisation of economic activity, however, reduces the potential of small or medium-sized regions.

Differences in funding lead to differences in the scale of provision of social services, education and health care. This contributes to social inequalities between residents of different territories and, as a consequence, to migration to more developed regions. This affects demographic problems in areas with low levels of funding. Such issues require close attention and examination within the framework of achieving the national development goals of the Russian Federation, defined by the Decree of the President of the Russian Federation dated 07.05.2024 No. 309 "On the national development goals of the Russian Federation for the period up to 2030 and in the perspective up to 2036" and "Fundamentals of State policy in the field of strategic planning in the Russian Federation", approved by the Decree of the President of the Russian Federation dated 08.11.2021 No. 633 in connection with the adopted "On approval of the strategy of spatial development of the Russian Federation for the period up to 2020 and in the perspective up to 2036".[3]

Thus, the deficient distribution of resources poses a serious problem for effective programme-targeted management due to disconnected priorities and indicators of targeted programmes at the three levels of public authority in Russia. Only an integrated approach will ensure an even and fair distribution of budgeting, which will contribute to a sustainable and balanced development of all regions and municipalities in the country.

RESEARCH FINDINGS

The analysis of the practical application of programme-targeted approach in the system of public administration makes it possible to formulate the following generalised list of key problems and shortcomings, which are characteristic of the Russian practice of programme-targeted approach.

1. Ambiguity of goal-setting and performance indicators.

The objectives of most programmes are often too vaguely formulated and do not contain clear measurable indicators. At the same time,

[3] The Decree of the President of the Russian Federation dated 07.05. 2024 No. 309. URL: http://www.kremlin.ru/acts/bank/50542; The Decree of the President of the Russian Federation dated 08.11.2021 No. 633 "On approval of fundamentals of State policy in the field of strategic planning in the Russian Federation". URL: http://www.kremlin.ru/acts/bank/47244; Order of the Government of the Russian Federation dated 28.12.2024 No. 4146-R "On approval of the strategy of spatial development of the Russian Federation for the period up to 2020 and in the perspective up to 2036". URL: https://www.consultant.ru/document/cons_doc_LAW_495567/?ysclid=m669hpy6fh485020258 (accessed on 20.01.2025).

the sophistication of the indicators does not allow to assess adequately both the progress of projects and the efficiency of budget spending.

2. Weak correlation between strategic and sectoral objectives. Hence, federal, regional and sectoral programmes are often not synchronised. Strategic priorities and budget constraints may contradict each other and lead to "misallocation of resources".

3. Duplication of functions and poorly coordinated actions occurs due to the fact, that different agencies and administrative bodies may launch similar projects or activities without coordinating them among themselves. The lack of a unified approach to planning and monitoring leads to twinning or contradictory projects.

4. Formal planning and lack of realistic plans. Programmes and government assignments are often accomplished in a formal way without taking into account realistic timeframes, risks and opportunities. Plans become overly optimistic in terms of implementation deadlines, costs or expected results.

5. Lack of transparency and accountability. Monitoring and publicly reporting mechanisms on programme implementation are often poorly developed. Limited access to data does not allow public to assess results objectively.

5. Not yet fully developed monitoring and evaluation system. Effective mechanisms for measuring results (both intermediate and final) are often lacking. Gaps between planned and actual indicators are not properly analysed which prevents timely adjustments.

6. Lack of inter-agency collaboration. Despite numerous proposals, there is still no single

Table 2

Structure of the Standard of program-targeted management for State programs

No.	Chapter	Content
1.	General provisions	
1.1.	Aim and purpose	Definition of a unified approach to the programme-targeted management of government programmes
1.2.	Scope of management	Level of government: federal, regional and local level
1.3.	Legal and regulatory framework	List of laws and regulations applicable to the programme-targeted management
1.4.	The basic principles of programme-targeted management	Efficiency, transparency, risk assessment, targeting, comprehensiveness, unification of methodologies
2.	Structure and elements of programme-targeted management	
2.1.	Components of the State programme	Programme objective Programme tasks Target indicators and indicative values. Expected results Main activities Sources and volume of financing List of responsible staff/entities for the implementation of the programme

Table 2 (continued)

No.	Chapter	Content
2.2.	Classification of public programmes	Sectoral (by policy directions) Intersectoral (cross-sectoral programmes) Territorial (regional and local) Integrated (long-term strategies)
2.3.	Life cycle of the State programme	Initiation (general idea) Planning (design and budgeting) Implementation (carrying out activities) Monitoring and control (assessing performance) Adjustment (changing parameters if necessary) Closing (assessing effectiveness, summary of results)
3.	Planning and budgeting	
3.1.	Methodology and instruments of planning	Targeted planning Programme-strategic planning Indicative planning
3.2.	Sources of financial support for the programmes	Programme budget (performance budgeting) Mechanisms of co-financing Public-and-private partnership
3.3.	Programme resources	Material and technical resources Human resources Information resources
4.	Implementation of programmes	
4.1.	Mechanisms to fulfill implementation	Project management Risk management Interaction of staff/entities responsible for the project
4.2.	State control and audit	Internal control External audit (audit chambers, independent experts) Qualitative evaluation of activities implemented
4.3.	Programme adjustments	Conditions for introducing changes Procedure to revise target indicators and budgets Deadlines postponement, reallocation of resources
5.	Monitoring, evaluation and reporting	
5.1.	Programme monitoring system	Current monitoring (quarterly, annual) Evaluation of intermediate results Deviation control
5.2.	Key performance indicators (KPI)	Performance indicators Socio-economic effects Return on investment ratios
5.3.	Reporting tools	Digital monitoring platforms Reporting regulations Automated control systems

Table 2 (continued)

No.	Chapter	Content
6.	Information technologies and digitalization of programme-targeted management	
6.1.	Programme management digital platforms	Government information systems Automated budgeting systems Electronic registers of programmes
6.2.	Big data analysis instruments	AI analytics, predictive modelling Geoinformation systems Business intelligence tools (BI-systems)
6.3.	Information security system	Personal data security Cybersecurity in digital platforms Networking technology for safe communication
7.	Risk management	
7.1.	Risk identification	Political and economic risks Financial risks Social risks Environmental risks
7.2.	Risk management methods	Risk insurance Creation of anti-crisis reserves Alternative scenarios of implementation
7.3.	Monitoring and response to risks	Regular auditing Forecasting of possible threats Rapid response instruments
8.	International and best experience	
8.1.	Global models of programme-targeted management	Examples of effective government programmes from different countries, comparative analysis of approaches, in particular, a guide to project management via ISO 21500
8.2.	Harmonisation with global standards	
9.	Final clauses	
9.1.	Adaptation and development of programme-targeted management	Flexibility of approaches Introduction of innovations Assessing long-term impact
9.2.	Responsibility of participants	Powers of the authorities Roles of responsible teams/entities
9.3.	Procedure of revision and updating of the Standard	Regulations of revision Frequency of updating Interaction with the authorities

Source: compiled by the author.

digital platform and standardised procedures for data exchange between agencies. Each of them originates its own system of indicators and criteria, which leads to fragmentation of the information database.

7. Problems with human resources and competence of personnel keeps affecting the quality of targeted programmes. Specialists capable to operate using targeted management and evaluation methods effectively often spend too much time for additional bureaucratic paperwork. At the same time, inadequate training and a lack of motivation of staff leads to a formal approach to programme implementation.

8. Lack of adaptability and flexibility reduces the PTM value. Changes in legislation or in economic conditions rarely affect project implementation quickly. Complex procedures for approving changes delay decision-making and have a negative impact on final effectiveness.

9. Inadequate financial discipline and monitoring of results affect the quality and success of programmes. Non-compliance with allocated limits and postponement of expenditure to later periods occur during implementation. Besides, financial reports do not always provide a clear assumption about costs and results, it is difficult to truly assess the effectiveness of projects at the accomplishment of the programme.

10. Low involvement of experts and stakeholders at certain stages of the projects. For example, the opinion of independent experts, business and civil society is not sufficiently taken into account in the design and adaptation stages of programmes. As a result, decision-making occurs in a departmental environment, which can lead to a so-called "narrow viewpoint" of objectives and results.

In general, the problems of programme-target management in Russia are mainly related to systemic factors of management and are caused by insufficiently developed mechanisms of coordination, control and assessment of project efficiency. Formal targeting, insufficient coordination of programmes at different levels, lack of modern monitoring tools and inadequately qualified personnel significantly reduce effectiveness.

In order to enhance efficiency, the following measures seem necessary to undertake, as:

- sophistication of the regulatory legal framework;
- strengthening interagency cooperation;
- introducing the evaluation of transparence and monitoring methods;
- upgrading the level of competence of civil servants in the management of State programmes.

At the same time, the process of building a unified public authority requires to develop a Common Standard of Programme-Targeted Management, which provides a unified mechanisms of planning, implementation and monitoring of state programmes at all levels of government (in *Table 2*). Such a postulate should also include clear methodological approaches to formulate goals and objectives, as well as to establish of programme performance indicators, distribution of resources and clear lines of responsibilities between different departments and agencies. Such standard postulate will make it possible to achieve consistency in the activity of all elements involved in the process, minimise the duplication of functions and improve coordination between all federal, regional and local levels involved. The introduction of monitoring and evaluation standards will ensure transparency and accountability in the use of budgetary resources, identify timely deviations from plans and make necessary adjustments in time.

The unified information Standard of programme-targeted management will lay the foundation for data collection, storage and analysis, which will significantly improve the quality of management decisions. It ensures the availability of necessary information to all stakeholders, including the public and independent experts, which will also increase

confidence in government programmes and enhance public control.

An important factor for successful implementation of the Standard is the development of common patterns for training and professional development of personnel involved in the sphere of programme-targeted management. Such professionals, who obtain the corresponding knowledge and skills, will be able to use actively standardised methods and tools, which will contribute to the all-round efficiency of public administration.

The Standard envisages the use of innovative technologies, such as big data and artificial intelligence, which will successfully automate routine processes, improve forecasting and analysis of results, as well as increase the adaptability of programmes to changing external conditions.

Its development and implementation appears to serve an important step towards an efficient, transparent and coherent public administration system. This will not only improve the effectiveness of Government programmes, but also inspire a stronger confidence of citizens in Government institutions and ensure the sustainable socio-economic development of the country.

CONCLUSIONS

Over the past two decades, programme-targeted management in Russia has gone through several stages of development to turn into a mature public administration system, which is results-oriented and integrated with digital technologies. Nevertheless, despite the successes, some of the challenges still remain, particularly, the need to strengthen inter-agency coordination, improve staff qualification and make the programmes more flexible and adaptable to a rapidly changing environment.

Non-stop development of programme-targeted management is an important factor in increasing the efficiency of the public administration and achieving the strategic goals of the Russian Federation. At the same time, the role of programme-targeted management in the Russian public administration system keeps growing, to become a central element in the planning and implementation of strategic priorities. Therefore, it is necessary to maintain a balance between formal regulations and the capability of the State system to respond quickly to current challenges, as well as to enhance transparency, coordination and accountability of all participants in State programmes.

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Modeling the Stability of the Housing and Construction Complex Based on Organizational and Economic Interaction of Entities

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ABSTRACT

The article addresses the structure of the socio-economic system of the housing and construction complex (HCC), focusing on the organizational and economic interaction of its participants against the backdrop of entropy-driven macroeconomic influences. The study **aims** to identify management methods, from a system-information approach, that allow the system to reach a new level of sustainable disequilibrium with the environment while maintaining homeostasis. Since the primary factor in the housing construction sector is the availability of built housing, the first research **task** was a detailed examination of household housing provision in Russia as a whole and in the Irkutsk region, based on census data from 2002, 2010, and 2020. As a result, the idea of the "best" structure of the housing stock in terms of the number of rooms corresponding to the composition of households was proposed. Achieving the "optimal" housing provision for the population requires timely organizational and economic changes, one of which is the introduction of project financing. To reach a new level of sustainable equilibrium in the HCC system, coordinated actions among all stakeholders are necessary to minimize the gap between the actual and the "optimal" housing stock structure. The second research objective was to find a solution to the multi-criteria problem of aligning the interests of economic entities in housing construction. A genetic algorithm in MATLAB was used for this purpose. Acceptable options for all participants were selected from a set of Pareto-optimal alternatives based on the preferences of the decision-maker. The state was imperatively assigned this role, with the optimization criterion being the minimization of the gap between the "optimal" and actual housing provision for households of various sizes. The modeling results indicated that effective collaboration towards a common goal is possible; however, the cost factor is inevitably passed on to consumers. The study's findings will be of interest to students and graduate students studying construction economics, as well as to banking professionals, regional authorities, and specialists in the field of housing construction.

Keywords: housing construction; system-information approach; economic entities; interest alignment; economic-mathematical model; multi-criteria problem

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INTRODUCTION

The relevance of the topic of sustainable development of the investment and construction complex as a whole and the housing construction sector in particular is due to the necessity of achieving the goals and key parameters of national projects.[1] Thus, the Federal Project "Housing" of the national project "Housing and Urban Environment" envisions "increasing the volume of housing construction in Russia (at least 120 million square meters per year by 2030). Every fifth square meter in Russia by 2030 should be new". *Sustainable development* is currently understood and fashionable to interpret as a certain "abundant world" that meets the needs of a socially developed person while adhering to environmental standards and preserving the environment for future generations.

During the research, we did not operate in such a mainstream manner, but rather examined a more specific issue of the existence of the housing construction sector within the country's economic system. Classical system-informational and homeostatic approaches to managing complex socio-economic systems, as described, for example, by R.F. Abdeev, A.P. Nazaretyan, Yu.M. Gorsky, and others, were used [1–3]. R.F. Abdeev in his paper presented a generalized process of system management, which breaks down into contours of self-organization and self-development. Such a construct "firstly, is unified for all areas covered by cybernetics, and secondly, reveals the system-organizing, "negentropic" function of management in all these areas" [1].

The description of complex systems is based on key concepts such as *organization, information, and purpose*. The functioning, development, and existence of the system as a whole are largely determined by the processes of transmission, processing, and transformation of information.

As a result, a systemic-information approach to management is formed, the mechanism of which represents a purposeful information-management process consisting of a controlled object and a controlling subject, united by direct and feedback information connections. Through such a mechanism, self-organization of open stable systems occurs, which actively interact with the environment but do not dissolve in it, preserving their individuality (stability) or *non-equilibrium, i.e., protection against entropic processes*.

The contour of self-regulation (homeostasis) is formed as a qualitative ordering of connections — in response to the influence of external conditions, incoming information causes a deviation, which is neutralized through feedback [4].

The contour of self-development essentially involves the purposeful accumulation of data followed by its ordering and structuring, which may include modeling and programming possible interaction scenarios with the selection of the most stable states at a new level of system self-organization. In other words, *development* is the creation of something new in the very process of the system's interaction with the environment as a result of selective reflection and selection of information about this interaction.

Having defined the key concepts, we identified the housing sector of the investment and construction complex (ICC) as a separate complex self-organizing socio-economic system and named it the housing construction complex (HCC). The main system-forming factor of the HCC, according to systems engineering in construction,[2] is the result of its activities, i.e., the constructed housing. Overcoming entropy processes in relation to this socio-economic system means that timely organizational and economic changes (OEC) are necessary to maintain its stable non-equilibrium with the environment (to prevent entropy and preserve effective interaction) [5]. For example,

[1] National projects of Russia. URL: https://xn-80aapampemcchfmo7a3c9ehj.xn — p1ai/projects/zhile-i-gorodskaya-sreda/zhile/ (accessed on 12.08.2024).

[2] System Engineering in Construction. Encyclopedic Dictionary edited by A.A. Gusakov. Moscow: New Millennium Foundation. 1999; 432 p.

the introduction of project financing by one of the participants — the state — to overcome the entropic influence of the existing phenomenon of deceived shareholders, which arose due to the disruption of self-regulation in the management of construction companies due to the lack of controlling (disrupting homeostasis, and thus forcing it to maintain) influence from the external environment — the state.

Interactions within the system have changed, and the role of one previously considered a peripheral participant t— the bank — has significantly increased, with its level of control almost equal to that of the state. To reach a new level of sustainable imbalance, the system needs a tool to reconcile the interests of all its parties.

ANALYSIS OF HOUSING PROVISION IN THE RUSSIAN FEDERATION AND IRKUTSK REGION

The authors of this article have already written about the structure of the housing sector and its participants (banks, construction organizations, the state, and the population) [6]. The organizational and economic interaction of the latter essentially constitutes the structure of the socio-economic system of the housing cooperative, the goal of which is constructed housing. However, the main question arises here: what and in what quantity should be built for this system to continue functioning stably, i.e., for all its subjects to interact harmoniously in terms of maintaining a stable imbalance with the environment (self-regulation) and further self-development?

To model an accurate response, the housing situation in the country as a whole and in the Irkutsk region in particular was first assessed in terms of the needs of households of different sizes. Such work had already been carried out based on the results of the 2002 and 2010 censuses [4].

This article reflects the dynamics taking into account the results of the 2020 census.

Tables 1 and *2* present a comparative analysis of housing provision based on the results of the population censuses of 2002, 2010, and 2020 across the subjects of the Russian Federation, depending on the composition of households.

The breakdown by federal districts (*Table 1*) shows that the average provision over the past 10 years (from 2010 to 2020) increased only in three districts (North Caucasian Federal District, Volga Federal District, and Siberian Federal District by 2, 3, and 2 m^2/person, respectively); remained unchanged in three (Southern Federal District, Ural Federal District, and Far Eastern Federal District), and even decreased in two central districts (Central Federal District and Northwestern Federal District) by 2 and 1 m^2/person, respectively.

Such trends cannot be explained without analyzing the structure of households (*Table 2*). Undoubtedly, we observe a constant decrease in the share of those that include three or more people. However, this dynamic depends on the numerical composition. Families that choose to have many children are the most stable: the share of families with five or more people has decreased by 1–2 percentage points (pp) over the past 10 years and usually constitutes 5–7% of the total number of households. The exceptions are the Far Eastern Federal District (a slight increase in percentage share) and the North Caucasian Federal District, where families are traditionally large. However, the decline is more significant — from 39.8% in 2010 to 26.5% in 2020. The decrease in the share of households with four people (which account for 9 to 11% in all districts, except for the Southern Federal District and the North Caucasian Federal District — where it is 12% and 14% respectively) is uniformly between 2 to 4 percentage points. The most catastrophic situation from a demographic perspective is for households of three people: their decline is 6 to 7 percentage points (2 percentage points in the North Caucasian Federal District); their share in the total number in 2020 is from 15 to 17%. This means that an increasingly smaller number of families are even deciding to have one child!

Table 1

Average housing provision per citizen in the Russian Federation by federal districts (based on the 2002, 2010 and 2020 census data)

Indicator	Average household size, pers.			Average housing provision, м²/pers.		
	2002	2010	2020	2002	2010	2020
Russian Federation	2.7	2.6	2.2	19	19	19
Central Federal District	2.6	2.5	2.1	20	19	17
Northwestern Federal District	2.6	2.4	2.1	20	19	18
Southern Federal District	3.1	2.7	2.3	18	20	20
North Caucasus Federal District		3.7	3.4		18	20
Volga Federal District	2.7	2.5	2.2	19	19	22
Ural Federal District	2.6	2.5	2.2	18	19	19
Siberian Federal District	2.7	2.6	2.2	18	19	21
Far East Federal District	2.6	2.5	2.2	19	19	19

Source: Compiled and calculated by the authors based on the results of the 2002, 2010 and 2020 censuses.

Table 2

Share of households with 3 or more people by federal districts (based on 2002, 2010 and 2020 census data)

Indicator	Share of total number of households, %								
	Households of 3 people			Households of 3 people			Households with 5 or more people		
	2002	2010	2020	2002	2010	2020	2002	2010	2020
Russian Federation	23.78	22.51	15.91	16.97	14.49	10.79	9.40	8.77	7.15
Central Federal District	23.22	22.66	15.17	15.51	13.64	9.4	7.89	7.71	6.22
Northwestern Federal District	24.4	22.31	15.53	15.58	12.8	9.65	6.97	6.30	5.19
Southern Federal District	21.14	22.33	17.08	18.82	16.02	12.01	17.79	10.63	7.81
North Caucasus Federal District		17.82	15.2		18.91	14.26		39.81	26.54
Volga Federal District	24.19	22.85	16.60	18.11	15.03	11.59	8.62	7.78	5.96
Ural Federal District	24.89	22.96	15.84	17.43	14.57	11.14	7.59	6.88	5.55
Siberian Federal District	25.08	23.13	16.00	17.26	14.44	10.90	8.73	7.73	6.04
Far East Federal District	25.67	22.98	16.23	16.09	13.33	11.20	8.01	6.85	7.06

Source: Compiled and calculated by the authors based on the results of the 2002, 2010 and 2020 censuses.

Table 3 presents a comparative analysis of the living conditions of households in the Russian Federation and the Irkutsk region, which, based on the number of rooms per person, can be divided into three groups: good, average, and poor. In 2002, slightly more than 23% of all households had good and very good conditions: 23.17% in the Russian Federation and 23.68% in the Irkutsk region; poor conditions accompanied the lives of approximately 40% of households: 38.72% in the Russian Federation and 39.45% in the Irkutsk region, and by 2010, the percentage indicators for this group had hardly changed. And the share of families with good and very good conditions increased by approximately 1%. At the same time, the percentage of households with average conditions decreased (by 1.38% and 0.66% respectively), while poor conditions increased (by 0.22% and 0.85%). Neither the mortgage boom (2005–2006) nor the development of the Federal Target Program "Housing" managed to change the situation over 8 years.

In 10 years, by 2020, the situation was as follows: the share of families with very good living conditions hardly changed (a decrease of about 1 percentage point) — just over 3% of households with three or more people. The share with good living conditions decreased by about 2 percentage points — 17.7% and 18.9% of households in Russia and the Irkutsk region, respectively. Further trends are more noticeable. The share of families with average living conditions decreased by 6 percentage points and reached about 30% in both the Irkutsk region and Russia as a whole. Approximately the same percentage of households have poor living conditions — their share decreased, with a more significant drop in Russia — by 6 percentage points compared to the Irkutsk region (4 percentage points). This single positive change is offset by the increase in the share of families living in similar conditions, taking into account those who did not specify the number of rooms and those who rent housing. An increase of more than 6 percentage points means that almost half of households with three or more people are forced to rent housing or live in cramped conditions (47.1% and 46.5% in Russia and the Irkutsk region, respectively).

Tables 4 and *5* present information on the average housing provision not in rooms but in square meters by household types in the Irkutsk region and in the Russian Federation, respectively, and the trends turned out to be similar. The share of singles in the population has doubled over the past 10 years (from 2002 to 2010, the increase was 1 percentage point) — to 18% of the population, however, the provision in square meters decreased from 40 to 33 m^2/person in 2020. This means that single citizens are living in apartments of increasingly smaller size. The number of two-person families increased by 2 percentage points in the Irkutsk region; in the Russian Federation, their share did not change, and housing provision fell to 22 and 23 m^2 per person, respectively. The living conditions of households with three or more people deteriorated in 2020 by approximately one square meter (in the Russian Federation — 16, 14, and 11 m^2 per person for families of three, four, five, and more people, respectively), which no longer complies with the existing standard. Conclusion: about 60% of the population in both the Russian Federation and the Irkutsk region live in conditions where there is less than 18 m^2 per person. This indicator decreased by almost 7 percentage points since 2020, but this happened simply due to the reduction of large families and their share in the total population. The number of three-person families decreased particularly noticeably (by 5 percentage points), meaning that citizens are increasingly less likely to decide to have even their first child.

In order for the housing conditions of all households to transition to the "good" category (*Table 3*), we defined the concept of the "optimal structure" of the housing stock, which implies the presence of the recommended (ideally desired) number of apartments, provided that parents and

Table 3

Housing conditions of households consisting of 3 or more people

Indicator	Census 2002		Census 2010		Census 2020	
	Russian Federation	Irkutsk region	Russian Federation	Irkutsk region	Russian Federation	Irkutsk region
Number of households with 3 or more people, units	25 435 908	463 196	25 190 405	431 421	21 689 345	346 670
The share of households with housing conditions, %:						
Very good, $k^a > n^b$	3.82	3.22	4.22	3.42	3.76	3.09
Good, $k=n$	19.35	20.46	19.71	21.03	17.67	18.87
Average, k= n – 1	38.12	36.86	36.74	36.20	29.82	30.54
Poop, n-2 ^{3} k	34.92	34.63	35.14	35.48	29.04	31.07
Poor considering those who are renting and did not specify the number of rooms and type of apartments.	38.72	39.45	39.33	39.35	47.13	46.54

Source: Compiled and calculated by the authors based on the results of the 2002, 2010 and 2020 censuses.

Note: a — n —number of household members; b — k — number of rooms.

children over 18 live separately (intergenerational households are divided into separate families). The structure of apartments, where the number of rooms corresponds to the quantitative composition of the household, is called "optimal" [7]. The authors of this article compared such housing structures in individual houses and apartments for the Irkutsk region based on the census data of 2010 [8] and 2020 (see *Figure*).

According to the *Figure*, the quantitative composition of families has changed significantly over the decade; there is a need to increase housing consisting of one room and to reduce two-, three-, four-, and more-room residential spaces (as confirmed by the data in *Tables 4* and *5*).

A detailed institutional analysis of the reasons why Russian households need to have their own housing was conducted by R.M. Nureev and O.A. Gulyaeva [9].

Questions arise: Is it necessary for developers to focus on the trends identified above; will the population be able to acquire the housing they need, and will the state be able to create an institutional framework in which favorable interaction between economic entities in the housing construction sector will take place; is there even a possibility of reconciling their divergent interests?

For a more comprehensive solution to this problem, mathematical modeling methods were used [6].

Table 4

Average housing provision by household type in the Irkutsk region according to census data 2002, 2010, 2020

Household size, pers.	Average housing supply, m²/pers.			Number of households			Share in the region's population, %		
	2002	2010	2020	2002	2010	2020	2002	2010	2020
1	41	40	33	181 367	213 235	416 471	7.16	8,93	18,12
2	23	24	22	256 971	268 973	276 131	20.29	22.54	24.02
3	17	17	16	231 282	211 907	165 732	27.39	26.63	21.63
4	14	14	13	165 352	139 452	114 290	26.11	23.37	19.89
5 and more	11	10	10	86 598	78 224	66 648	19.04	18.53	16.35
3–5 and more	< 18			483 232	429 583	346 670	72.54	68.53	58.00

Source: Compiled and calculated by the authors based on the results of the 2002, 2010 and 2020 censuses.

Table 5

Average housing provision by household type in the Russian Federation according to census data 2002, 2010, 2020

Household size, pers.	Average housing provision, m²/pers.			Number of households			Share in the region's population, %		
	2002	2010	2020	2002	2010	2020	2002	2010	2020
1	42	40	33	11 41 449	14 018 754	26159856	8.22	9.95	18,28
2	24	24	23	14 534 669	15 563 868	16225383	20.36	22.08	22,68
3	18	17	16	1 2536 743	12 284 058	10194710	26.35	26.14	21,37
4	15	14	14	8 943 575	7 907 406	6 912 897	25.06	22.44	19,32
5 and more	12	12	11	4 954 939	4 786 541	4 581 738	20.01	19.39	18,35
3–5 and more	< 18			13 898 514	25 190 405	21689345	45.07	67.97	59.04

Source: Compiled and calculated by the authors based on the results of the 2002, 2010 and 2020 censuses.

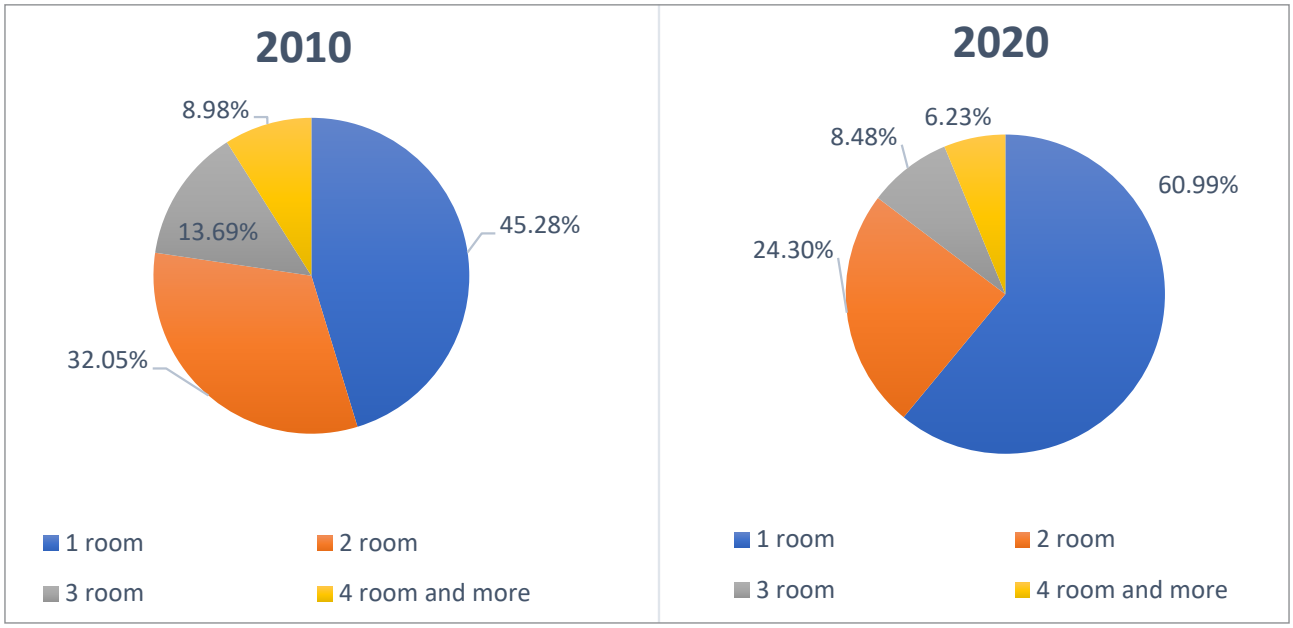

Fig. **"Optimal" structure by in number of rooms in individual houses and apartments for the Irkutsk region, based on the 2010 and 2020 census data**

Source: Compiled by the authors.

MODELING OF ORGANIZATIONAL-ECONOMIC INTERACTION OF PARTICIPANTS IN HOUSING CONSTRUCTION

Systemic modeling of the economic interaction of participants in the housing construction sector has been conducted by Russian scientists such as D.A. Makarov and M.N. Yudenko [10]. Foreign researchers M. Liu, Y., Yi Hu, Bo Xia, M. Skitmore, and X. Gao analyzed and systematized 103 articles from 41 peer-reviewed journals from 1997 to 2016 on system dynamics modeling in the construction industry [11].

Among foreign authors, the approach related to agent-based modeling is the most popular. For example, M.J. Smith focused on the behavior of individual agents (such as homebuyers, sellers, developers, and investors) and demonstrated how their interactions influence market trends, pricing, and housing availability [12]. J. Smith and A. Brown in their work [13] examined the relationships between developers and government bodies and their role in the development of residential real estate. W. Kirsch and M. Shilling paid special attention to how agent-based models help predict housing market behavior and take into account complex socio-economic factors [14]. To apply such models, a clear understanding of which criteria determining market behavior will prevail among different agents (economic entities) is needed.

The decision-making process concerning a wide range of practical tasks is viewed as a continuous flow of actions — from the moment the initial data is presented to the stages of design, selection, verification, and testing of the obtained results. In this process, one has to take into account the constantly growing number of often conflicting criteria that are at odds with each other [15].

A multi-criteria optimization problem arises, which usually has several constraints [16].

In the paper [17], it was shown that it has a solution. Unlike [6], where the results of numerical calculations were presented by first selecting criteria for two (pairwise) and then for three (the developer, the bank, and the consumer) economic

Table 6

Solution of a multicriteria problem based on 2023 data

Optimal solution				Value of criteria at the optimal point			
X_1	X_2	X_3	X_4	B(X)	S(X)	N(X)	G(X)
240 268.75	42 063.63	151 339.67	6 327.95	7 911 725 452.87	14 665 895 740.50	114 540.58	15 954 371.15
73 507.54	12 870.42	351 631.45	1 990.60	7 594 778 513.33	11 905 033 903.46	108 265.90	16 074 781.63
65 334.33	11 442.98	361 317.30	1 905.39	7 579 247 904.26	11 769 749 848.82	107 958.43	16 080 766.68
93 848.13	16 428.92	327 289.56	2 433.38	7 633 435 555.77	12 241 767 775.77	109 031.20	16 059 915.62
220 610.17	38 621.51	174 976.66	5 791.66	7 874 361 604.17	14 340 426 631.20	113 800.88	15 968 389.24
128 639.69	22 522.36	285 393.90	3 444.05	7 699 563 399.93	12 817 794 172.24	110 340.35	16 034 598.18
0.79	**0.25**	**439 997.99**	**0.97**	**7 455 069 208.15**	**10 688 053 954.49**	**105 500.03**	**1128 928.86**
11 610.28	2 033.31	426 026.89	329.52	7 477 134 968.19	10 880 264 396.72	105 936.87	16 120 333.44
269 212.80	47 128.83	116 638.99	7 019.39	7 966 734 843.70	15 145 071 640.43	115 629.62	15 933 819.68
79 349.69	13 898.57	344 405.69	2 346.05	7 605 887 631.77	12 001 803 200.67	108 485.83	16 070 501.20
262 395.39	45 935.37	124 827.59	6 841.65	7 953 777 645.98	15 032 204 065.63	115 373.10	15 938 651.19
309 153.19	54 120.24	68 691.47	8 035.10	8 042 645 155.00	15 806 311 125.70	117 132.43	15 905 629.82
14 967.80	2 620.54	422 014.94	396.72	7 483 515 741.51	10 935 846 047.81	106 063.20	16 117 851.44
84 110.36	14 726.85	338 884.59	2 278.19	7 614 930 607.77	12 080 574 666.09	108 664.85	16 067 024.95
69 894.68	12 237.05	356 004.98	1 863.29	7 587 910 993.60	11 845 212 336.55	108 129.94	16 077 428.53
295 096.93	51 659.97	85 558.10	7 685.00	8 015 930 187.08	15 573 602 499.17	116 603.55	15 915 528.08
324 177.16	56 749.73	50 669.87	8 403.24	8 071 199 156.98	16 055 039 346.64	117 697.73	15 895 077.28
122 955.29	21 526.56	292 247.72	3 270.43	7 688 758 894.04	12 723 678 324.41	110 126.45	16 038 724.76
116 361.79	20 371.79	300 186.77	3 079.65	7 676 226 758.10	12 614 513 394.28	109 878.35	16 043 516.02
55 320.06	9 686.24	373 486.11	1 507.60	7 560 211 036.92	11 603 923 507.38	107 581.55	16 088 118.35
30 406.82	5 325.79	403 375.55	891.84	7 512 861 739.39	11 191 473 058.66	106 644.17	16 106 450.29
76 081.80	13 321.52	348 521.47	2 075.22	7 599 671 617.41	11 947 656 773.44	108 362.77	16 072 896.77
41 243.06	7 220.62	390 443.63	1 092.69	7 533 454 935.81	11 370 856 440.06	107 051.86	16 098 469.35
279 976.66	49 012.80	103 726.13	7 284.41	7 987 192 328.42	15 323 272 615.85	116 034.62	15 926 203.17

Table 6 (continued)

Optimal solution				Value of criteria at the optimal point			
X_1	X_2	X_3	X_4	B(X)	S(X)	N(X)	G(X)
6 108.27	1 069.79	432 648.13	173.81	7 466 677 483.23	10 789 171 327.39	105 729.84	16 124 405.00
197 724.02	34 615.72	202 439.21	5 221.05	7 830 864 763.67	13 961 534 313.93	112 939.76	15 984 767.96
143 246.36	25 079.61	267 842.34	3 831.69	7 727 325 095.50	13 059 620 816.75	110 889.96	16 024 013.73
205 241.76	35 931.72	193 412.23	5 414.29	7 845 152 948.66	14 085 995 850.07	113 222.63	15 979 380.64
347 204.72	60 780.87	23 014.32	9 000.09	8 114 965 326.82	16 436 277 954.63	118 564.18	15 878 957.62
216 146.90	37 839.96	180 345.16	5 667.97	7 865 878 494.24	14 266 531 908.37	113 632.94	15 971 578.56
19 632.18	3 438.00	416 377.76	552.06	7 492 381 797.37	11 013 076 485.06	106 238.72	16 114 403.76
341 096.93	59 711.75	30 346.02	8 845.29	8 103 356 981.03	16 335 159 755.49	118 334.36	15 883 226.71
25 011.53	4 378.60	409 959.30	650.57	7 502 604 694.35	11 102 126 114.73	106 441.10	16 110 433.20
51 482.97	9 014.71	378 087.27	1 415.05	7 552 918 453.04	11 540 399 253.02	107 437.18	16 090 936.89
133 047.39	23 294.09	280 095.24	3 563.28	7 707 940 809.48	12 890 768 179.87	110 506.20	16 031 401.44
138 998.02	24 334.33	273 004.92	3 662.74	7 719 249 085.04	12 989 272 306.67	110 730.07	16 027 090.65
183 349.32	32 098.01	219 753.06	4 799.62	7 803 542 866.00	13 723 538 637.65	112 398.86	15 995 089.21
102 707.73	17 980.72	316 616.31	2 695.24	7 650 274 993.44	12 388 452 742.91	109 364.57	16 053 454.51
61 945.49	10 846.16	365 525.91	1 682.44	7 572 803 450.90	11 713 613 424.28	107 830.85	16 083 255.40
189 634.81	33 199.57	212 157.06	5 008.55	7 815 490 335.02	13 827 610 721.39	112 635.39	15 990 572.61
32 953.86	5 772.07	400 301.51	972.57	7 517 703 060.58	11 233 644 822.91	106 740.01	16 104 572.19
46 630.36	8 165.09	383 920.32	1 284.22	7 543 695 452.19	11 460 059 527.79	107 254.59	16 094 504.29
37 844.72	6 627.23	394 466.37	1 061.68	7 526 997 578.59	11 314 607 671.43	106 924.02	16 100 969.86
181 210.47	31 723.45	222 326.96	4 739.12	7 799 477 615.46	13 688 127 155.65	112 318.38	15 996 627.07
85 250.50	14 930.59	337 355.90	2 463.01	7 617 101 748.33	12 099 487 148.22	108 707.83	16 066 187.97
347 204.72	**60 780.87**	**23 014.32**	**9 000.09**	**8 114 965 356.95**	**16 436 278 006.33**	**118 564.18**	**15 878 957.62**
161 980.37	28 359.28	245 337.78	4 322.57	7 762 931 137.04	13 369 777 869.01	111 594.86	16 010 476.64
96 602.41	16 914.31	323 857.87	2 625.42	7 638 673 641.32	12 287 395 512.37	109 134.90	16 057 903.40

Source: compiled by the authors.

entities, in this article we propose a solution variant in which there are four criteria for optimization (each economic entity has its own).

The task looks like this:

$$F(X) = \{B(X), S(X), N(X), G(X)\} \to \text{exrt}, \quad (1)$$

$$B(X) = \sum_{i=1}^{n} r\beta X_i C + \sum_{i=1}^{n} h\gamma X_i P_i \to \max, \quad (2)$$

$$S(X) = \sum_{i=1}^{n} (P_i - C) X_i \to \max, \quad (3)$$

$$N(X) = \frac{\sum_{i=1}^{n} P_i X_i}{\sum_{i=1}^{n} X_i} \to \min, \quad (4)$$

$$G(X) = \sqrt{\sum_{i=1}^{n} (L_i \cdot U_i - X_i)^2} \to \min, \quad (5)$$

where $i = (1, n)$ — room type number;

In t- year, the following will be considered:

X_i — the amount of housing of i-type required to increase the housing stock (the sought value in the optimization problem, m²;

U_i — the need for housing of i-type by households, units of apartments;

L_i — average area of housing of the i-type, m²;

C — cost price of 1 m² of housing, rubles;

P_i — price for the consumer when purchasing 1 m² of apartment of the i-type, rubles;

β — share of borrowed funds issued by the bank to developers for project implementation, $0 < \beta \leq 0.9$;

r — interest rate on the loan for the developer;

γ —share of borrowed funds issued by the bank to the population for the purchase of housing, $0 < \gamma \leq 0.85$;

h — interest rate on mortgages for the population.

$B(X)$ maximizes bank income; $S(X$ maximizes developer profit; $N(X)$ minimizes the average apartment price for the population; $G(X)$ — reduces the gap between housing demand and supply to increase the housing stock.

The set of feasible solutions is defined by the constraint on the amount of housing being constructed and non-negativity conditions:

$$\sum_{i=1}^{n} X_i \leq V, \; X_i \geq 0. \quad (6)$$

It is required to determine such a vector $X = (X_1, X_2, \ldots, X_n)$ from this set for which the value of the vector function of the $F(X)$ vector argument reaches its extremum (maximum or minimum).

To solve the aforementioned problem, it is important to simultaneously consider several criteria and constraints [18]. In this study, we used MATLAB (version R 2019), which is a high-tech software product [19], utilizing its multi-objective genetic algorithm (gamultiobj). Such a choice was made because "genetic algorithms are an effective tool and can be applied to solve a wide range of applied problems in multi-criteria conditional optimization" [15].

Table 7

Solution of a multicriteria problem based on 2020 data

Optimal solution				Value of criteria at the optimal point			
X_1	X_2	X_3	X_4	$B(X)$	$S(X)$	$N(X)$	$G(X)$
0.00	**70219.53**	**335306.00**	**599147.47**	**11240842963.57**	**23949177254.78**	**72328.78**	**16 011 903.69**
130751.37	127278.04	278830.17	467813.42	11484320449.32	26070061314.53	74439.80	15 904 877.48
122047.34	123479.69	282589.73	476556.23	1146812317.19	25928875519.26	74299.27	15 911 944.86
113087.03	119569.51	286459.98	485556.48	11451426951.08	25783532594.62	74154.61	15 919 228.92
58072.62	95561.80	310222.51	540816.07	1134898234 7.69	24891158035.76	73266.38	15 964 141.66

Table 7 (continued)

Optimal solution				Value of criteria at the optimal point			
X_1	X_2	X_3	X_4	B(X)	S(X)	N(X)	G(X)
23436.49	80446.96	325183.00	575606.54	11284484997.56	24329334446.82	72707.17	15 992 584.89
190225.28	153231.83	253141.45	408074.44	11595069255.77	27034772201.76	75400.03	15 856 807.39
390237.75	240515.15	166749.51	207170.59	11967520667.87	30279122524.71	78629.29	15 698 010.83
272214.25	189010.94	217727.73	325720.08	11747744281.95	28364694022.18	76723.76	15 791 175.72
202676.98	158665.61	247763.14	395567.26	11618256078.64	27236748005.51	75601.06	15 846 792.21
184343.29	150664.99	255682.08	413982.64	11584116152.13	26939361899.48	75305.06	15 861 544.32
323704.10	211480.57	195487.57	274000.76	11843625639.78	29199897467.00	77555.08	15 750 339.17
164787.47	142131.03	264128.87	433625.63	11547700454.47	26622151970.52	74989.33	15 877 320.39
74374.43	102675.74	303181.24	524441.58	11379338627.43	25155585572.57	73529.58	15 950 799.15
164787.47	142131.03	264128.87	433625.63	11547700454.47	26622151970.52	74989.33	15 877 320.39
312444.89	206567.17	200350.79	285310.14	11822659409.07	29017264822.24	77373.30	15 759 243.59
429542.97	257667.53	149772.30	167690.20	12040712551.13	30916682395.02	79263.88	15 667 332.14
143739.68	132946.00	273220.10	454767.22	11508506496.92	26280741199.13	74649.50	15 894 346.70
36322.44	86070.26	319617.14	562663.16	11308480453.31	24538354088.36	72915.22	15 981 987.92
335134.21	216468.55	190550.53	262519.71	11864910119.41	29385302363.46	77739.62	15 741 314.10
16192.68	77285.84	328311.85	582882.63	11270995999.05	24211834464.01	72590.22	15 998 549.73
110822.37	118581.24	287438.17	487831.22	11447209839.84	25746798200.90	74118.04	15 921 071.29
96455.42	112311.65	293643.73	502262.20	11420456542.36	25513755552.30	73886.08	15 932 772.21
433968.89	**259598.96**	**147860.59**	**163244.55**	**12048954230.65**	**30988474128.53**	**79335.34**	**15 663 888.58**
47092.53	90770.21	314965.18	551845.08	11328535876.45	24713052907.97	73089.11	15 973 144.61
86497.38	107966.07	297944.92	512264.63	11401913270.24	25352228791.08	73725.31	15 940 895.45

Source: compiled by the authors.

Input data for calculations for 2023 are as follows:

$n = 4$ — number of apartment types, units;

$V = 440\,000$[3] — planned housing input, m²;

$C = 81\,209$ — cost price of 1 m² of housing;

$P = [120\,510; 114\,330; 105\,500; 105\,500]$; — price for the consumer when purchasing 1 m² of an apartment of the i-type, rub.;

$\beta = 0.85$ — share of borrowed funds for developers;

$r = 0.07$ — interest rate on loans for developers;

$\gamma = 0.7$ — share of borrowed money for the population;

$h = 0.164$ — interest rate on mortgages for the population;

$L = (33; 42; 54; 72)$ — average apartment area, m²;

$U = [421\,416; 167\,879; 58\,568; 43\,071]$ — the need for housing for households of the i-type, units of apartments.

The found Pareto-optimal solutions are presented in *Table 6*.

Since all points in the Pareto-efficient set in the solution space are equivalent from the perspective of multi-criteria optimization theory, the decision-maker plays a crucial role.

In this set of solutions, the choice is obvious: with maximum values of criteria

B(X) and *S(X)* and minimum *G(X)* the solution is found at point $X = (347205; 60781; 23014; 9000)$, which indicates how many square meters of apartments of different room counts need to be built. In *Table 6*, this row is highlighted in yellow, and the value *N(X)* in it is not the smallest. However, it is precisely the population that is forced to make this compromise, even though, in the context of the average weighted price per 1 m², the point highlighted in orange in *Table 6* is more advantageous for them, i.e., from the citizens' perspective, it is more reasonable to build three-room apartments.

The calculation option based on the 2020 data is presented in *Table 7*.

Initial information for 2020:

$r = 0.07$; $\beta = 0.85$; $\gamma = 0.7$; $h = 0.085$; $C = 48\,491$;

$P = (84\,357; 80\,031; 71\,750; 71\,750)$;

$L = (33; 42; 54; 72)$;

$U = (421\,416; 167\,879; 58\,568; 43\,071)$;

$V = 1004673$ [20].

The best for the state, developers, and banks is highlighted in yellow, for the population in orange. The maximum values of the criteria *B(X)* and *S(X)* and the minimum *G(X)* are achieved at the point $X^* = (433969; 259599; 147861; 163245)$[4]

From the population's perspective, it is more reasonable $X^* = (0; 70220; 335306; 599147)$[5]

The comparison of the structure of solutions obtained in 2020 and 2023 is presented in *Table 8*.

CONCLUSION

Based on the results of the work, it can be concluded that the research task has been solved. The authors of the article have shown that there are points where the interests of economic entities align, and the decision-maker has options to choose from. Among the four entities considered, developers, banks, and the state are more active, making decisions and influencing their parameters. The opportunities for the population are limited in terms of cost: the consumer pays for everything. However, the obtained results can be explained differently: in essence, the criterion *G(X)* serves not only the interests of the state but primarily those of the population. Who, if not households, is interested in reducing the gap between the actual and "optimal" structure of the housing stock? The tendency of this indicator towards zero indirectly indicates the complete correspondence of the household composition to the required

[3] In the Irkutsk region, they plan to build 460 thousand square meters of new housing in 2023. The regional. 01.07.2023. URl: https://www.ogirk.ru/2023/07/01/v-irkutskoj-oblasti-planirujut-postroit-460-tys-kv-m-novogo-zhilja-v-2023-godu/ (accessed on 04.07.2024).

[4] * means the optimal value of the value X.

[5] The same thing.

Table 8

Structure of decisions in 2020 and 2023, %

	2020		2023	
Economic subjects	**Developers, banks, state**	**Population**	**Developers, banks, state**	**Population**
One-room apartments	43	0	79	0
Two-room apartments	26	7	14	0
Three-room apartments	15	33	5	100
Four-room (and larger) apartments	16	60	2	0

Source: Compiled and calculated by the authors.

number of rooms in the apartments. The only thing is, the model does not provide a definite answer as to who acquires these apartments. The minimum price factor (orange line) confirms the market truth: the larger the living space, the cheaper the square meter. However, this does not mean that all households should acquire 3- and 4-room apartments. In such a situation, only additional state regulation can help minimize the gap between the real situation and the ideal housing needs of the population. In this case, the presented model becomes a necessary tool for reconciling the interests of all participants in the housing construction complex to maintain the sustainability of its existence in a challenging macroenvironment.

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Authors' declared contribution

N.N. Shelomentseva — construction of the best structure by the number of rooms in individual houses and apartments for the Irkutsk region based on the 2010 and 2020 censuses; development of a multi-criteria economic and mathematical model for coordinating the interests of economic entities in housing construction and numerical experiments on the model.

O.V. Grushina — development of the general concept of the article, justification for the application of a system-information approach to managing the sustainability of the housing construction complex, analysis of housing provision by households based on the 2002, 2010 and 2020 censuses.

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ORIGINAL PAPER

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Leadership Approaches in Public Owned Industrial Organisations: Evidence from a Developing Country

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ABSTRACT

This paper aims to examine the styles of leadership as practiced and desired by the management personnel within publicly owned industrial organisations in the developing country of Bangladesh. Sixty management personnel were systematically selected from three distinct manufacturing organisations for the study. Following a review of pertinent literature, a behavioural scientist assisted in the development of a questionnaire that included twenty forced-choice items. Analysis of the data was conducted using SPSS software. The findings show that perceived control in decision-making by the management personnel was much far from ideal. In the decision-making areas, such as, departmental policy making in connection with subordinates' work, determination of the techniques and methods of the department, job assignment to subordinates, participation in subordinates' activity, and maintenance of discipline, they had virtually little influence. They had to act in accordance with the systems and procedures laid down by the company. They, of course, desired much influence in decision-making in all the areas.

***Keywords*:** Leadership styles; Bangladesh; Industrial organisations; management; Laissez-faire; Democratic leadership; Autocratic leadership; Bureaucratic leadership

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INTRODUCTION

A significant critique of classical organisational theory is to the presumption that achieving organisational objectives necessitates unilateral control exerted by a singular authority at the apex of the organisation [1]. The investigation into the characteristics of democratic leadership and the advantages of involvement in collective decision-making has strengthened the critique of this authoritarian model of management. Nevertheless, it would be erroneous to construe this assault as endorsing the eradication of an organisation's power over its members. The early study on styles of leadership documented the negative consequences of morale and productivity of laissez-faire leadership [2]. The main thrust of the criterion was to advocate an organisation whose parts are all dependent upon centralised source of control.

Numerous studies have highlighted the need of a sufficiently high degree of social influence inside an organisation for the purpose of ensuring that the organisation is able to function properly [3–6]. The studies used a method called the "control graph technique" and found that, in most of the organisations they looked at, there was a link between the level of total control and good organisational performance. It thus appears that organisations require for their functioning the exertion of an adequate amount of the influence by one part on another, but this influence may take a variety of forms.

This study aims at exploring the forms of influence exercised by the managerial executives within publicly owned industrial organisations in the developing country of Bangladesh. The forms of influence are here referred to as the styles of leadership, which we may define as a pattern of interacting with subordinates.

LITERATURE REVIEW

This research defines leadership style as the practices and attitudes of a leader, manager, head, or supervisor in leading, managing, and supervising employees in the workplace. Leaders exert a

crucial influence throughout organisations. To sustain the effective functioning of the business, leaders must do crucial tasks such as establishing objectives, inspiring subordinates, engaging in decision-making, and providing feedback [7]. Nonetheless, as leadership behaviour is influenced by several dynamic elements, such as cognition and emotion, it is not unusual for leaders to experience temporary incapacitation in their organisational positions [8].

Laissez-faire leadership embodies a state of minimal intervention within organisational structures. Bass and Avolio (1995) characterize laissez-faire leadership as a phenomenon marked by "the absence of leadership, the avoidance of intervention, or both", entails a non-intrusive approach where the leader permits team members to make choices with minimal direction [2, 4, 5]. Laissez-faire leaders tend to avoid making decisions, are hesitant to express their views, show reluctance in taking action, and are frequently absent when their involvement is necessary [9–11].

However, a leader who adopts a laissez-faire approach is effectively stepping back from the situation. Lack of engagement does not imply inactivity [12]. One may interpret it as a demonstration of regard for an individual's own competency [13]. It might also be interpreted as the leader carefully avoiding the imposition of their own identity. Non-involvement and empowering leadership might be considered synonymous, as they both eliminate bureaucratic constraints [14]. The lack of engagement in laissez-faire leadership and empowering leadership is analogous [10]. A non-involved laissez-faire leader can be viewed as an alternative to traditional leadership roles. The substitution hypothesis posits that specific attributes of a worker, an employee, or a scenario influence a leader's capacity to influence personnel [15]. The concept of substitution serves as a critical factor in assessing the effectiveness of laissez-faire leadership in various contexts.

Laissez-faire leadership enables employees to exercise in the process of decision-making [16]. The leaders typically refrain from exerting influence over the activities of a group. An earlier investigation has indicated that a lack of timely intervention by managers can adversely impact the efficiency of subordinates [17]. Laissez-faire is characterized by a lack of leadership presence. Research focused on the laissez-faire style has primarily examined its association with employee job satisfaction and the resulting outcomes, revealing a negative correlation with job satisfaction [11]. This particular point of debate brought to light the fact that the laissez-faire style gives employees the ability to make decisions. It grants autonomy to employees to determine their own actions pertaining to assignments. The leaders offer the essential assistance. The laissez-faire style is regarded as the most radical option within the democratic-style continuum [18]. Research has consistently highlighted the negative impacts of laissez-faire leadership on outcomes, including reduced work performance and increased role ambiguity among team members, e.g. [4, 8, 10, 12].

Democratic and laissez-faire leadership represent two unique approaches that can be strategically utilized across different organisational and group environments. Krieg (2017) asserts that including employees in the process of making decisions is a crucial foundation of democratic leadership [19]. According to this leadership style, the leader should assume the role of a coach who has the authority to make final decisions. However, it is important for the leader to collect information from the team before engaging in decision-making [20]. Democratic leadership is a leadership style that actively involves all persons within an organization in the decision-making process [17, 19]. Democratic leadership is characterised by decentralised decision-making, where organisational choices are made via common understanding, rendering it distinct [19, 20]. This type of leadership is frequently seen as a very assertive approach that leads to increased competence and refined engagement among group members, thereby boosting the overall morale of the group [21].

Furthermore, the democratic leadership style fosters the generation of innovative solutions to challenges by encouraging people to contribute their ideas. Group participants may also desire more engagement in projects and commit themselves to these tasks, therefore displaying a higher propensity to be concerned with the ultimate outcomes of these endeavours [21].

A substantial amount of efficacy is demonstrated by the democratic approach, which encourages more contributions from members of the team, boosts production, and boosts the morale of employees [21]. The democratic leader engages in consultations with subordinates, takes their perspectives into account, offers guidance and recommendations, and fosters a collaborative and supportive workplace atmosphere for employees [17]. The characteristics exhibited by democratic leaders encompass staff development, personnel coordination, consultation, motivation, team building and management, as well as conflict management [22]. The democratic approach entails a balanced level of oversight while prioritizing dialogue and inclusivity in the processes of decision-making and problem resolution.

Numerous researchers discovered that job satisfaction is a robust indicator of organisational commitment [23–28]. Consequently, the degree of commitment to the organisation is substantially affected by employee job satisfaction, and organisational commitment positively influences organisational performance. Research conducted by Rai et al. (2020) demonstrated a significant positive effect of job satisfaction and the perceived democratic leadership style of managers on the level of organisational commitment [29]. The findings indicated a positive correlation between the managers' perceived democratic leadership style and the overall organisational commitment of the workers. When employees perceive their managers as more democratic, there is a significant increase in their overall commitment to the organisation.

The distinctions between laissez-faire and democratic leadership styles, in contrast to autocratic leadership, are significant. In the context of autocratic leadership, authority is exercised to guarantee that all tasks are completed in accordance with the established timeline. Research indicates that employee motivation can diminish, resulting in suboptimal performance [30]. Furthermore, studies [31] have identified a significant correlation between employee work effort and job performance. Research indicates that [7] autocratic leadership typically functions as a controlling, directing, or coercive style wherein the leader infrequently incorporates input from subordinates when making decisions. Employees experiencing pressure reported instances of autonomous supervision by their leaders. Nonetheless, Dawson (2002) indicated that the autocratic style could yield significant outcomes within a brief timeframe [32]. The autocratic leader closely observes and wields authority with minimal trust or confidence in the followers [33]. This attitude contributes to a climate of fear and mistrust among followers towards their leader [34]. This suggests that autocratic leadership is primarily suited for short-term scenarios, as there are numerous instances where this leadership style may present challenges [30].

The leadership style exhibits significant differences within a bureaucratic system. The leaders in question prioritize the systematic completion of their tasks [34]. Ojukuku et al. (2012) indicated that bureaucratic leadership adversely affects organisational performance [35]. It has been observed that bureaucratic leaders fail to motivate the employees within their job place to perform in the anticipated manner, which may result in suboptimal organisational performance [35]. A separate study presented similar results, suggesting that the bureaucratic leadership style does not significantly impact employee or organisational performance [36]. This approach proves advantageous solely when tasks are executed over an extended duration in accordance with a specified procedure [37].

The primary objective of leadership inside the bureaucracy is to effectively serve the community and public interest [38]. It is an essential instrument for ensuring that employees adhere to management orders and state regulations [39]. Lead-

ers are those who provide assistance as agents in politics and administration [40]. In his 2019 study, Lumby suggests that effective leadership in public organisations should confront criticism, preconceptions, and promote constructive interaction. Leadership exercises authority over the development, planning, and creation of reform programs and selectively implements suggestions to protect the interests of the community [41].

The aforementioned literature indicates that numerous studies have been conducted in the realm of leadership; however, a significant gap exists, as only a limited number have been undertaken in Bangladesh, and none have illustrated the impact of various leadership styles on organisational success within successful organisations.

The objective of this study is to investigate the various forms of influence exerted by managerial executives within publicly owned industrial organisations in the developing country of Bangladesh.

METHODOLOGY

Sample

A total of sixty management personnel was selected from Bangladesh Textile Mills Corporation (BTMC), Bangladesh Jute Mills Corporation (BJMC), and General Electric Manufacturing Company Limited (GEMCO). The chosen industries have established a reputation for manufacturing activity. BTMC is a public corporation responsible for management of all government-operated textile industries in Bangladesh. It oversees the operations of 18 government-owned textile manufacturing facilities. However, 78 jute mills were nationalised after Bangladesh's independence and became BJMC subsidiaries. GEMCO was founded in 1972 by the Government of Bangladesh. It was constructed with the technical assistance of M/s. Promash Export, a company from the former Soviet Union, for the purpose of manufacturing electrical equipment, such as power transformers, and was completed in 1978. In 1979, it was changed into a limited company. It possesses the greatest transformer manufacturing facility in Bangladesh.

Three manufacturing industries from distinct categories were selected to examine the attitudes of managers across various sectors concerning a consistent representation of the leadership ideal. Secondly, since the birth of Bangladesh as part of Pakistan, these three industries have had a significant impact on the domestic economy, and their leadership styles closely resemble those of contemporary organizations. The policies and administrative activities of these institutions resemble those of countries in the Asian continent, particularly in South Asia. The present investigation involved the selection of three large organisations according to two specific criteria [42]: (a) each firm employed a minimum of 200 employees and (b) each was registered under the Dhaka Stock Exchange (DSE).

Care was taken so as to include in the sample management personnel of all important functions at different hierarchies. This study employed judgemental sampling, a nonprobability sampling technique, to collect data from respondents across three distinct industries in Bangladesh. Judgemental sampling is suggested as an approach grounded in educated and knowledgeable assumptions to represent a certain target demographic [43, 44]. Judgmental sampling takes place when a sample is selected based on specific criteria. The managerial level was selected as a suitable sample population for several reasons. All interviewees for the managerial positions were department heads with substantial experience in the organisational context. The managerial level constitutes a crucial tier of organisational management, responsible for implementing policy within their respective departments. Consequently, these individuals are well-situated to observe the implementation of the organization's mission. Managers possess exclusive access to information about the organization's developing strategic plans and are cognisant of departmental sentiments concerning progress towards the organization's mission.

Instruments

A questionnaire containing twenty forced-choice items was developed with the help of a behav-

ioural scientist after a survey of the relevant literatures. Diverse types of scales were used to measure the variables parameters. Prior to the finalization of the questionnaire, expert advice was sought, after which it was administered to the samples. For each item or statement, the respondents had to indicate, first, what they perceived regarding control in decision-making related to their department on a five-point Likert-type scale ranging from "strongly disagree" to "strongly

Table 1

Perceived and desired styles of leadership as viewed by management personnel

Items	Actual Mean Score	Desired Mean Score
(a) Laissez-faire leadership		
In my departmental policy-making, I leave it to my subordinate to decide.	1.17	2.63
As regards the techniques and methods of my department, I take care only in formulating the basic plans and give advice when asked for.	1.83	3.47
As regards job assignments to my subordinates, I leave it entirely to my subordinates.	1.17	2.50
I do not make any deliberate attempt to participate.	2.53	3.20
I hardly take any disciplinary action against my subordinates.	1.47	2.23
Average across all items	1.63	3.21
(b) Autocratic leadership		
I have to decide practically everything in my departmental policy-making.	1.60	3.40
I have to lay down practically everything to each subordinate as regards the techniques and methods of my department.	1.67	4.03
As regards the job assignment, I have to decide practically everything.	3.67	4.83
I do not participate in subordinates' activities.	2.07	3.67
The company's rules and procedures stand in the way of maintaining discipline in my department.	2.80	3.70
Average across all items	2.36	3.93
(c) Democratic leadership		
In the departmental policy-making, my subordinates decide with my help.	1.20	3.77
As regards the techniques and methods of my department, my subordinates determine the goals by group decisions.	1.60	3.97
As regards job assignments, I leave it to my subordinates, primarily who do this with my help.	1.77	3.73
I participate symbolically in subordinates' activity.	2.77	3.73
I think it is necessary to hear both sides, collect all the relevant information, and check them before taking any disciplinary action.	2.63	4.27
Average across all items	1.99	3.86
(d) Bureaucratic rule-oriented leadership		
In my departmental policy-making, I strictly follow the systems and procedures laid down by the company.	3.33	4.43
As regards the techniques of my department, I strictly follow the company rules.	3.47	4.83
I strictly follow the company rules regarding job assignments.	3.43	4.87
It is laid down by the company rules; I participate in subordinates' work, otherwise not.	3.03	4.23
As regards discipline, I strictly follow the company rules.	3.20	4.80
Average across all items	3.29	4.63

Source: compiled by the author.

agree", and secondly, what they desired for control in such decision-making on a similar type of scale ranging from "not important" to "essential". The validity and reliability of the scale were tested through factor analysis. Cronbach alpha was 0.67.

RESULTS AND DISCUSSIONS

Table 1 shows the style of leadership as perceived and desired by the managerial personnel. From *Table 2*, four types of leadership, such as laissez-faire, autocratic, democratic, and bureaucratic rule-oriented leadership, were identified and separately presented in *Table 1*. Across all items, the perceived mean score was 1.63 and 3.21, respectively, for laissez-faire leadership and 2.36 and 3.93 for autocratic leadership. 1.99 and 3.86 for democratic leadership and 3.29 and 4.63 for bureaucratic rule-oriented leadership. This indicates the absence of the first three categories of leadership and the general presence of bureaucratic leadership in the enterprise concerned.

An examination of *Table 2* reveals that there were wide differences between the perceived and the desired mean scores in all the items, which were all

Table 2

Styles of leadership practiced and desired by the management personnel

Items*	Actual (A)			Desired (D)			$\bar{X}_A - \bar{X}_D$	t value**
	$\bar{X}$	SD	$\frac{SE}{X}$ of	$\bar{X}$	SD	$\frac{SE}{X}$ of		
1	1.60	0.66	0.09	3.40	0.61	0.08	1.80	15.33
2	1.20	0.40	0.05	3.77	0.50	0.06	2.57	30.56
3	3.33	1.14	0.15	4.43	0.50	0.06	1.10	6.82
4	1.17	0.58	0.08	2.63	1.17	0.15	1.46	8.63
5	1.67	0.79	0.10	4.03	0.41	0.05	2.36	20.48
6	1.60	0.80	0.10	3.97	0.31	0.04	2.37	21.15
7	3.47	0.99	0.13	4.83	0.45	0.06	1.36	9.63
8	1.83	0.37	0.05	3.47	0.67	0.09	1.64	16.36
9	3.67	0.75	0.10	4.83	0.37	0.05	1.16	10.75
10	1.77	0.76	0.10	3.57	0.62	0.08	1.18	14.13
11	3.43	1.05	0.14	4.87	0.34	0.04	1.44	9.94
12	1.17	0.37	0.05	2.50	0.96	0.12	1.33	9.97
13	2.07	1.06	0.14	3.67	0.75	0.10	1.60	9.29
14	2.77	1.43	0.18	3.73	0.77	0.10	0.96	4.57
15	3.03	1.05	0.14	4.23	0.96	0.12	1.20	6.50
16	2.53	1.18	0.15	3.20	0.54	0.07	0.67	3.96
17	2.80	1.40	0.18	3.70	0.64	0.08	0.90	4.49
18	2.63	0.98	0.13	4.27	0.63	0.08	1.64	10.75
19	3.20	0.98	0.13	4.80	0.60	0.08	1.60	10.70
20	1.47	0.50	0.06	2.23	0.80	0.10	0.76	6.21

Source: compiled by the author.

Note: * — The items are same as those in *Table 1*.

** — All are significant at 0.01 level.

$\bar{X}$ — Sample mean; SD — Standard deviation; SE — Standard error.

statistically significant at the 1% level of confidence. Taking a criterion of 4 (agree) and above, not a single item could achieve this level. In the desired scale, taking a criterion of 4 (very important) and above, all the items in the category of rule-oriented bureaucratic leadership (i.e., items 3, 7, 11, 1 and 19), one item (item 18) in the category of democratic leadership and two items (5 and 9) in the category of autocratic leadership were found to achieve this level. This was an in indication of the fact that although autocratic and democratic leadership were non-existent, the management personnel desired autocratic control in deciding the techniques and methods of the department and in "job assignment to their subordinates; democratic leadership in taking disciplinary action; and bureaucratic rule-oriented leadership in departmental policy making in connection with the subordinates" work, in "determining the techniques and methods of the department", in "assigning jobs to subordinates", in "participation in subordinates work" and in "the maintenance of discipline".

The available data indicate that the management personnel neither practiced laissez-faire leadership nor did they desire to practice the same. They were also not autocratic in their departmental policy making in connection with their subordinates' work as well as regarding the (i) techniques and methods of their department, (ii) job assignment to subordinates, (iii) participation in subordinates' work, and (iv) discipline. But they desired autocratic control in deciding the techniques and methods of their department and in assigning jobs to their subordinates. Democratic leadership also could not get any foothold, which, however, was considered to be quite important in all the cases except in discipline, where they thought it to be very important to hear both sides and collect all the relevant facts and check them before taking any action. Again, compared with the laissez-faire, autocratic, and democratic styles of leadership, the management personnel were actually more prone toward strict adherence to the systems and procedures laid down by the organisation, and, in the same tone, they thought it highly desirable to follow the organisation rules.

The results of the study regarding leadership styles do not conform with those of Ali and Ullah (2023), a study conducted in Bangladesh, who found that the majority of managers and employees employed in a private sector industrial organisation practiced democratic-laissez-faire styles of leadership, and they considered it also very important on-the-job conditions of work [45]. However, the finding of this study is in line with the observation of Fiaz et al. (2017) that managers in public sector organisations act largely on the basis of rules and regulations laid down by the organisation [6]. Since the present study was confined to only three organisations, findings cannot obviously be generalised.

CONCLUSIONS

The overall conclusion of the study is that the management personnel of the organisations under study act largely on the basis of rules and regulations laid down by the company rather than on the immediate requirement of the situation. While the reasons for those rules and regulations may be sound, nevertheless, they have the effect of restricting freedom of action and, consequently, the initiative of the managers in taking decisions. The prevalence of rule-oriented leadership indicates that control over certain policy matters resides maximally in the central authority. Perhaps, by the very nature of the public sector, this is inevitable.

In the public sector, organisations state-dictated rules become the organisation rules, which the people responsible for managing the affairs of the organisation are expected to meticulously follow. It might probably be one of the reasons for non-practice of either autocratic[1] or democratic leadership[2].

[1] Autocratic leadership appears to be theoretically absent. But practically it is wholly present, which finds its expression in the strict adherence to the organisation rules formulated by the central authority. To follow the systems and procedures laid down by the organisation is nothing but the practice of autocratic leadership, unless the systems and procedures contain elements of other kinds of leadership.

[2] In Bangladesh, the jute mills, textile mills, and production of power transformers in the public sector virtually face very little competition within the country. The price of the product is fixed on the basis of the cost, not in relation to the competition in the

Labelling the manager of a nationalised organisation as solely bureaucratic and rule-oriented is an oversimplification; their function often fluctuates based on the specific situation, the organisation's nature, and the work group involved. A clear necessity exists to better investigate leadership patterns in work groups utilising more precise tools. The literature review indicates that the autocratic leadership style is the most practical among leadership styles and reveals a negative correlation with people performance, while democratic and laissez-faire styles demonstrate a positive correlation. In light of this conclusion, it is essential for leaders to embrace their responsibilities through a democratic and laissez-faire approach to leadership. The analysis presented in this study represents only a small part of what we need to learn about executive leadership style. Considerably more research is needed on how one learns about and measures leadership style.

market. As a result, it is difficult to assess the performance of these mills. Inefficiency is covered up by an upward revision of selling prices. Consequently, management people have no opportunity of knowing how well they are doing and how much scope there is for improving performance. Under these circumstances, it is not unexpected of the managers to go by the wind.

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Integration of Sustainable Development Principles into Engineering Management Practices: Analysing the Impact on Companies' Efficiency and Competitiveness

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ABSTRACT

The article examines the challenges and tasks related to integrating sustainable development principles into production and technological, engineering and technical, as well as managerial and economic processes. The author analyses the impact of these principles on the implementation of engineering management (particularly paing attention to its role on sustainable development strategies) and on the efficiency and competitiveness of enterprises, production systems, as well as on the image and reputation of companies. The need of integrating sustainable development principles into business processes is justified by means of analysis of experience employed by companies to improve operational efficiency. The study also applies universal scientific research methods, such as systematic approach, analysis, synthesis, comparison and generalization. As a result, the findings of the study draws up conclusions about the necessity to differentiate the impact on efficiency from the impact on competitiveness: the achievement of competitiveness is associated with competitive advantages, meanwhile the impact on efficiency leads to the growth of competitiveness of the company by proxy. The findings of the study are valuable for enterprises involved in elaboration of a sustainable development strategy.

Keywords: impact on sustainable development; engineering management; enterprise efficiency; competitiveness; sustainable development integration; production systems

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INTRODUCTION

The concept of sustainable development is a long-term oriented trend, which determines complex transformations of the world economy to achieve carbon neutrality, minimise environmental damage and maintain social stability. It is the transformation of the economic sphere in the fundamental processes of sustainable development, that plays a key role, with special attention to the development of sustainable ("green") competitive and efficient production systems. The latter are able to fulfill the basic functions and have a minimal negative impact on society and the environment, preserving it for future generations, at least in the form in which it exists nowadays. Since production (manufacturing, mining, electricity generation, etc.) accounts for the most significant share of emissions,[1] it should be given special attention within the framework of maintaining global sustainable development and the subsequent transition to a green economy with the implementation of the goals presented.

In this context, the task of integrating ESG principles[2] into the company's activities becomes relevant, which is a complex challenge for any manufacturing company and it requires systematic, strategically oriented transformations. When integrating these principles in the company, particular attention should be paid to the issues of engineering management, which is seen as an instrument to coordinate harmoniously the company's production, management, financial and economic objectives for implementing sustainable development policies. The professional responsibilities of engineering managers include supporting the sustainable development of the enterprise as a whole, as well as individual elements of the production system in particular. The rational organisation of activities of such specialists is assumed to lead to an increased efficiency and expansion of the competitive factors of their companies.

In view of the obvious importance of this issue, the aim of this research was to study the impact on the efficiency and competitiveness of companies by means of integrating ESG principles into engineering management practice.

The author used such methods as:

- analysis and synthesis of scientific publications covered by domestic and foreign
- authors on this topic, published in peer-reviewed scientific journals for the period of 2006–2023;
- content analysis to identify key aspects of the impact of integrating sustainable
- development principles on engineering management practice;
- comparative analysis to compare different approaches to assessing the impact of
- sustainable development on the efficiency and competitiveness of enterprises;
- as well as the method of logical modelling to develop a framework for assessing

the impact of sustainable development on the efficiency and competitiveness of enterprises.

To arrange the data obtained systematically in order to visualise the results, the information obtained was presented graphically in the form of diagrams and charts.

This approach helped to consider the problem in a comprehensive way and to formulate reasonable conclusions.

RESULTS AND DISCUSSIONS OF THE STUDY

Engineering management and its role in improving competitiveness

Engineering management is a relatively new direction of activity for the Russian economy, which implies the unification of engineering,

[1] The State Report "On the State and Environmental Protection of the Russian Federation in 2017". URL: https://gosdoklad-ecology.ru/2017/atmosfernyy-vozdukh/vybrosy-zagryaznyayushchikh-veshchestv/

[2] Environmental, social and governance principles of sustainable development.

information and communication, financial and economic management processes underlying the functioning of the production complex.

As was pointed out by T. A. Yakovleva and E. G. Doroshenko, specialists in this field should have the ability to think critically and analytically, make balanced decisions, as well as operate in the context and state of a particular production system and its resources [1]. In fact, the functioning of the engineering management system includes debugging and maintenance of the performance (productivity) of the business system simultaneously with the implementation of the development management objectives, as well as the achievement of performance factors and indicators and expansion opportunities related to competitiveness. In other words, engineering management and all its activities aim high at strengthening the company's position in the market in the conditions of a developing competitive struggle. This is achieved by implementing technical and technological, production, information, management, other mechanisms and solutions that can influence the competitive position of the company. Therefore, the tasks of increasing the efficiency and ensuring the competitiveness of the company are of primary importance in the practice of engineering management. M. A. Katanaeva, O. E. Podverbnykh and T. G. Okuneva call as a vivid example, the quality management system, which coordinates the technical side of the enterprise with the state standards and the needs of the target customers [2].

Such a system, according to these scientists, is linked to the provision of production systems with competitive personnel capable of meeting the growing demands and organising productively their own activities, supporting and maintaining the introduction and implementation of a sufficient number of standards in the field of quality. The latter is accomplished by means of developing an internal strategy, one of the directions of which can be the sustainable development. *Fig. 1* presents provisions and elements of its formation.

Since increased variability is characteristic for the modern economy, it would be relevant to express solidarity with the points of view stated by A. V. Tebekin and A. A. Egorova, regarding the potential to address the challenges of adapting to particular niches, solutions, demands and modern peculiarities that determine the specificity of enterprise development management when coordinating system tasks [3]. The authors of the publication point out, that high dynamics of external environment determines the processes of market customisation, in the conditions, where the once existing models of competitiveness may lose their own effectiveness. At the same time, there occurs a need for new methods of production systems management, for example, to implement a circular management and decision-making scheme, to make a transition from functional managers to universal managers, etc., which has a significant impact on the approaches to the organisation of engineering management.

If we consider the theses presented, it is worth pointing out, that the goal of the latter and its related practices is to debug and develop the production system not only technically, but also make it economically and management-wise strong. The most important metrics (indicators) of any company's development in engineering management practice are efficiency and competitiveness, which reflect compliance with internal expectations, external requirements and activities of other market participants.

Integration of ESG principles into engineering management

Obviously, within the framework of the sustainable development paradigm and related principles engineering management also acquires a characteristic specificity based on the integration of ESG principles into production, techno-

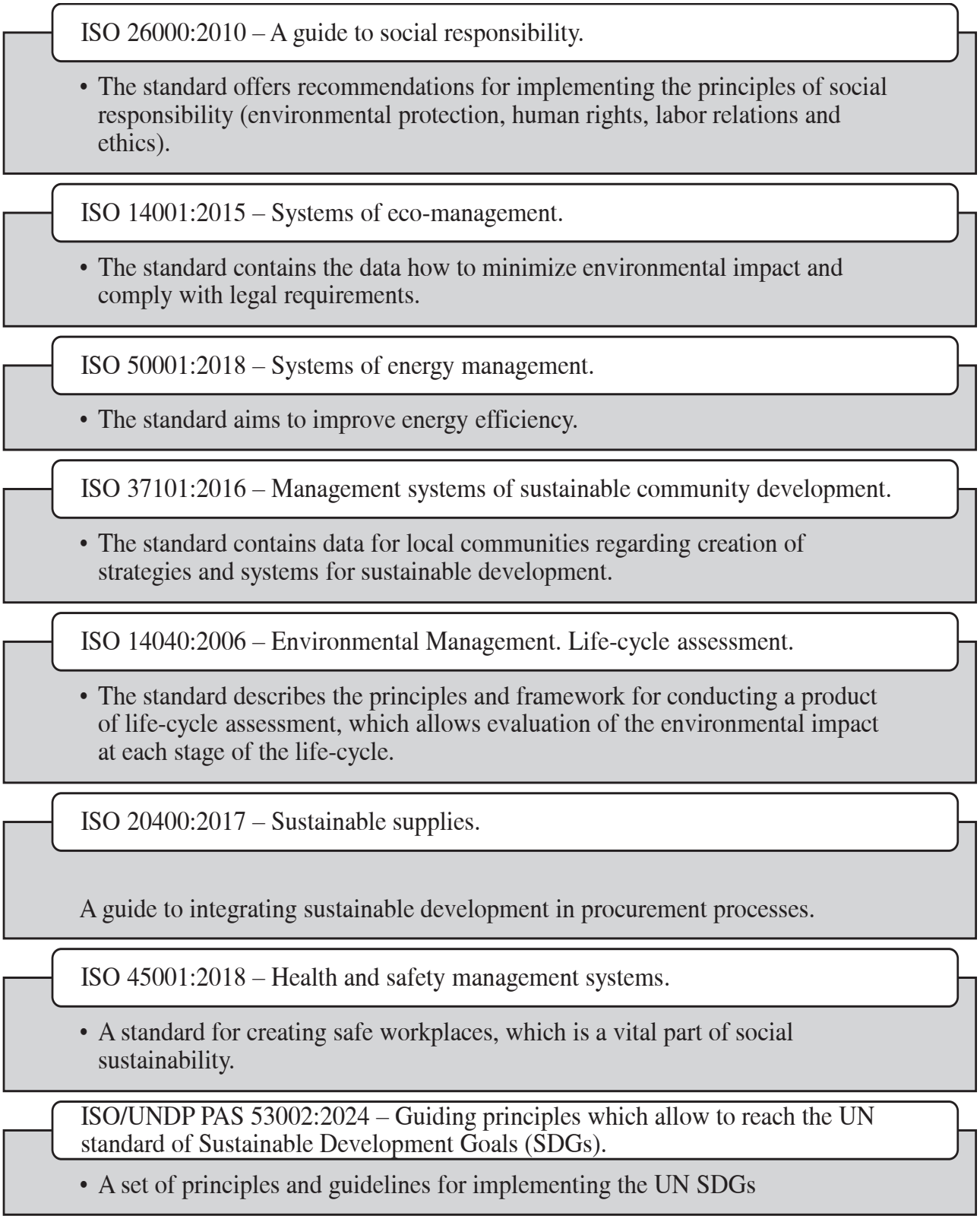

Fig. 1. **International ISO Standards in the Field of Sustainable Development**

Source: developed by the author based on ISO/UNDP PAS 53002:2024. URL: https://www.iso.org/standard/87945.html?utm_source=banner-sdgs&utm_campaign=sdgs-launch&utm_medium=organic-web

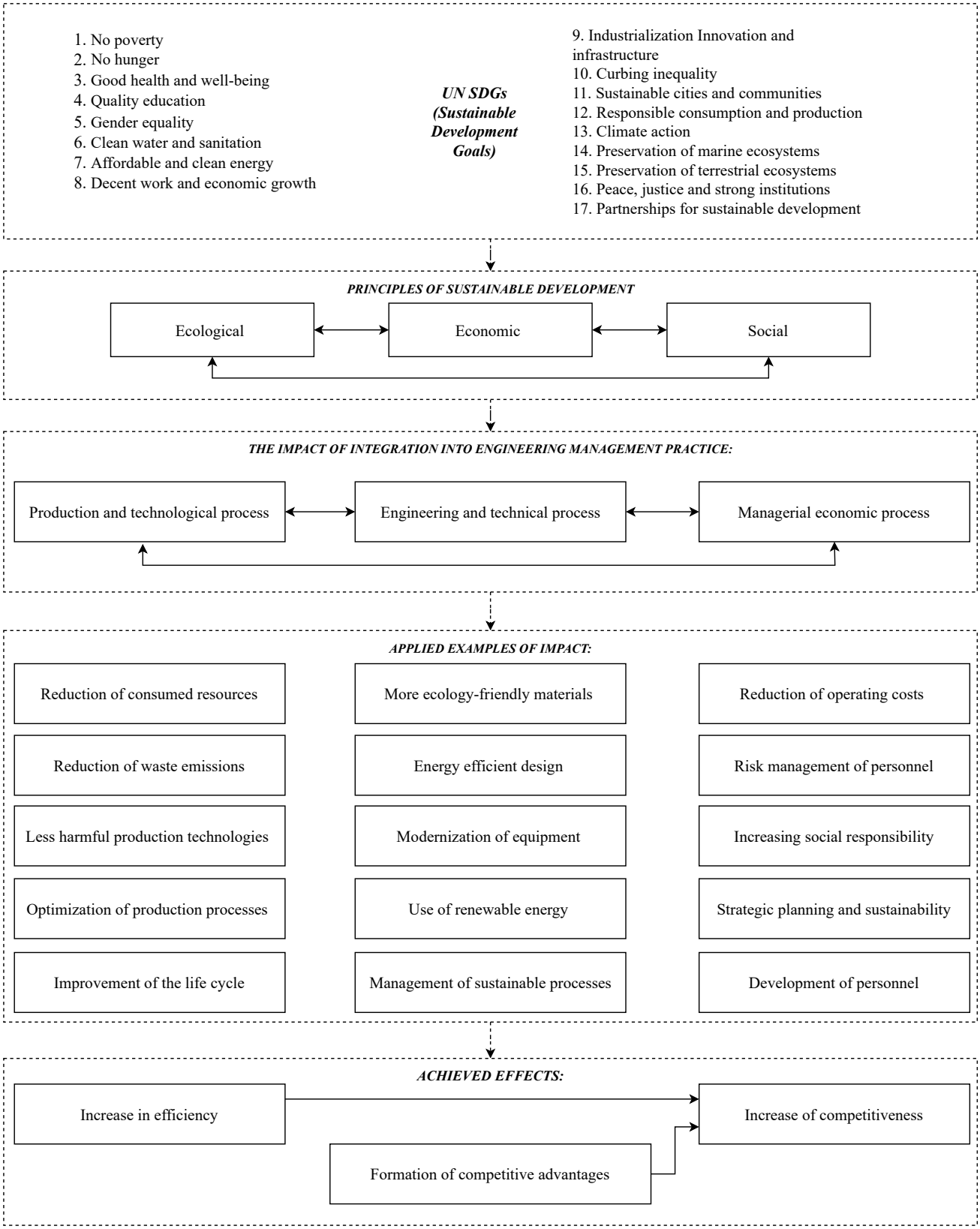

Fig. 2. **Principles of sustainable development and their impact on engineering management practice**

Source: developed by the author

logical, engineering and managerial-economic processes of the company. In this regard, the Sustainable Development Goals determined by the United Nations (UN SDGs) play an important role in business activity (*Fig. 2*).

The above-mentioned principles (see *Fig. 2*), when integrated into engineering management practice, lead to several directions to improve efficiency and competitiveness of the company. One can implement it in the following ways:

• A long-shot approach towards strategically-oriented transformations based on inevitability and consistency of impact of sustainable development on business systems and organisation of business processes and business models, as well as on the choice of material suppliers, customers, specific equipment, personnel development and many other aspects. In reality, sustainable development makes significant adjustments to many components of business and, when making decisions in the interests of the latter, it implies taking into account the factors of impact on its sustainability. This "makes" enterprises to at least implement certain sustainability practices and gradually transform their operational and modernisation strategies to include a mandatory social and environmental agenda.

• Proactive and preventive action of the company in response to the expected increase in government regulation, public pressure, etc. Since ESG principles are actively promoted (lobbied) by the community, enterprises have to demonstrate commitment and devotion to meet their demand. This looks like a compulsory measure aimed to avoid long-term negative consequences and negative impact on business from possible government decisions related to the environment. This also involves potential opportunities for attracting investments, obtaining government contracts and building productive interaction with the State and society.

• Improving the company's image and reputation while levelling a similar set of risks and challenges. Thus, the company maintains its image as a responsible, sustainable and rational business entity that remains committed to unified prospective goals and its initiatives are associated with the ideas and trends of social development. This component is particularly relevant in terms of the efficiency of the company, because it is associated with the productivity of its current relationships with consumers, suppliers, and other partners (stakeholders). In essence, integrating ESG principles can contribute to the implementation and maintenance of the enterprise's relevance, its adaptation to market trends and external environmental influences. Since the sustainable development policy is recognised of a global significance, it would be wise to consider the impact on internal subsystems. This also stimulates the need to launch of planned transformations and transition to the implementation of previously highlighted standards related to sustainable development.

In the given context, E. V. Shcherbina and T. K. Nguyen pointed out noteworthy ideas regarding the need to develop methodological approaches to the implementation of ESG-principles [4]. For example, both researchers cite a set of fundamental positions in the implementation of sustainable business development with a focus on ensuring the sufficiency of resources (their availability). They also take into account the dynamics of expenditure and limitations of resources, the characteristics of the current infrastructure and the problems associated with its changes, maintaining a balance between environmental, financial and economic, production and technological, social and other influential factors. Therefore, the researchers propose not just "blindly" follow the ESG-principles and implement effective solutions related to them, but also develop ways to implement transformations in the vector of sustainable development that take into account the state of the internal environment. This would combine the commitment to this policy and meanwhile avoid decreasing

competitiveness and economic efficiency or other negative changes.

Likewise, D.S. Kondaurova shares a similar opinion, that a comprehensive reflection of this position means implementing a sustainable development management mechanism adapted to the company's specifics features [5]. The author suggests coordinating such mechanism into a number of directions (*Fig. 3*), so that the coordinated action along these directions could provide an opportunity to transform towards sustainable development and allow for the concentration of the resources necessary for successful functioning. In other words, the aim is to coordinate the mechanism, internal tasks and philosophy of the company with the process of supporting the implementation of sustainable development. In our opinion, such approach is possibly quite productive: it implies that attention paid to such procedures as coordination of ways and directions of sustainable development, forecasting their effectiveness in the context of specific metrics and indicators that are most appropriate for a particular company. At the same time, N.V. Shandova gives somewhat different points of view and ESG-principles in her research, which are applicable in manufacturing companies, including the principles of connectivity, productivity, innovativeness, environmental friendliness, safety, etc. [6].

It is also important to take them into account, when implementing transformations towards sustainable development, which is accompanied by supplementing quantitative performance indicators and criteria with qualitative metrics that cannot be determined by traditional measurements (for example, this would require research work, involvement of experts, etc.).

Besides, it is important to point out, that the policy of sustainable development partially brings some adjustments to the existing strategic plans of company's development. Among other things, it is able to provide additional advantages in economic and financial activities, implementation of mechanisms and integration of principles of sustainable development of the company, not restricted to the framework of abovementioned "compulsory" benchmarks of efficiency improvement. A vivid example of this is the transition to new elements of organisational culture, as described in the publication by S.V. Ponomareva and N.V. Koryushov [7]. Both researchers determine organisational culture in this case as a set of certain ideas, philosophy, values and rules established in companies both formally and informally. Subsequently, the authors consider, that organisational culture makes a direct impact on the development of companies, including the ability to minimise costs, reduce the level of risks, increase the re-

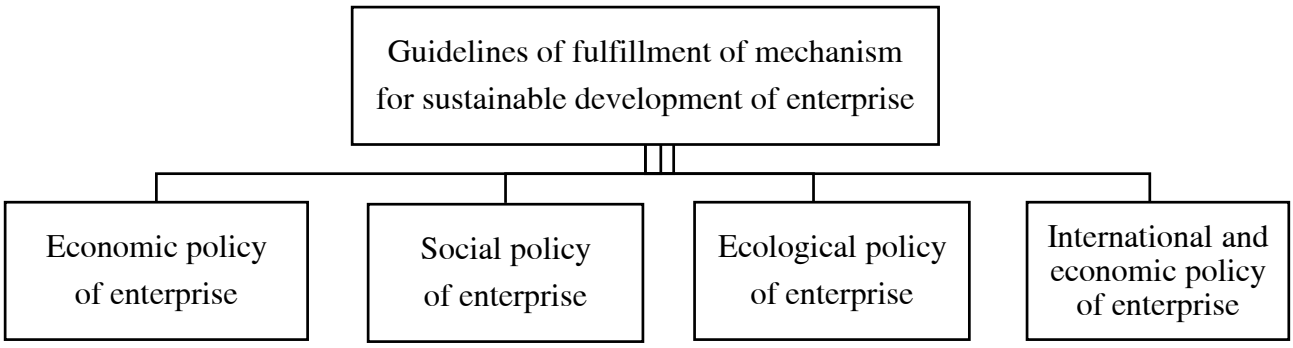

Fig. 3. **Directions for implementing the enterprise transformation mechanism under the influence of sustainable development**

Source: developed by the author based on [5].

sponsibility of employees for the sake of the optimum result etc. In this way, the nature of internal management is changed. In this way, it shapes the nature of internal and external interaction, the correctness of the response to certain manifestations. The basis for organisational culture in the paradigm of sustainable development inculcates its values, characteristic principles and beliefs among employees and management.

However, this is not limited to the internal level: a company can introduce its own corporate values and standards to its suppliers, partners or customers by means of information campaigns or through relevant actors. According to the CDP report,[3] partners and suppliers of sustainable companies often generate significantly more CO_2 emissions than their sustainable companies themselves (11.4 times more in supply chains than in the company itself) [8]. This is why, this direction, related to the introduction of organisational culture and its resulting impact at the external level, should be in fact considered as a prospect not only for integration into the processes of sustainable development, but also for the transition to a global, conscious and unified vector of implementation of the environmental agenda. Any sustainable change among partners is able to potentially generate more productive conditions for cooperation and, consequently, improve the company's efficiency.

Thus, the research made by E. V. Erokhina and D. S. Alutina indicates comprehensively the transition to the resource-saving mode of operation carried out within the framework of the described above policy [9]. The authors of the article point out, that sustainable development can be implemented in several conceptually related directions. The latter are determined both by the development of production and other systems of companies through innovation and investment, as well as by changing the current structures without major investments (which implies revision of approaches to the company's activity, changes in its order, methods of remuneration, organisation of working space, methods of production output, reuse of materials, etc.). Such approach reveals the company's commitment to sustainable development policies, it also emphasises the integration of these principles into the business (and thus gaining the necessary benefits), as well as it stimulates efficiency gains by enabling some costs to be shifted on to the end user etc. In a way, we visualise the ideas of lean production close to the principles of sustainable development, which emphasises the need to increase customer value while minimising losses, but it is important to have the proper conditions in place. The same opinion is shared by A. A. Abrosimova and P. S. Shalabaev: some decisions taken during transformations, even being in line with lean production, may lead to negative changes [10]. The reason for this is, in particular, poorly planned hasty introduction of methods and mechanisms, the lack of validity and strategic consistency of transformations, ignoring integrated management of the production system.

Taking into account all of the above, it is important to specify the impact of sustainable development tools and its related practices for the integration of relevant principles into engineering management practice, which is reflected in *Fig. 4*.

ASSESSING THE IMPACT OF SUSTAINABLE DEVELOPMENT ON EFFICIENCY AND COMPETITIVENESS

In our point of view, when ESG principles are integrated into engineering management practice, the impact of sustainable development on business efficiency is conceptually expressed in a number of systemic effects, which:

[3] CDP — Customer Data Platform, a programme which collects customer data from various online and offline sources into a single database.

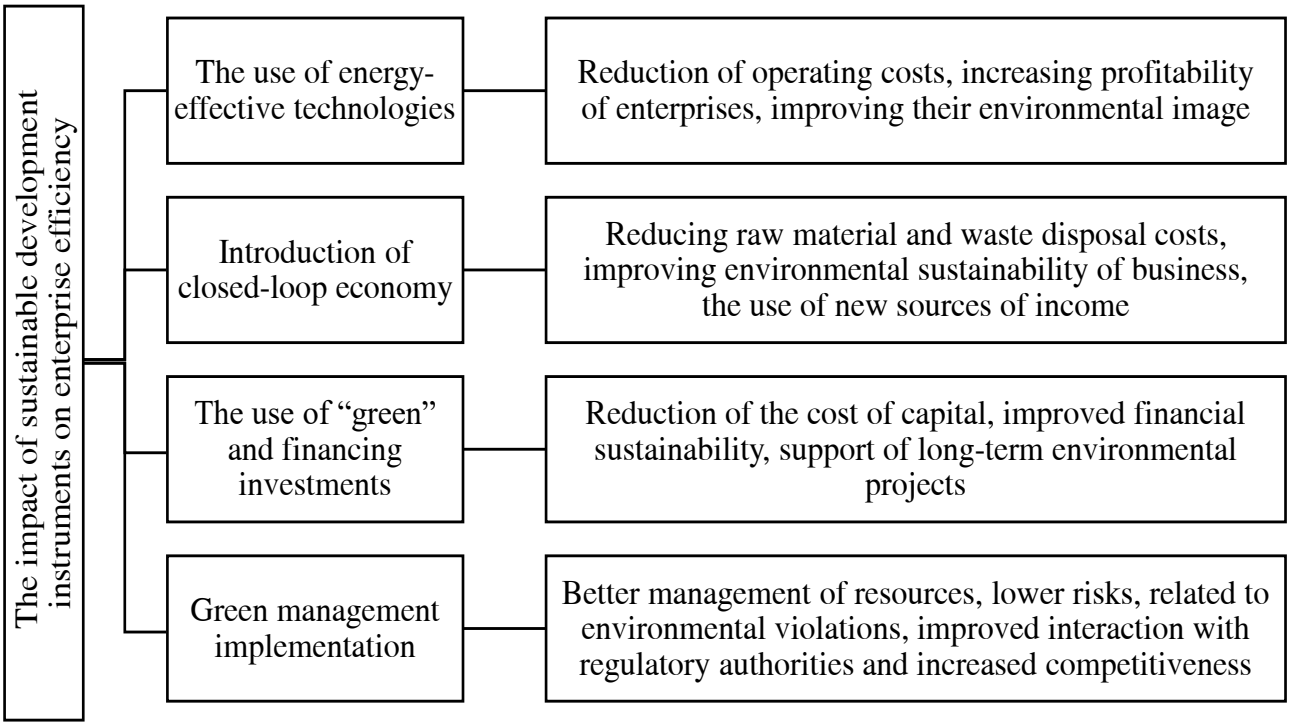

Fig. 4. **Impact of sustainable development tools on enterprise efficiency**

Source: developed by the author.

• are caused by positive changes in the functioning of existing systems leading to cost reduction through rational of costs by means of redesign of work processes, orientation towards lean approaches, etc., improvement of productivity, speed of operations, creative work of employees, etc.;

• are related to the revision of the global business development policy (strategy), but do not imply current changes, as they lead to image development, attracting additional investments, maintaining the company's openness, creating conditions for employees' commitment to global goals, etc.;

• directly occur from the actual activity, e.g. implementation of equipment, allocations in development, etc. and they lead to indicators' changes of environmental impact, productivity of manufacture systems, cost reduction in waste management, etc.

At the same time, the factors of achieving systemic effects are often the efficiently made management decisions coordinated with the characteristics of the enterprise, as well as the results of using such an asset as intellectual capital: innovative ideas and their development, ensuring their viability, etc. According to E.A. Ilyina, no less important are the issues of development and gradual implementation of the sustainable development strategy of the company, which will include specifically the set goals, as well as the means and directions that will ensure their achievement within the specified timeframe, relatively agreed upon with the objectives of sustainable development and certain time frames [11]. As E.A. Ilyina points out, generating specific ways to ensure sustainable development is the start of integration of ESG principles into business, which is associated with a stronger potential to improve the image, to attract investment and innovation opportunities.

In addition to the strategy itself, it is advisable to ensure an appropriate, effective system

of interim and final evaluation of its implementation, which should include the following:

- at the strategy development stage, it is important to develop indicators that take into account preliminary results and rates of movement towards planned (projected) values, as well as external influences and factors, meanwhile allowing to compare the final results of the implementation of sustainable development strategies for a certain period of time (for example, within the last three years against the planned period);
- develop solutions, recommendations and reveal cause-and-effect link for achieving or failing to achieve the planned results.

Subsequently, such a system will allow the company to specify and improve the strategy of current sustainable development and to proceed systematically towards achieving the goals.

In order to assess the results of the implementation of the strategy and the concept of sustainable development, scientists use to analyse various methods. For example, the research work of A. I. Gribanov suggests the approach towards the all-round performance of the enterprise and traditional performance indicators [12]. In particular, the scientist's evaluation system is supported with balance and production indicators of sustainable growth, such as profitability, current assets, liquidity, etc. The scientist analyses the indicators in relationship to the achieved benchmarks of the sustainable development strategy: economic value, impact of financial risks, CO_2 emissions, investments in environmental projects and initiatives, etc. As sustainable development is based on the implementation of ESG principles, A. I. Gribanov primarily suggests taking into account economic, social and environmental indicators, which help assessing the dynamics of the activity of a given company and the results it has achieved.

Similar ideas regarding the impact of sustainable development on the efficiency of the enterprise are available in the research work by A. Rakhimov [13]. The author has developed a whole system of indicators of social, environmental and risk sustainability. He also pointed out the initial objective to determine the factors that characterise the indicators, then as a follow up to bring them to a single value by the method of integral assessment and, subsequently, form a comprehensive indicator of the company's sustainability. It should be noted, that this approach may be used, among other research work, for comparative analyses of several companies, including subsidiaries, or divisions, which potentially expands the application range of its scenarios. In addition, the sustainable development can be assessed in comparison with traditional economic efficiency indicators. It makes it possible to coordinate purely economic objectives of the activities and development of production systems with those objectives that are of top-priority for sustainable development [13].

The research work of M. G. Salko, E. P. Kiselitsa and N. N. Shilova offers a slightly different approach towards assessing the impact of sustainable development on the efficiency of the company [14]. According to the scientists, such an assessment should be carried out within the framework of different projects aimed at the introduction of appropriate technologies, solutions, implementation of transformations, etc. in a given area. No doubt, such an approach has an obvious advantage for evaluation of a narrow area, when it specifies and analyses in detail the procedure itself. In addition, a company can align such projects and their performance evaluation indicators with the all-round development strategy, which increases the potential impact on efficiency by means of ensuring a more precise management and accumulation of resources for the project. The authors of the publication under review suggest a whole set of indicators, with specific focus on the following groups of indicators:

• social effectiveness indicators — the project's impact on the life of the population;
• indicators of the all-round social orientation of the project;
• traditional indicators of socio-economic effectiveness;
• environmental effectiveness indicators;
• indicators of innovation effectiveness;
• economic, environmental and innovation efficiency indicators;
• indicators of the expenditures;
• financial and economic indicators.

Moreover, the use of such method implies the presence of its own metrics within each of the groups of indicators, and each of them are assigned appropriate weights. This makes the assessment both more comprehensive and more balanced.

Within the framework of the problems discussed, P. S. Shpak and E. G. Sycheva made an important contribution in the study. They substantiate the importance of not only the research of the framework of sustainable development management and its impact on the

Traditional economic indicators and metrics of sustainable growth	Asset profitability
	Liquidity
	Level of CO_2 emissions etc.
Integrated system of sustainability indicators	Index of social ecological risk sustainability
	Integral sustainability (index)
	Index of corporate-social responsibility etc.
Assessment of individual projects of sustainable development	Social efficiency
	Economic efficiency
	Ecological efficiency, innovations etc.
Focusing on economic efficiency	Profitability
	Cost recovery
	Marginal profit etc.
Risk analysis and priorities in management	Level of financial risk
	Penalty prevention ratio
	Risk compensation ratio, etc.
The use of balanced system of financial indicators	Balanced financial indicators
	Balanced indicators of internal business processes
	Balanced ecological indicators, etc.

Fig. 5. **Methods and indicators for assessing the impact of sustainable development on enterprise efficiency**

Source: developed by the author

relevant spheres of activity, but also the need to specify primarily how to ensure economic efficiency [15]. To support this factor, the researchers suggest that sustainable development works exclusively with economic efficiency. At the same time, economic efficiency means return on investment, profit generation, creation of direct and indirect economic benefits, etc., provides an opportunity to allocate some funds and resources for self-financing of current initiatives and even changes directly related to sustainable development. The authors [15] suggest their own model of strategic management of innovative development of the company. The model employs assessment of profitability and efficiency of management of economic resources, which are considered as important factors influencing sustainable development and implementation of its principles in the activities of economic entities.

However, S. G. Vegera, E. B. Maley, E. Y. Afanasyeva and O. A. Sushko point out that in some cases, like the implementation of sustainable development some components of direct economic efficiency can be overshadowed by more obvious and significant impact risks [16]. The authors pay attention to industrial waste management as an example to point out that penalties imposed on enterprises and the associated financial consequences may exceed the level of costs of effective waste management and recycling, despite the fact that this item is a potential element of the formation of stranded costs for sustainable business development. Nevertheless, the scientists present the system of environmental, economic and social indicators to ensure analytical support for sustainable development in the field of waste management and to avoid potential losses caused by penalties.

Based on the above-mentioned studies, which deal with assessing the impact of sustainable development on the company's efficiency, below is the draft summary to classify and specify the possible ways of assessing the impact (*Fig. 5*).

Notably, business efficiency of a company defined in the context of its objectives usually deals with specific, measurable and predictable indicators, determined by the company aimed at its particular activities, etc. However, due to its abstract nature and different approaches to understanding it, the impact of sustainable development on competitiveness is cumulative and somewhat more complex to define. A vivid example confirming this thesis is the accumulated experience of implementing ESG principles in Russia and abroad presented in the research work of A. R. Akhmetshina and T. N. Gubaidullina [17]. Both researchers distinguish the following basic ways in which the principles under consideration can make an impact on the competitiveness of enterprises:

- costs reduction through justification of energy consumption, waste management, minimising cost;
- joint efforts to ensure innovation and intellectual capital, improving processes in terms of sustainable development;
- expanding markets and potential customers, who are only interested in products manufactured by sustainable companies;
- image opportunities (externally — with consumers; internally — with shareholders, employees, partners, etc.);
- avoiding risks caused by changes in legislation, etc.

However, this needs to be verified: the impact on competitiveness as measured by researchers in terms of the accumulation of benefits is not of a direct nature in relation to the impact on efficiency.

In particular, when considering the effects of cost reduction by means of a rational approach to the consumption of energy resources and waste management, the issues of cost minimisation of their impact on competitiveness are largely related to the efficiency of the financial

and economic activities of the company. The growth of the company causes a transformation of its activities, which gradually leads to internal improvements, which in turn influence competitiveness. However, it is hard to guarantee this result. This is confirmed by the work of F. Flachenecker, who claims, that it is really possible to ensure the growth of competitiveness in the long term by moving the company towards environmental sustainability, which is achieved through the management of operational efficiency by means of measures to rationalise resource consumption, resource conservation, proper waste management [18]. At the same time, Y. Wang, S. Zhang and S. Xu revealed that the implementation of effective resource management methods in the context of sustainable enterprise development does not always have a guaranteed effect on competitiveness, as it depends on the level of the company's innovation culture and human resource management approaches [19].

Focusing on innovation, intellectual capital and improving processes from a sustainability perspective may not always have a direct impact on competitiveness either. In particular, A. Parmentola and I. Tutore point out, that, indeed, focusing on intellectual capital leads to creation of effective sustainable innovations able to help solving competitiveness problems. However, as the researchers found out, the degree of involvement of this type of capital in this process remains uncertain and often depends on the extent to which the current management system is able to transform know-how into specific activities, projects and effective solutions [20].

In line with the ideas of the above-mentioned authors, the current research work can assume that investments in sustainable development through the development of innovations and intellectual capital will not always serve as the real efficiency indicator, or they will not be justified.

More positive prognosis in terms of impact on competitiveness rather deal with the impact on sustainable development on the expansion of market outlets and the number of potential buyers oriented exclusively towards the products manufactured by sustainable enterprises. Recent statistical studies confirm such hypotheses. The Deloitte[4] survey indicates that by 2023, over 46 per cent of consumers have bought a "sustainable" product at least once. Consumers are willing to spend 27 per cent more simply because such products are made by the company, which adheres to sustainability principles and policies.[5] In addition, according to the research made by M. Majeed, S.B. Azumah and C. Asare, a part of consumers generally prefer companies that publish open, transparent reports, and this makes a strong factor for increasing loyalty and growing brand positions [21]. However, such surveys have an obvious drawback: they depend on a particular region, the specifics of the products manufactured, the sales market etc. At least, the socio-economic status of the respondents is important, since this may predetermine the priorities in purchasing products of certain categories. Besides, the country of residence and the cultural traditions of consumption are also important for a more precise analysis.

Probably, another strong factor is the geography of the survey: the respondents represent not only developed but also developing countries. BCG[6] has surveyed 19.000 respondents from the USA, Japan, Germany, France, Italy, China, India and Brazil. As to Deloitte, it has surveyed more

[4] Deloitte — an international accounting and consulting company with a global network of offices; it is one of the "Big Four" accounting firms and the largest in terms of staff (312.000 people).

[5] Green products come of age. URL: https://www2.deloitte.com/us/en/insights/industry/retail-distribution/consumer-behavior-trends-state-of-the-consumer-tracker/sustainable-products-customer-expectations.html

[6] BCG — Boston Consulting Group, international company specialised in management consulting; it is one of "The Big Three" major companies by revenue.

respondents from the European Union, namely 22.600 people from Australia, Belgium, Brazil, Canada, China, Denmark, France, Germany, India, Italy, Mexico, the Netherlands, Poland, South Korea, Saudi Arabia, Spain, Sweden, the UAE, the UK and the USA. Obviously, the wealth, standard of living and consumer habits of the respondents were so different, which influenced the results[7].

As to the inhabitants of our country, according to the survey conducted by the NAFI Analytical Centre, 90 per cent of them focus on iconic brands and products. At the same time, 82 per cent of them mention, that a key factor to buy a product is the cost[8]. In cases where sustainable products are more expensive, citizens are likely to show a relatively little demand for them. Nevertheless, despite the importance of price factor, environmental issues are starting to play a certain role in the choice of Russian consumers too. According to NielsenIQ, 68 per cent of Russians believe that environmental catastrophe is inevitable if mankind does not change its habits. By the year of 2021, 49 per cent of respondents were willing to change their habits to improve the environment, but by 2023, this figure dropped to 43 per cent[9]. It is therefore appropriate to take into account regional specific aspects and preferences in the area of consumption, as well as the socio-economic situation, the level of well-being of the population and many other factors.

The other similar identified method of the impact of sustainable development on the competitiveness of the company is the creation of image opportunities, since the degree of its implementation directly depends on the region in which the company operates and the conditions of its activity.

As for the management of sustainable development risks, the research work by A.A. Burdina [22] confirms, that it is extremely difficult to establish a direct link between the risks and the level of competitiveness. Likewise, it is hardly possible to predict and prevent the risks due to the changes in legislation. Thus, it cannot be fully attributed to the factors related to sustainable development.

In line with the mentioned above, it is important to determine the impact of sustainable development on the components of the company's competitiveness which is expressed in the opportunities to differentiate and reach a narrowly focused consumer segment and to obtain profitable investments. Thus, the key influence factor of the integration of the principles of sustainable development on the competitiveness of the company is the direct competitive advantages created by the implementation of the sustainable development policy. This factor should be always under consideration in the context of a specific market, segment, consumer niche, etc. In this context, it is worth mentioning the ideas of A.S. Bednyakov [23] regarding the acquisition of infrastructural opportunities due to the implementation of sustainable development policy:

- use of green financial mechanisms;
- attracting green investments characterised by their long-term nature, lower interest rates and directed exclusively to sustainable projects and innovations;
- participation in state projects, including through public-private partnership.

CONCLUSIONS

To sum up the results of the study, it is important to focus attention to the fact, that the tasks of integrating the principles of sustainable development into engineering management prac-

[7] Less than 7 per cent of consumers pay a premium for sustainable products and services today, but 40 per cent could be convinced to make sustainable choices. URL: https://www.bcg.com/press/13september2022-consumers-sustainable-choices

[8] Trends of food consumption in Russia. URL: https://nafi.ru/projects/potrebitelskoe_povedenie/trendy-potrebleniya-rossiyanami-produktov-pitaniya/

[9] Consumer Behaviour in Russia and the World: Development Trends. URL: https://world-food.ru/ru/media/news/2024/january/29/potrebitelskoe-povedenie/

tice imply a systemic impact on the functioning of the company, which influences production-technological, engineering-technological and managerial-economic processes. The author of this article have conceptually distinguished the impact of integrating the principles of sustainable development on efficiency and competitiveness, and this has become an element of scientific novelty of the current research work. Thus, the impact on efficiency deals with acquisition of measurable benefits, generation of additional opportunities or prevention of risks (direct effects of sustainable development). As to competitiveness, its growth is purely the result of acquisition of competitive advantages by means of integration of ESG principles into the practice of technical management of the company, which is regarded, among other things, as an increase in efficiency. Such a distinction and its validity, confirmed indirectly in modern scientific literature, denotes the expediency to study these issues in the future. The theoretical significance of this research work is the development of theory and applied problems to justify the integration of the principles of sustainable development into the practice of engineering management.

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The Integral Assessment of Interorganizational Innovation Effectiveness Using Fuzzy Sets Method

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ABSTRACT

In the current economic environment, the effective operation of higher education institutions is difficult to imagine without collaboration with organizations from the real sector of the economy, particularly in the context of innovation generation. Decision-makers responsible for the development of academic-industrial partnerships require modern methods to assess the potential effectiveness of such interactions. This study aims to develop a fuzzy-set-based integral aggregation model for evaluating the effectiveness of interorganizational innovations. The research contributes to scientific novelty through the following key solutions: the development of a hierarchical structure of integral indicators for assessing interorganizational innovation effectiveness; the selection of components and the evaluation of their significance using Fishburne's weighting method; the creation of a fuzzification database to transform precise numerical values into fuzzy sets; the construction of an equation system to quantify non-standardized components values to term sets membership degree and the formulation of a calculation method for intersection points of non-inversive indicators.

The results of the conducted research has practical value and are possible to be used by both academic institutions and organizations in the real sector of economy for a preliminary assessment of interorganizational collaboration effectiveness in innovation generation. Future research by the author in this field will be aimed at testing the developed model refining it, and further systematizing and algorithmizing the results for efficient use in interorganizational innovation management.

Keywords: interorganizational innovations; fuzzy sets method; integral assessment; innovation effectiveness; innovation management; academic institutions; real sector economy; academic industrial partnership

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INTRODUCTION

The terminological results obtained by the author of this article earlier [1] indicate that interorganizational innovations arise when there is alignment between the goals of the real sector of the economy and higher educational institutions (universities). In accordance with the priority areas for the development of the Russian economy and, in particular, the strategies in the field of digital transformation developed by the state authorities of the Russian Federation,[1] many problems in the scientific and educational sector are related to the absence of a number of innovative digital services, platforms, and tools. For this reason, the modern domestic system of science and education faces challenges in increasing the level of digitalization and ensuring the growth of digital maturity. The real sector of the Russian economy, in turn, faces the problem of creating conditions both for increasing investments in the development of innovative technologies and for enhancing the level of cooperation between organizations. The tasks associated with the mentioned challenges can be addressed by the academic-industrial partnership of these economic segments based on innovation generation. However, such interaction inevitably necessitates the evaluation not only of the effectiveness of implementing innovations in the activities of the university and the real sector organization separately but also of the resulting synergistic effect.

The inconsistency in expectations regarding the outcomes of such interactions signals the presence of uncertainty, which is one of the most significant factors in the process of managing interorganizational innovations [2, 3]. For the success of this process, both quality planning and the presence of alignment among economic agents in the context of achieving set commercial and non-commercial goals are required.

Therefore, when assessing the effectiveness of inter-organizational innovations, it is necessary to take into account the factor of uncertainty, the reduction of which is facilitated by fuzzy set theory. The use of fuzzy tools is particularly promising, partly due to the presence of a system that combines specific components that cannot be clearly formalized and components that have different dimensions [4–6].

Thus, fuzzy logic, stemming from the theory of fuzzy sets first proposed by L. Zadeh in 1965, can be used as an effective tool for managing interorganizational innovations [7]. The necessity of creating a system of components for evaluating the effectiveness of inter-organizational innovations allows for a departure from classical Boolean set theory and binary Boolean logic, favoring instead extended fuzzy logic. The latter, within the framework of the developed axiomatic system, provides the opportunity to characterize fuzzy categories associated with intermediate and integral indicators, as a result of which the generalized multiple representation of the integral indicator, first described in [8], is transformed into a formula (1).

$$Int_{\mu} = \left\{ \begin{array}{l} y_{\mu}^{1} = \left\{ x_{t}^{11}, x_{t}^{12}, \ldots, x_{t}^{1j_1} \right\} \\ y_{\mu}^{2} = \left\{ x_{t}^{21}, x_{t}^{22}, \ldots, x_{t}^{2j_2} \right\} \\ y_{\mu}^{3} = \left\{ x_{t}^{31}, x_{t}^{32}, \ldots, x_{t}^{3j_3} \right\} \\ \ldots \\ y_{\mu}^{i} = \left\{ x_{t}^{i1}, x_{t}^{i2}, \ldots, x_{t}^{ij_n} \right\} \end{array} \right\}, \quad (1)$$

where: Int_{μ} — integral indicator calculated using unclear logic;

y_{μ}^{i} — intermediate indicators i, used to determine the integral indicator;

$x_{\mu}^{ij_n}$ — non-binary elements j, n-set of which determines intermediate indicators y_{μ}^{i}.

Int_{μ} is a universal set that includes subsets y_{μ}^{i}, consisting of non-binary elements $x_{\mu}^{ij_n}$.

[1] Digital Transformation Strategies.Ministry of Digital Development of Russia. 2024. URL: https://digital.gov.ru/ru/activity/directions/1064/ (accessed on 10.01.2025).

Integral indicators mostly contain a hierarchical system of components. In this regard, there is a need to use either specific fuzzy tools designed for working with hierarchical division systems or a fuzzy inference method that will allow for the effective transformation of non-binary elements and intermediate indicators into integral indicators of the performance of inter-organizational innovations.

RESEARCH METHODOLOGY

In this study, the following designations of integral indicators and their components are used:

1. Integral indicators

Int_S — synergy result index. It demonstrates the potential result synergy of interorganizational interaction depending on external conditions (created for generating innovations) and the degree of their use by the university as the main driving force of innovative activity.

Int_U — integral indicator of the effectiveness of inter-organizational innovations for a higher education institution. It shows their potential effectiveness from the university's perspective, depending on its resource base and the alignment of innovation activity results with the demands of the current economic situation.

Int_B — integral indicator of innovation effectiveness for the real sector of the economy. It reflects the potential effectiveness of inter-organizational innovations from the perspective of an organization in the real sector of the economy, taking into account its financial capabilities and the results of its scientific and innovative activities.

2. Intermediate indicators

K — the letter designation of the intermediate indicator.

A — the intensity of the development of solutions for the current technological paradigm.

B — the level of research integration of a higher education institution.

C — level of result compliance.

G — level of resource provision.

Components within intermediate and integral indicators

Ki — an alphanumeric designation of a component.

A*i* — components of the intermediate indicator A, $i \in [1;12]$.

B*i* — components of the intermediate indicator B, $i \in [1;7]$.

C*i* — components of the intermediate indicator C, $i \in [1;5]$.

G*i* — components of the intermediate indicator G, $i \in [1;2]$.

D*i* — components of the integral indicator Int_B, $i \in [1;4]$.

For the structure of integral indicators with hierarchies, the most suitable method is the fuzzy matrix method of integral convolution developed by A.O. Nedosekin and O.B. Maksimov [9, 10]. Based on the mentioned methodology, steps have been formulated, the sequential execution of which will allow for the assessment of all proposed integral indicators:

Step 1 — creating a hierarchical structure of integral indicators.

Step 2 — defining membership functions for each evaluated integral indicator and the associated intermediate indicators.

Step 3 — deriving linguistic variables, forming term sets of their values, and fuzzy value scales for conducting expert evaluation.

Step 4 — defining the set of components for each integral indicator.

Step 5 — evaluation of the significance level of components from the resulting set.

Step 6 — creating the fuzzification base.

Step 7 — conducting fuzzification based on it.

Step 8 — conducting defuzzification of intermediate and integral indicators.

Step 9 — implementation of linguistic identification.

RESEARCH RESULTS

Fig. 1 presents the hierarchical structure of integral indicators developed by the author,

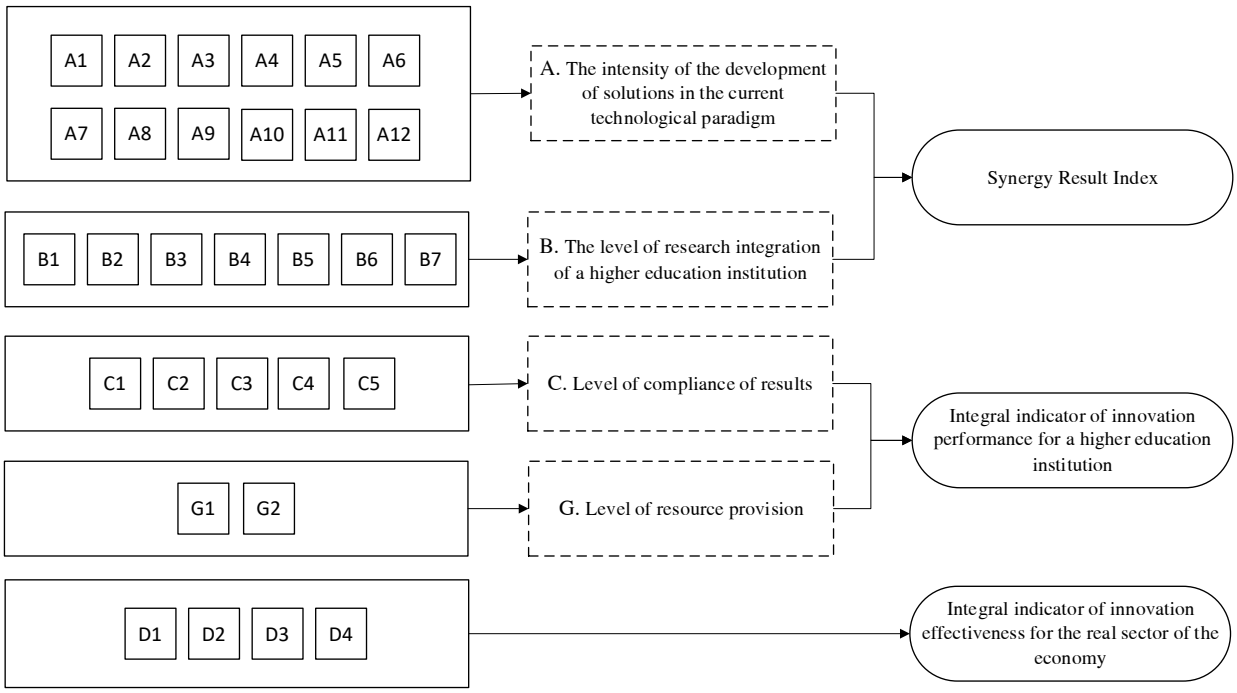

Fig. 1. **The hierarchical structure of integrated indexes of the interorganizational innovation effectiveness**

Source: Compiled by the author.

which includes intermediate indicators used in integral convolution and their components.

Among the wide variety of membership functions [11, 12] for all components and intermediate indicators, it is proposed to use trapezoidal functions (*Fig. 2)*. There are two reasons for this: first, their established reliability (due to frequent use by researchers compared to most other membership functions) and, second, the recommendation of the scientific school of A. O. Nedosekin to use these functions specifically when applying the matrix method of integral convolution [13].

This set of trapezoidal functions with term sets of linguistic variable values within the framework of the present study is universal and is used to evaluate three integral and all intermediate indicators, as well as their components.

Next, according to the chosen methodology, it is necessary to create fuzzy value scales, as well as to designate the magnitudes of all linguistic variables by forming term sets of values for each of them (*Table 1*).

For each variable, a characteristic is presented along with a relation to term sets of values, which, in turn, are based on the corresponding fuzzy value scales.

As a result of accepting the universality of the set of membership functions depicted in *Fig. 2,* the scales of fuzzy values consist of trapezoidal numbers, generically denoted as a_1, a_2, b_1, b_2, where a_1 and b_2 are the abscissas of the vertices of the lower bases of the trapezoids, and a_2, and b_1, — are the abscissas of the vertices of their upper bases.

Let's define a set of components for each integral indicator (*Table 2*).

The presented components of groups A and D were selected based on the results of analyzing the methodologies for calculating the digital readiness index, the ICT development index, the network readiness index, the digital economy and society index, the "Digital Russia" index, and a number of scientific sources offering various ways to assess the effectiveness of innovations for the real sector of the economy, taking into

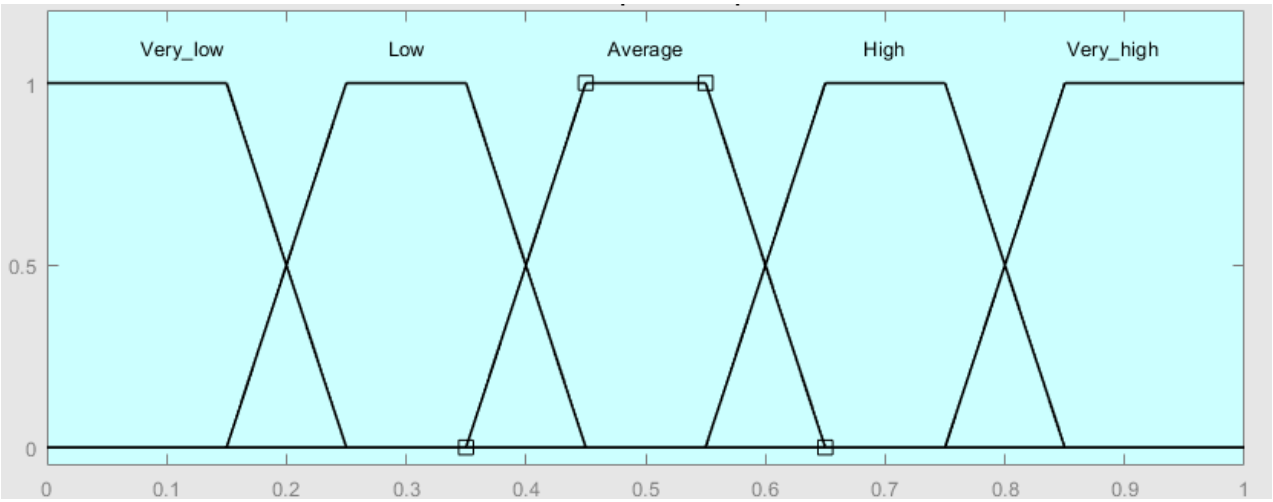

Fig. 2. **The combination of trapezoidal membership functions with the term sets for the linguistic variables**

Source: Developed by the author using the MATLAB application package with the Fuzzy Logic Toolbox extension

account changing external conditions.[2] In an early study by the author, the characteristics of the components used in the calculation of the aforementioned indices were compared, and principles of a systematic approach to the task of selecting components for the proposed integral indicators were suggested [8]. The sources for determining the components of groups B, C, and G are widely recognized global rankings and scientific sources [14–16].[3] Thus, the choice of this particular list of components is determined, firstly, by the use of widely recognized methodologies; secondly, by the successful testing in the author's early studies; and thirdly, by the full compliance with the formulated principles of the systems approach. The selected components with the proposed method of separation fully and adequately characterize the effectiveness of interorganizational innovations.

At the next stage, the significance level of the components is assessed. We will create a system of Fishburne weight coefficients (*Table 3*) using the formula (2):

$$r_i = \frac{2\times(N-i+1)}{N\times(N+1)}, \qquad (2)$$

where: r_i — weight coefficient of the i-th component; N — the number of components within a single indicator.

The Fishburne weight coefficient system suggests arranging all components in order of decreasing significance [17], and this is confirmed by the data in *Table 3*. The values of the

[2] Digital Readiness Index. Cisco; 2021. URL: https://www.cisco.com/c/en/us/about/csr/research-resources/digital-readiness.html (accessed on 10.01.2025); the ICT Development Index. ITU; 2024. URL: https://www.itu.int/en/ITU-D/Statistics/Pages/IDI/default.aspx (accessed on 10.01.2025); Network Readiness Index. Portulans Institute. 2024. URL: https://networkreadinessindex.org/ (accessed on 10.01.2025); the Digital Economy and Society Index; 2022. URL: https://digital-strategy.ec.europa.eu/en/policies/desi (дата обращения: 10.01.2025); Index "Digital Russia". SKOLKOVO School of Management. 2018. URL: https://www.skolkovo.ru/researches/indeks-cifrovaya-rossiya/ (accessed on 10.01.2025).

[3] Russian Statistical Yearbook (Rosstat). URL: https://rosstat.gov.ru/storage/mediabank/Ejegodnik_2023.pdf (accessed on 16.10.2024)., Europe's most innovative universities. URL: https://www.reuters.com/graphics/EUROPE-UNIVERSITIES-INNOVATION/010091N 72J7/ (accessed on 16.10.2024); The Impact Rankings. URL: https://the-ranking.s3.eu-west-1.amazonaws.com/IMPACT/IMPACT2023/THE.ImpactRankings.METHODOLOGY.2023_v1.2.pdf (accessed on 16.10.2024); University Innovation Rankings URL: https://www.scimagoir.com/methodology.php (accessed on 16.10.2024); The World University Rankings for Innovation. URL: https://www.wuri.world/_files/ugd/8e5131_708743231b0a45ffacc8470fc959c980.pdf (accessed on 16.10.2024).

Table 1

The descriptions, the term sets and the scales for the linguistic variables

Indicator designation	Characteristic of linguistic variable	Estimation of term set	Trapezoidal number scales
	Linguistic variable "Result Synergy"		
Int_S	The synergy effect is absent, or its influence is minimal due to the low level of research integration in the university and the weak development of solutions regarding the current technological structure. The effectiveness of innovation generation depends solely on the research base of the real sector organization	Very low	(0; 0; 0.15; 0.25)
	The influence of the synergy effect is minimal due to the low level of research integration in the university and the weak development of solutions regarding the current technological structure. The effectiveness of innovation generation is almost entirely dependent on the research base of the real sector organization	Low	(0.15; 0.25; 0.35; 0.45)
	The average value of the synergy effect, determined more by the neutral influence of the external environment and the level of research integration of the university, or by the high variability of the term sets of intermediate indicators	Average	(0.35; 0.45; 0.55; 0.65)
	The synergy effect has a positive impact due to the sufficiently intensive development of solutions regarding the current technological order and the research integration of the university	High	(0.55; 0.65; 0.75; 0.85)
	The synergy effect has a very strong influence on the effectiveness of innovations due to the high-intensity development of solutions regarding the current technological structure and the complete (or nearly complete) research integration of the university	Very high	(0.75; 0.85; 1; 1)
	Linguistic variable "Intensity of development of solutions of the current technological paradigm"		
A	Decisions regarding the current technological structure are either not made or are made extremely slowly. The external conditions for generating innovations are minimal or nonexistent	Very low	(0; 0; 0.15; 0.25)
	Low intensity of decision-making regarding the current technological paradigm. The favorability of external conditions for generating innovations is below average	Low	(0.15; 0.25; 0.35; 0.45)
	The intensity of decision-making regarding the current technological structure is at an average level. A significant portion of economic agents is implementing new digital technologies to activate innovative activities	Average	(0.35; 0.45; 0.55; 0.65)
	High intensity of decision-making regarding the current technological paradigm. The digital innovation environment fosters the generation of innovations within its boundaries	High	(0.55; 0.65; 0.75; 0.85)
	The development of the current technological paradigm is characterized by very high or maximally possible intensity. The digital innovation environment significantly contributes to the generation of innovations within its framework	Very high	(0.75; 0.85; 1; 1)

Table 1 (continued)

Indicator designation	Characteristic of linguistic variable	Estimation of term set	Trapezoidal number scales
	Linguistic variable "Level of research integration in higher education institutions"		
B	The university is not integrated or is poorly integrated into the digital innovation environment and practically does not use the existing external conditions for generating innovations. The potential synergy of the result cannot be above average even under favorable external conditions. The effectiveness of innovation generation in this situation largely depends on the organization of the real sector of the economy	Very low	(0; 0; 0.15; 0.25)
	Low degree of research integration at the university. It does not utilize all the opportunities of the external environment, which indicates either a low interest in generating innovations or being in the initial stages of integration into the digital innovation environment	Low	(0.15; 0.25; 0.35; 0.45)
	The degree of the university's integration into the digital innovation environment is sufficient for the successful generation of innovations as a result of interorganizational interaction, provided that there is proper support from the real sector of the economy	Average	(0.35; 0.45; 0.55; 0.65)
	A high degree of research integration of the university into the digital innovation environment. The synergy effect can be extremely high with a decent level of development of the innovative activities of the real sector organization	High	(0.55; 0.65; 0.75; 0.85)
	The university is fully (or almost fully) integrated into the digital innovation environment. The potential synergy of the result can be very high, provided that the intensity of decision-making regarding the current technological paradigm is similar	Very high	(0.75; 0.85; 1; 1)
	Linguistic variable "Effectiveness of innovations for higher education institutions"		
Int_U	The extremely low level of innovation effectiveness in interaction with the university is explained by the lack of both interest in innovative activities and the possibility of their implementation	Very low	(0; 0; 0.15; 0.25)
	Low innovation performance for the university, either due to weak interest in generating innovations or the lack of necessary resource base	Low	(0.15; 0.25; 0.35; 0.45)
	The average effectiveness of innovations in interaction with the university, determined by the average levels of compliance of results and resource provision, or by directly opposite values of the term sets of these parameters	Average	(0.35; 0.45; 0.55; 0.65)
	The effectiveness of inter-organizational innovations when interacting with a university is high due to a sufficient level of resource provision and a high level of result compliance	High	(0.55; 0.65; 0.75; 0.85)
	The effectiveness of inter-organizational innovations when interacting with a university is very high due to the high level of resource provision and the complete alignment of the results of innovative activities with the demands of the digital innovation environment	Very high	(0.75; 0.85; 1; 1)

Table 1 (continued)

Indicator designation	Characteristic of linguistic variable	Estimation of term set	Trapezoidal number scales
	Linguistic variable "Level of result conformity"		
B	The results of the university's activities do not meet the demands of organizations in the real sector of the economy at all. Insufficient attention is paid to innovative activity, and there is a lack of incentives for innovation	Very low	(0; 0; 0.15; 0.25)
	The low level of compliance of the results indicates a poorly developed innovation system at the university and a small incentive for its development	Low	(0.15; 0.25; 0.35; 0.45)
	The level of compliance of the results of the university's innovative activities is sufficient for the development of inter-organizational innovations	Average	(0.35; 0.45; 0.55; 0.65)
	A high level of result compliance, indicating that the university's innovative activities largely meet external demands	High	(0.55; 0.65; 0.75; 0.85)
	The results of the university's activities fully meet the demands of organizations in the real sector of the economy, operating in the same digital innovation environment	Very high	(0.75; 0.85; 1; 1)
	Linguistic variable "Level of resource provision"		
G	Very low level of resource provision, indicating the absence or very small number of applied laboratories and very low publication activity	Very low	(0; 0; 0.15; 0.25)
	Low level of resource provision. This is explained by the presence of a small number of applied laboratories and low publication activity	Low	(0.15; 0.25; 0.35; 0.45)
	The level of resource provision is sufficient for the development of academic-industrial partnerships	Average	(0.35; 0.45; 0.55; 0.65)
	High level of resource provision. This is explained by the presence of a large number of applied laboratories and a fairly high level of publication activity	High	(0.55; 0.65; 0.75; 0.85)
	A very high level of resource provision, indicating the presence of the necessary number of applied laboratories and very high publication activity	Very high	(0.75; 0.85; 1; 1)
	Linguistic variable "Effectiveness of innovations for the real economy sector"		
Int_B	The organization is not interested in innovative activities or is unable to engage in them. Financial resources for generating innovations are also absent or minimal	Very low	(0; 0; 0.15; 0.25)
	The organization has low innovation performance due to limited experience in innovative activities and insufficient financial resources	Low	(0.15; 0.25; 0.35; 0.45)
	The organization possesses sufficient financial resources and experience in innovative developments for potential success when interacting with it for the purpose of generating innovations	Average	(0.35; 0.45; 0.55; 0.65)
	The organization has high innovation effectiveness due to significant experience in innovative activities and financial capabilities	High	(0.55; 0.65; 0.75; 0.85)
	The organization is extremely interested in developing innovative activities due to its vast (possibly unique) experience in innovative developments and their application in its operations. The organization's financial capabilities fully allow for the generation of innovations, including jointly	Very high	(0.75; 0.85; 1; 1)

Table 1 (continued)

Indicator designation	Characteristic of linguistic variable	Estimation of term set	Trapezoidal number scales
	Linguistic variable “Component value”		
Ki	Very low value of the *i*-component of the intermediate or integral indicator	Very low	(0; 0; 0.15; 0.25)
	Low value of the *i*-component of the intermediate or integral indicator	Low	(0.15; 0.25; 0.35; 0.45)
	Average value of the *i*-component of the intermediate or integral indicator	Average	(0.35; 0.45; 0.55; 0.65)
	A high value of the *i*-component of the intermediate or integral indicator	High	(0.55; 0.65; 0.75; 0.85)
	Very high value of the *i*-component of the intermediate or integral indicator	Very high	(0.75; 0.85; 1; 1)

Source: Compiled by the author.

weight coefficients indicate that the lower the ordinal number of a component in the system, the greater the weight assigned to it, regardless of their total number in the group. Note that the Fishburn rule is applied in this study only to the *Ki*-components of integral indicators. Intermediate K indicators are considered equivalent within the boundaries of a single integral indicator.

After selecting the components and assessing the significance levels, it is necessary to create a fuzzification base — a set of trapezoidal numbers ordered according to all possible values of linguistic variables and part of the possible magnitudes of each component (*Table 4*). At the same time, trapezoidal numbers are the result of an expert evaluation, as the fuzzy logic apparatus used involves the participation of experts in the fuzzification and defuzzification of data. The use of trapezoidal numbers is also due to the possibility of establishing a sufficient degree of uncertainty when experts work with fuzzy values.

It should be emphasized that in the case of significant changes in the external environment or changes in the model structure, the fuzzification base must be adjusted each time to ensure the principle of adaptability [8]. Only trapezoidal numbers are included for unnormalized values of the components *Ki*. Three integral and four intermediate indicators take values limited to the range [0; 1], which makes their fuzzification unnecessary. The linguistic identification of integral and intermediate indicators is immediately carried out using the scales from *Table 1*, bypassing the fuzzification stage.

Next, the experts perform fuzzification of the component values using the developed database with the help of the degree of membership calculation system (3):

$$\lambda_{ij} = \begin{cases} 1 \ at \ Ki \le a_1, if \ j = 1 \\ 0 \ at \ Ki \le a_1, if \ j \in [2;4] \\ \dfrac{Ki - a_1}{a_2 - a_1} \ at \ a_1 < Ki < a_2 \\ 0{,}5 \ at \ Ki = a, if \ a_1 = a_2 \\ 1 \ at \ a_2 \le Ki \le b_1 \\ 0{,}5 \ at \ Ki = b, if \ b_1 = b_2 \\ \dfrac{b_2 - Ki}{b_2 - b_1} \ at \ b_1 < Ki < b_2 \\ 0 \ at \ Ki \ge b_2, if \ j \in [2;4] \\ 1 \ at \ Ki \ge b_2, if \ j = 5 \end{cases}, \quad (3)$$

where: λ_{ij} — degree of membership of *Ki* to the term set *j*, $\lambda_{ij} \in [0;1]$; *Ki* — unstandardized component values; a_1 — the abscissa of the vertex of the left corner of the lower base of the fuzzy trapezoidal number function; a_2 — the abscissa of the vertex of the left corner of the upper base of the fuzzy trapezoidal number function; b_1 — the abscissa of the vertex of the right angle of the upper base of the fuzzy trapezoidal number function; b_2 — the abscissa of the vertex of the right angle of the lower base of the fuzzy trapezoidal number function.

The matrix method involves reducing the obtained values of components into a fuzzy value matrix μ_{Ki} of size $i \times j$ of the form (4), in which the *i*-th row of the matrix contains fuzzified values λ_{ij}, that characterize the degree of membership of each *Ki*-component to the formed evaluations of the term sets μ_j. In the *i*-th row for calculation, the value corresponding to the criterion $\lambda_i \to \max$, is selected, the value of the weighting coefficient w_i is determined, and in the j-th column — the linguistic characteristic of the term set to which K*i* belongs to the greatest extent. According to the same criterion, the corresponding intersection point ω_j for this term set (and linguistic characteristic) is sought.

$$\mu_{Ki} = \begin{pmatrix} \lambda_{11} & \lambda_{12} & \dots & \lambda_{1j} \\ \lambda_{21} & \lambda_{22} & \dots & \lambda_{2j} \\ \vdots & \vdots & \ddots & \vdots \\ \lambda_{i1} & \lambda_{i2} & \dots & \lambda_{ij} \end{pmatrix}. \quad (4)$$

Table 2

The components of the integrated indexes of innovation effectiveness

№	Name of the component
Components of the intensity of development of solutions for the current technological paradigm	
A1	The level of regulatory framework for digitalization processes and innovative processes
A2	The presence of digital economy specialists, % of the total employed
A3	Investments in digital technologies, million rubles
A4	Share of innovative products, % of the total market volume
A5	Level of innovative activity of organizations, %
A6	Share of innovative products owned by Russian rights holders, % of the total market volume
A7	Share of expenses on digital technology development, % of total research and development expenses
A8	Organizations using information protection measures, %
A9	Organizations with a website, %
A10	Organizations using broadband Internet access, %
A11	Organizations using electronic data interchange, %
A12	Organizations using personal computers, %

Table 2 (continued)

№	Name of the component
Components of the research integration level of a higher education institution	
B1	The number of technology parks and business incubators created at the university, units
B2	Number of spin-off companies, units
B3	Number of implemented projects from the real sector of the economy, units
B4	Number of subject collaborations, units
B5	Research income from the real sector of the economy, thousand rubles
B6	Number of item purchases, units
B7	Total amount of item purchases, million rubles
Components of innovation effectiveness for higher education institutions	
C1	Research income, thousand rubles
C2	Number of patents and intellectual property rights owned by the university, units
C3	Number of license agreements, units
C4	Share of research income, % of total university income
C5	Share of income from the use of intellectual property results, % of the university's total income
G1	Number of subject laboratories, units
G2	The number of publications of the university indexed in scient metric databases, units
Components of innovation effectiveness for the real sector of the economy	
D1	Volume of research conducted by the organization and/or on its behalf, million rubles
D2	Weighted relative turnover, million rubles
D3	Number of patents and IP owned by the organization, units
D4	The coefficient of patent utilization in the organization's production activities

Source: Compiled by the author based on data from the Russian Statistical Yearbook (Rosstat). URL: https://rosstat.gov.ru/storage/mediabank/Ejegodnik_2023.pdf accessed on 16.10.2024), calculation methods of Europe's most innovative universities. URL: https://www.reuters.com/graphics/EUROPE-UNIVERSITIES-INNOVATION/010091N72J7/ (accessed on 16.10.2024); The Impact Rankings URL: https://the-ranking.s3.eu-west-1.amazonaws.com/IMPACT/IMPACT2023/THE.ImpactRankings.METHODOLOGY.2023_v1.2.pdf (accessed on 16.10.2024); University Innovation Rankings URL: https://www.scimagoir.com/methodology.php (accessed on 16 October 2024); The World University Rankings for Innovation. URL: https://www.wuri.world/_files/ugd/8e5131_708743231b0a45ffacc8470fc959c980.pdf (accessed on 16 October 2024); [14–16].

Table 3

The system of Fishburne weights for the components of the integrated indexes

Ki	1	2	3	4	5	6	7	8	9	10	11	12	N
No. A*i*	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	12
Weight A*i*	0.15	0.14	0.13	0.12	0.10	0.09	0.08	0.06	0.05	0.04	0.03	0.01	–
No. B*i*	B1	B2	B3	B4	B5	B6	B7	–	–	–	–	–	7
Weight B*i*	0.25	0.21	0.18	0.14	0.11	0.07	0.04	–	–	–	–	–	–
No. C*i*	C1	C2	C3	C4	C5	–	–	–	–	–	–	–	5
Weight C*i*	0.33	0.27	0.20	0.13	0.07	–	–	–	–	–	–	–	–
No. G*i*	G1	G2	–	–	–	–	–	–	–	–	–	–	2
Weight G*i*	0.67	0.33	–	–	–	–	–	–	–	–	–	–	–
No. D*i*	D1	D2	D3	D4	–	–	–	–	–	–	–	–	4
Weight D*i*	0.4	0.3	0.2	0.1	–	–	–	–	–	–	–	–	–

Source: Compiled by the author based on formula (2).

Weight coefficients and intersection points do not make sense to represent in matrix form due to the fact that traditional mathematical rules for working with matrices will not yield the desired result because of incomplete compatibility with the fuzzy integral convolution method used. Instead, a defuzzification formula has been developed to convert fuzzy component values into crisp ones (5):

$$Int_{\mu} = \sum_{j=1}^{n=5} \omega_j \sum_{i=1}^{N} w_i \lambda_{ij} \ , \qquad (5)$$

where: Int_{μ} — integral or intermediate indicator calculated using fuzzy logic; ω_j — points of intersection corresponding to the membership function j; w_i — weight coefficients of the i- indicator; λ_{ij} — fuzzy values of the i- indicator, selected by the criterion $\lambda_i \to \max$.

As a result of using the matrix method, defuzzification is carried out through double integral convolution of the component values (obtained from the expert's work with the fuzzification base), using not only weighting coefficients but also intersection points.

The location and values of the latter depend on the type and number of membership functions in the used set. Researchers often suggest calculating the intersection points using formula (6) [13, 18, 19]:

$$\varpi_j = 0,9 - 0,2 \times (j-1) \ , \qquad (6)$$

where: ϖ_j — intersection points corresponding to the function of belonging j with the inverse nature of the indicator; j — the serial number of the belonging function in the aggregate. In addition to the analytical method,

Table 4

The fuzzification base for converting a standard numbers into a fuzzy numbers

Term Set Score	Very Low	Low	Average	High	Very High
Ki	Trapezoidal numbers for evaluating term sets of values of the linguistic variable "Intensity of development of solutions of the current technological paradigm"				
A1	(0; 0; 0.1; 0.3)	(0.1; 0.3; 0.5; 0.6)	(0.5; 0.6; 0.7; 0.8)	(0.7; 0.8; 0.9; 0.95)	(0.9; 0.95; 1; 1)
A2	(0.2; 0.2; 0.4; 0.7)	(0.4; 0.7; 1.3; 1.6)	(1.3; 1.6; 2.1; 2.4)	(2.1; 2.4; 2.7; 3)	(2.7; 3; 3.3; 3.3)
A3	(242; 242; 38638; 77277)	(38638; 77277; 135235; 164214)	(135235; 164214; 222172; 251151)	(222172; 251151; 309109; 347748)	(309109; 347748; ∞; ∞)
A4	(0.1; 0.1; 2.2; 4.4)	(2.2; 4.4; 7.7; 9.3)	(7.7; 9.3; 12.6; 14.2)	(12.6; 14.2; 17.5; 19.7)	(17.5; 19.7; 21.8; 21.8)
A5	(1.1; 1.1; 3.3; 6.6)	(3.3; 6.6; 11.6; 14.1)	(11.6; 14.1; 19; 21.5)	(19; 21.5; 26.5; 29.8)	(26.5; 29.8; 32; 32)
A6	(0; 0; 9; 17.9)	(9; 17.9; 31.4; 38.1)	(31.4; 38.1; 51.5; 58.2)	(51.5; 58.2; 71.7; 80.6)	(71.7; 80.6; 89.6; 89.6)
A7	(0; 0; 2.8; 5.5)	(2.8; 5.5; 9.7; 11.8)	(9.7; 11.8; 15.9; 18)	(15.9; 18; 22.2; 24.9)	(22.2; 24.9; 27.7; 27.7)
A8	(48.2; 48.2; 49.6; 51.9)	(49.6; 51.9; 53; 57.1)	(53; 57.1; 70.5; 73.9)	(70.5; 73.9; 77.2; 80.6)	(77.2; 80.6; 86.1; 86.1)
A9	(29.2; 29.2; 30.1; 33)	(30.1; 33; 32.1; 37.5)	(32.1; 37.5; 46.4; 48.6)	(46.4; 48.6; 50.8; 53)	(50.8; 53; 59.1; 59.1)
A10	(46.6; 46.6; 48; 50.6)	(48; 50.6; 51.3; 56.1)	(51.3; 56.1; 69.2; 72.5)	(69.2; 72.5; 75.8; 79.1)	(75.8; 79.1; 85.3; 85.3)
A11	(28.9; 28.9; 29.8; 34.6)	(29.8; 34.6; 31.8; 40.8)	(31.8; 40.8; 50.3; 52.7)	(50.3; 52.7; 55.1; 57.5)	(55.1; 57.5; 67; 67)
A12	(52.6; 52.6; 54.2; 56)	(54.2; 56; 57.9; 61.2)	(57.9; 61.2; 75.5; 79.1)	(75.5; 79.1; 82.7; 86.3)	(82.7; 86.3; 91.3; 91.3)
Ki	Trapezoidal numbers for evaluating the term sets of values of the linguistic variable "Level of research integration of a higher education institution"				
B1	(0; 0; 0; 0)	(0; 0; 1; 1)	(1; 1; 2; 2)	(2; 2; 3; 3)	(3; 3; 4; 4)
B2	(0; 0; 2; 4)	(2; 4; 7; 9)	(7; 9; 12; 13)	(12; 13; 16; 18)	(16; 18; 20; 20)
B3	(0; 0; 20; 40)	(20; 40; 70; 85)	(70; 85; 115; 130)	(115; 130; 160; 180)	(160; 180; 200; 200)
B4	(0; 0; 15; 30)	(15; 30; 53; 64)	(53; 64; 86; 98)	(86; 98; 120; 135)	(120; 135; 150; 150)
B5	(0; 0; 383; 766)	(383; 766; 1341; 1629)	(1341; 1629; 2203; 2491)	(2203; 2491; 3065; 3449)	(3065; 3449; ∞; ∞)
B6	(0; 0; 0; 0)	(0; 0; 1; 1)	(1; 1; 2; 2)	(2; 2; 3; 3)	(3; 3; 4; 4)
B7	(0; 0; 0; 0)	(1.5; 3; 5.3; 6.4)	(5.3; 6.4; 8.6; 9.8)	(8.6; 9.8; 12; 13.5)	(13.5; 15; ∞; ∞)
Ki	Trapezoidal numbers for evaluating the term sets of values of the linguistic variable "Level of result conformity"				
C1	(0; 0; 272; 544)	(272; 544; 952; 1156)	(952; 1156; 1564; 1768)	(1564; 1768; 2176; 2448)	(2448; 5759; ∞; ∞)
C2	(0; 0; 6; 12)	(6; 12; 21; 26)	(21; 26; 35; 39)	(35; 39; 48; 54)	(48; 54; 60; 60)
C3	(0; 0; 6; 12)	(6; 12; 21; 26)	(21; 26; 35; 39)	(35; 39; 48; 54)	(48; 54; 60; 60)
C4	(0; 0; 5; 10)	(5; 10; 18; 21)	(18; 21; 29; 33)	(29; 33; 40; 45)	(40; 45; 50; 50)
C5	(0; 0; 0.01; 0.02)	(0.01; 0.02; 0.03; 0.04)	(0.03; 0.04; 0.05; 0.06)	(0.05; 0.06; 0.07; 0.08)	(0.07; 0.08; 0.1; 0.1)
Ki	Trapezoidal numbers for evaluating the term sets of values of the linguistic variable "Level of resource provision"				
G1	(0; 0; 1; 3)	(1; 3; 5; 6)	(5; 6; 8; 9)	(8; 9; 11; 13)	(11; 13; 15; 15)
G2	(0; 0; 3061; 6122)	(3061; 6122; 10713; 13008)	(10713; 13008; 17600; 19895)	(17600; 19895; 24486; 27547)	(24486; 27547; 30608; 30608)
Ki	Trapezoidal numbers for evaluating the term sets of values of the linguistic variable "Effectiveness of innovations for the real sector of the economy"				
D1	(0; 0; 17; 34)	(17; 34; 59; 72)	(59; 72; 97; 110)	(97; 110; 135; 152)	(152; 200; ∞; ∞)
D2	(0; 0; 0.2; 0.4)	(0.2; 0.4; 0.7; 0.85)	(0.7; 0.85; 1.15; 1.3)	(1.15; 1.3; 1.6; 1.8)	(1.6; 1.8; 2; 2)
D3	(0; 0; 1; 2)	(1; 2; 3; 4)	(3; 4; 5; 6)	(5; 6; 7; 8)	(8; 9; 10; 10)
D4	(0; 0; 0.02; 0.04)	(0.02; 0.04; 0.08; 0.09)	(0.08; 0.09; 0.13; 0.14)	(0.13; 0.14; 0.18; 0.19)	(0.18; 0.19; 0.2; 0.2)

Source: Compiled by the author.

a graphical method for determining intersection points is also applicable [20, 21] — they are equal to the x-coordinates of the midpoints of the upper bases of all membership functions in the set.

When using the formula (6) proposed in several sources and further comparing it with the results obtained graphically, it becomes evident that the results of calculating the nodal coefficients on the fuzzy value vector are inversive. In other words, such a distribution of nodal coefficients is suitable for cases where a low level of the indicator corresponds to a high qualitative characteristic. No indicator or component in the developed system possesses such a property, which necessitates the derivation of the inverse formula (7), yielding non-inversive values of the nodal coefficients. The complete match with the results obtained graphically indicates the correctness of the derived formula:

$$\omega_j = 0,2 \times (1 + j) - 0,3 , \qquad (7)$$

where ω_j — intersection points corresponding to the membership function j with a non-inversive nature of the indicator; j — ordinal number of the membership function in the compiled set.

The result of finding the intersection points for a set of five trapezoidal membership functions (see *Fig. 2*) is presented in *Table 5*.

The purpose of the existence of intersection points lies in the additional reduction of subjectivity in the constructed fuzzy model. Thus, in addition to the already existing uncertainty intervals (which are the sides of the trapezoids used in the fuzzy number model), intersection points add the possibility of recognizing absolute certainty based on the criterion of maximum proximity to them [22].

Intersection points represent node coefficients that serve as an additional weighting system alongside the established Fishburn system [20], with the decision on the application of a particular set being made by an expert. In this model (considering the provided justification), values obtained analytically using formula (7) for non-inversive indicators are used.

At the final stage, after performing the integral convolution, linguistic identification of intermediate and integral indicators is carried out, as a result of which qualitative (linguistic) characteristics are assigned to the already existing quantitative characteristics of the latter.

CONCLUSION

The evaluation of innovation effectiveness is an important task for both the academic and real sectors of the economy, highlighting the need to create methods that facilitate its implementation. Among them is the fuzzy set model devel-

Table 5

The calculation results for the intersection points

The value of *j*	1	2	3	4	5
Values ϖ_j, obtained analytically using formula (6)	0.9	0.7	0.5	0.3	0.1
Values ω_j, obtained graphically	0.1	0.3	0.5	0.7	0.9
Values ω_j, obtained analytically using formula (7)	0.1	0.3	0.5	0.7	0.9

Source: Compiled by the author.

oped during the research and presented in the article. Its features and limitations can be noted as follows:

1. The use of more than one integral indicator to assess the effectiveness of innovations.

As a rule, in similar studies, a single integral indicator is proposed for calculation, which comprehensively characterizes some aspect of the economic condition or activity of the subject [23–26], but in this case, it was decided to use three without combining them into a single one to avoid unjustified model complexity.

2. The possibility to calculate the result of the interaction between a single higher education institution and a single organization in the real economy sector in one iteration.

Despite this circumstance, the model is universal. This limitation is mitigated by the absence of a restriction on the number of possible iterations, which hypothetically allows for the calculation and evaluation of the effectiveness of innovations applied during interactions, for example, between a university and a group of organizations, by sequentially replacing data Int_B for each of them. The universality of the model is also characterized by the ability to replace data Int_U and Int_S without a significant risk of encountering a lack of necessary information for calculations.

3. The impossibility of accounting for absolutely all factors affecting the effectiveness of inter-organizational innovations.

This limitation arises because the set of components presented in the study is based on the examination and analysis of the most popular international studies, indices, and rankings, although in reality, there are many more sources of this kind. The impact of this limitation was reduced by following the principles of a systems approach, formulated in an earlier study by the author of this article [8].

4.The presence of subjectivity in the use of expert evaluations.

The application of trapezoidal membership functions and intersection points during defuzzification helps reduce the subjectivity of the model, but does not eliminate it completely.

Future research is planned to focus on the testing of a fuzzy-set model for the integral assessment of the effectiveness of inter-organizational innovations with the aim of its further development and improvement.

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Heuristic vs Formalized Pricing in Consumer Markets: The Role of Price Perception Factors

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ABSTRACT

In pricing management the dominating approach is applied on the basis of the classical paradigm of negative correlation between demand and price, which leads to overenthusiastic preference of price sales incentives and discount-bonus programs. However, the actual results of retailing raise doubts about unwavering fairness of this rule and unconditional effectiveness of the corresponding activities. The reason for this presumably lies in irrational perception of prices by customers, which probably needs to use heuristic adjustments in price management to increase retail profits. **The objectives of the study** is to justify the need of combining two methodological approaches for Russian retailing system when managing pricing — formalized and heuristic — by means of modeling situations of consumer choice of retail purchase and analysis of its determinants. **The methodological basis** combines the conceptual provisions of economic theory, as well as the theory of consumer's behavioral analysis. **Research methods**: in-depth interviews with management specialists and experts, who assessed scenario cases, as well as by means of contextual and narrative analyses. **Information base** of the study consists of modern scientific publications and practical analysis data obtained by means of 110 in-depth interviews conducted in the second half of 2023 and the first quarter of 2024. **The research findings** show that price management in retailing should take into account the impact of pluralistic nature of irrational price perception and spontaneous customer reactions to prices. **Practical significance:** this study may facilitate Russian retailers to forecast price reactions of customers and find effective prices; it will be helpful for teaching management disciplines, and may also be in demand in the process of integration of neoclassical and behavioral models in the context of retail pricing management.

Keywords: behavioral economics; pricing psychology; pluralism of price perception; heuristic reaction to price; pricing management; price in marketing mix; retail pricing

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INTRODUCTION

Price is one of the central categories of modern economic and management sciences. Classical economic theory postulates that sellers and buyers, guided by prices based on their capabilities and needs, optimize supply and demand. Prices, in turn, change depending on demand and marginal production costs, leading to the achievement of market equilibrium without any external regulatory intervention. The elegance of this model lies in the simplicity of explaining how free markets naturally arrive at the equilibrium of price and demand. Based on the assumption that consumers tend to seek maximum consumer utility from the goods and services they purchase, the inverse relationship of "price-demand" (according to classical economic theory) can be graphically represented as a demand curve. Marketers put considerable effort into collecting and processing data to model this relationship as accurately as possible in order to set the "correct" prices for their products.

However, retail reports cast doubt on the absolute reliability of the notion that the demand for any product is always well described by a smooth[1] and monotonically decreasing function with respect to price increases. Empirical data suggests the opposite — the actual demand curve (reflecting the actions of real economic agents, rather than idealized perfectly rational actors) is not smoothly downward sloping, but has kinks and inflection points. Moreover, even a small (without changing the price) adjustment of product information can diametrically change buyers' attitudes, which will affect not only the slope of individual sections of the curve but also the sign of the demand function's derivative.

So, since this function is quite unstable, even the slightest changes in framing[2] or minor shifts in emphasis and boundaries of the advertising and informational context can cause significant movement; the possibilities of formalized pricing as a scientific and methodological approach are limited. In this regard, based on the classic price-demand relationship, before engaging in modeling price elasticity (considering the irrational characteristics of economic agents' behavior), it is necessary to determine what causes the ambiguity in price perception and what drives people to make a purchase or refrain from it.

The purpose of this study was to justify the need to combine two methodological approaches — formalized and heuristic — in managing pricing in Russian retail through the modeling of situations related to consumer choice in retail purchasing and the analysis of the factors determining it.

The authors set themselves several research tasks (which were subsequently successfully solved):

1. Identify the rational and irrational internal motives and rules that (under the influence of the informational context and market situation, as well as the sales environment and conditions for making a purchase decision) a Russian citizen consciously or unconsciously follows when forming a favorable or negative attitude towards the price; identify and examine the underlying perceptual processes,[3] affective reactions[4] and cognitive mechanisms.[5]

2. Characterize the multiple perceptions and ambiguous reactions to prices in Russian

[1] A function is considered smooth if its derivative is continuous over its entire domain.

[2] Framing in sales involves the seller creating specific informational frameworks and boundaries related to the product being sold in order to encourage the decision to purchase it.

[3] The process of perception is the formation of a personal impression based on perceived information.

[4] An affective reaction is an explosive emotional response that reflects an unconscious subjective evaluation of the current situation.

[5] Cognitive mechanisms activate the inherent patterns of information processing and analysis, methods of knowledge acquisition and modification, and techniques for structuring and conceptualizing specific objects and abstract entities in human consciousness.

retail, thereby confirming the necessity of considering the irrational behavioral aspect in retail through heuristic price planning, as well as outlining an updated approach to pricing in retail trade in our country, prioritizing the heuristic consideration of the effects of pluralistic price perception by economic agents.

3. Conduct a study of the evaluative rules and internal mechanisms that Russian retail buyers consciously or subconsciously use when considering price offers and deciding whether to accept or reject them; identify patterns and characterize the underlying psychological reasons that determine the reaction of domestic economic agents to retail prices.

4. Show that when managing pricing in Russian retail, one should take into account the effects caused by the ambiguity and irrationality of mass buyers' price perception, as well as their spontaneous reaction to prices.

During the study, answers were obtained to the following research questions:

- What approaches to retail pricing (heuristic, formalized, or any other) are predominantly practiced by Russian retail today?
- What internal rules and mechanisms drive the domestic buyer both in forming an attitude towards retail prices and in making a decision to purchase or refrain from purchasing?
- How do these rules and mechanisms vary and combine depending on the specific situation and circumstances?

ANALYTICAL REVIEW OF SOURCES WITHIN THE FRAMEWORK OF SEARCH RESEARCH

Fluctuations and variations in demand as a consequence of irrational price perception

Not a smooth and continuous demand curve. The demand function plays a key role in price theory — in particular, it is used to determine price elasticity and calculate the market price that maximizes the seller's revenue. Analysts engage in computer modeling of the demand function and price sensitivity. University students and business school attendees are taught to primarily focus on demand elasticity when making pricing decisions: it is recommended to raise the price if demand is inelastic; otherwise, it should be left unchanged or lowered.

The demand curve (as it is usually depicted in economics textbooks) is shown by a dashed line in *Fig. 1*. Let's note two of its features. First, it is monotonic, smooth, and continuous, with no "jumps" or special points, and second, it does not account for the dependence of demand on the framing effect in sales.[6]

However, the assumptions of classical theory regarding the nature of the price-demand relationship contradict published facts, which indicate, in particular, that when perceiving numbers and arithmetic sums, the average human mind is guided by certain heuristic irrational approaches. For example, since the reading of numbers for most people occurs from left to right, the quantitative values fixed in the minds of real economic agents turn out to be tied to the extreme left digits of the number [1, 2]. Therefore, 2990 rubles is perceived as a significantly smaller amount than 3000 rubles, whereas the difference between 5000 and 5010 rubles is hardly noticed. The difference in prices is also perceived as more significant if it is easy to calculate in one's head [3]. For example, the difference between 5500 and 4500 rubles seems greater to people than the difference between 5520 and 4470 rubles. Thus, the demand of an average consumer with medium cognitive abilities is significantly different from the demand of the infamous *homo economicus* endowed

[6] The framing effect lies in the fact that the format, volume, and setting of presenting information about a product and its price so significantly influence the perception of a potential buyer that the same price offer can elicit either an absolutely positive or a negative reaction.

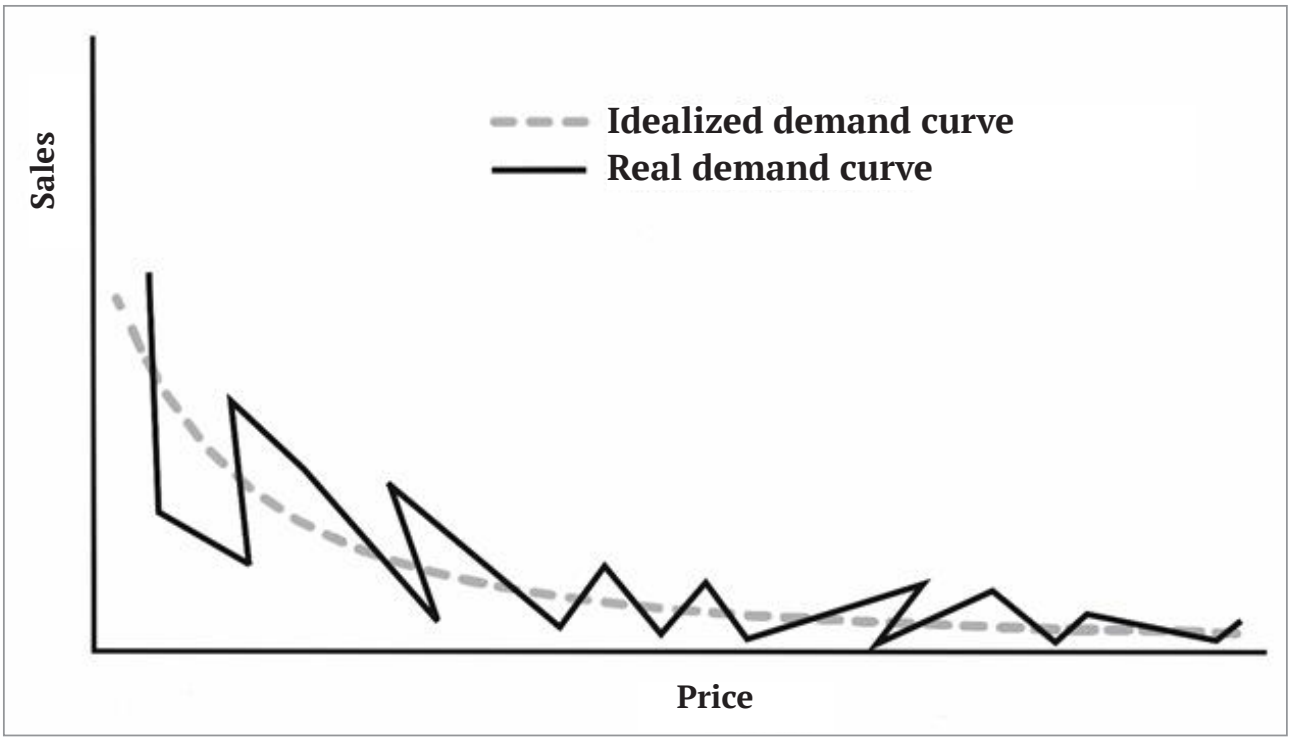

Fig. 1. **Demand curves — idealized and actual in retail**

Source: developed by the authors.

with extraordinary intelligence.[7] The function describing the price-demand relationship of a rationally behaving real economic agent is far from smooth and continuous — it has bends, breaks, and discontinuities that reflect spontaneous reactions and the peculiarities of reading numerical labels on product price tags (solid line in *Fig. 1*).

Unstable and non-monotonic demand. There is another reason why the canonical price theory based on the classical demand model is sometimes far from practical reliability — it is the instability of demand. Since both the perception of price by economic agents and the corresponding price-demand relationship are highly sensitive to advertising and informational content and the framing effect, even very small innovations in the packaging and market presentation of a product (box size, portion packaging, label on the packaging, wrapper design, etc.) can provoke a significant change in price elasticity of demand.

A clear illustration of this is the packaging of baked goods in small portions: buyers have started paying attention to the calorie content of food to reduce the consumption of sweets and baked goods, and sellers have found a way to meet this consumer demand by changing the packaging. By purchasing a product containing only 100 calories, one can enjoy their favorite food without the guilt of breaking their diet. As a result, the price sensitivity of demand has noticeably decreased. Sellers now earn almost one and a half times more per unit of weight, as the 100-calorie portions sell quickly, and very few consumers are concerned about the nearly 50% price increase they are paying in the process [4].

[7] Homo economicus (Latin) — the "economic" person, i.e., a rational individual who, acting sensibly, always strives to maximize the benefits received and, when making choices, bases them on their economic outcomes.

Another factor influencing retail demand is the way the quantity of the product being sold is indicated. Sometimes, using units of measurement such as pieces, servings, packs, boxes, sachets, etc., instead of indicating weight in grams or volume in liters, significantly reduces price sensitivity [5], and the desire to purchase a high-calorie food product increases significantly if it's packaging prominently states that it contains mini-portions.

So, the demand for most goods and services is not invariant even to small changes in the framing within the context and setting of sales. And even very slight shifts in emphasis and boundaries of product information presentation can have very serious consequences, up to a local change in the nature of the price-demand relationship.

Behavioral economics and heuristic pricing

The poor predictability of retail demand raises the question of whether there is any practical sense in highly precise modeling of price elasticity, which will change radically each time (for example, with the slightest changes in the advertising and informational context). Maybe, first of all, it makes sense to figure out what "hidden springs" influence the price perception of target customers, i.e., to determine:

- What internal rules and motives do economic agents follow when perceiving price?
- What circumstances and conditions in each specific case determine the reaction to the price, and under the influence of what does the choice of one or another decision-making mechanism for purchasing occur?
- Will this help the retailer adjust the price set based on classical principles?

Some scholars consider that the canonical demand model can be modified to account for the framing effect and irrational price perception, and the price-demand relationship can be improved by considering gaps and fluctuations [6]. In doing so, researchers overlook the fundamental differences between the two approaches to pricing. The first — formalized — approach assumes that economic agents have stable preferences regarding the value of products, striving to achieve maximum utility, while the influence of contextual signals is insignificant [7]. Therefore, the priority is given to considering the benefits of the value proposition for customers. In the case of heuristic pricing, it is assumed that the preferences of economic agents and the important values of products for them are quite variable, as they entirely depend on the nature of the incoming contextual signals and their personal perception [8]. Thus, this pricing approach primarily focuses on the psychological aspects that influence perceived economic value.

Heuristic pricing studies the real behavior of buyers based on spontaneous judgments and decisions. It is not limited by postulates about the nature of the price-demand relationship, nor by axiomatic propositions about the tendency of economic agents towards rational utility and their stable value preferences, but is based on the integration of seemingly disparate ideas aimed at explaining specific behavioral responses to prices [9, 10]. Thus, some researchers assume that people prefer a compromise between the offered prices and product options [11]. Others base their conclusions on the assumption that consumers analyze prices by comparing them to certain "reference" prices for similar goods. Thirdly, some argue that buyers perceive prices according to their feelings regarding the necessity to spend money and incur expenses [12]. Recognizing that all these algorithms, which determine the attitudes of economic agents towards retail prices, work in certain situations and under the influence of specific triggers, heuristic pricing unites various perspectives on the motives of price perception [13].

So, the central postulate of the heuristic approach to pricing is that there are various rules

and mechanisms for making decisions regarding purchases and prices, the application of which varies among economic agents depending on the situation and individual characteristics. For example, an obviously inflated price will deter some from making a purchase, while for others it will serve as confirmation of the product's superior quality and positively influence their decision to buy. Moreover, an individual may perceive the price as unfair, but it is not necessarily the case that this judgment will lead to a refusal to purchase in certain circumstances and situational contexts. Thus, heuristic pricing is based on the understanding that the influence of prices on the purchasing decision is rooted in the knowledge of how the mechanisms and rules, whether consciously or unconsciously, are relied upon by economic agents when perceiving and understanding retail prices.

Psychological principles of decision-making regarding price acceptability and purchasing

When perceiving prices and considering the feasibility of a purchase, people usually follow certain rules that regulate the internal mechanisms influencing their decisions [14]. In this regard, based on the literature on behavioral economics and pricing [15], as well as from the experience of observing the actions of economic agents in various situations and circumstances [16, 17], certain characteristics can be identified in people's behavior when forming their attitudes towards prices and purchases.

1. Judgments of buyers regarding the acceptability of prices are pluralistic, diverse, and based on a set of internal rules and mechanisms, selectively used depending on circumstances and context:

- when making and paying for a discretionary purchase[8] people always hesitate and experience doubts (and sometimes even strong negative emotions and psychological pain of loss associated with parting with money), especially if they end up spending more than they initially intended and/or can afford [18, 19];
- in the case of a regularly purchased and widely distributed product, the offered price is compared with some benchmark (reference market average) [20, 21];
- when prices seem opaque, and the seller's sincerity is in doubt, they are guided by an internal sense of fairness in the price offer [22, 23];
- if they see the seller's uncertainty, they may try to negotiate a price reduction and/or an installment payment plan [24–27];
- when it comes to purchasing a high-end product from a well-known brand, they assess whether its price is commensurate with the expected consumer utility [28,29];
- when faced with an alternative choice between expensive durable goods with multiple functions and more budget-friendly options, albeit with fewer features, a compromise is sought between the price and the breadth of functionality [30];
- in a situation of rising inflation expectations and allowing for the potential partial destabilization of food supplies, today's Russian consumers are increasingly moving away from the principles of a free market, which are the foundation of classical economic theory and canonical pricing, contradicting the notion that the price-demand relationship is always illustrated by a monotonically descending curve [31].

2. There are correlations between the context of purchases and decision-making mechanisms. That is, people tend to associate the nature and conditions of purchases with certain internal rules of price perception. For example, they associate the price of exclusive services and luxury brand products with their consumer utility; purchases in supermarkets and marketplaces with

[8] A discretionary purchase is made spontaneously at the buyer's personal desire, rather than according to a plan, rules, accepted commitments, and/or necessity.

Table 1

Mechanisms and Rules for Perceiving the Price of a Product and Making Decisions about a Purchase, Inherent in Economic Agents

Rules and mechanisms of price perception	Explanations and notes
Doubts and worries when paying: am I spending more than I have or planned to spend?	The economic agent evaluates whether he is spending more money than he actually has or can afford, and how he feels deep down about such expenditures. If he feels uncomfortable, morally uneasy (or even pained) parting with money, he refrains from making the purchase
Price comparison: how does the product's price compare to the market average and the prices of similar products?	The individual weighs whether the price of the product is lower or higher compared to the reference price. If it is higher, the purchase will not take place
Sense of price fairness: an internal opinion on whether the price is reasonable and justified?	A person decides whether the price is adequate, whether the pricing is understandable and transparent to them, and whether it is worth buying at an inflated price with opaque pricing
Relevance of bargaining: will the price be a subject of discussion and negotiation with the seller?	In some cases, the price may be at parity, and the economic agent will make the purchase if an acceptable price can be negotiated
Correlation of price with value: does the price of the product correspond to its expected utility and the benefit that the economic agent will receive by purchasing and consuming it?	The buyer is contemplating whether the price matches the value of the product as he understands it. He is willing to pay more if the value of the product (service) is significantly higher
Compromise between price and functionality: am I paying for exactly the features and options of the product that I need?	The consumer compares the price with the features and properties of the product they will receive by paying it. They choose the product with the specific options they need at the corresponding price
Adjustment for supply instability and price increase: will there be another opportunity to buy, and what will happen next with the price?	The economic agent fears that the product will disappear from the market or become more expensive, and strives to make the purchase as quickly as possible

Source: Developed by the authors.

the ability to compare prices of similar products; and the acquisition of expensive second-hand items with price negotiations. In other words, specific circumstances and the type of product trigger corresponding algorithms for perceiving its price and making a decision about its acquisition.

3. When considering price offers, economic agents tend to use a combination of rules and mechanisms. For example, they may simultane-

ously experience doubts, compare prices, seek a compromise between prices and product functionality, etc., which collectively leads to the final decision.

The aforementioned features of consumer behavior are integrated into *Table 1*.

STUDY DESIGN

1. A pool of informational materials has been formed, which includes scientific articles, proceedings of scientific and practical conferences, and online posts by practicing specialists. The criteria for selecting publications were both the relevance to the research topic (search by keywords) and the timeliness.

2. Based on the ideas gleaned from the selected materials, a selection of methodological approaches was conducted, and a guide ("roadmap") for interviews with experts was compiled; algorithms for price perception and purchase decision-making were formulated (*Table 1*); and scenario cases were developed to immerse interviewees in various retail shopping and selling situations (*Table 2*).

3. To obtain answers to the research questions, a series of in-depth interviews was conducted, involving more than 110 Russian experts,[9] who are simultaneously retail customers and representatives of retail-related businesses, with an average age of 37 years. Two-thirds of them are women, and 59% of the respondents live in Moscow and the Moscow region. All participants in the study are either current students of additional business education programs or have been such in the past.

Initially, experts as representatives of the business community were required to state which of the approaches to pricing tasks outlined below, in their opinion, predominates in the business practices of Russian retailers:

- application of cost-based pricing (costs plus expected profit according to the established profitability norm);
- the use of the classic price-demand relationship in formalized pricing, associated with the difficulty of collecting and processing reliable data for its modeling;

Heuristic pricing — taking into account the irrational evaluative psychology of economic agents when making purchasing decisions under the influence of the peculiarities of subjective price perception, as well as due to individual internal mechanisms and rules.

Then the interviewees acted as buyers and were presented with seven scenario cases (left column of *Table 2*): each had to match only one of the price decision-making mechanisms (*Table 1*). The question to the experts was formulated as follows: "Which price and purchase decision-making rule will you, as consumers, follow first?" The study was open-ended — participants were informed in advance about its goals and objectives.

THE RESULTS OF THE STUDY AS EMPIRICAL CONFIRMATION OF THE AMBIGUITY OF RETAIL PRICE PERCEPTION

The first part of the study, when experts acted as representatives of the business, showed that 39% of them consider that Russian retail companies typically use formalized pricing based on the classic price-demand relationship. A third of the respondents (33%) considered that heuristic accounting of the psychology of retail buyers is carried out, including the peculiarities of subjective price perception and the presence of internal mechanisms and rules for making purchasing decisions. The remaining

[9] The error is estimated as $\sqrt{Z^2 P(1-P)/n}$ 100%, where n — is the sample size (n=110), Z — is the standardized deviation (at a confidence level of 95% Z = 1,96); P — is the variation for the sample. In the worst-case scenario (when P = 50%) the error is less than 10%, which is quite acceptable for this study, the aim of which was merely to confirm the hypothesis that Russian retail consumers, when considering the same price offers and making decisions regarding the purchase of identical goods and services, are guided by significantly different motivational rules and behavioral criteria.

Table 2

Options of Choice for a Russian Customer Regarding Rules and Mechanisms Decision Making about Price and Purchase, Based on the Case, in%

Rules and mechanisms for decision making / Scenario cases	1. Payment doubts	2. Price comparison	3. Feeling the fairness of the price	4. Appropriateness of bargaining	5. Matching price to value	6. Trade-off between price and functionality	7. Adjustment for supply instability and price increases
Desk lamp While browsing the product catalog, you see a vintage table lamp that perfectly matches the interior of your home, and you feel an urge to buy it. The lamp is expensive. You check your cash and find that you have already exceeded your budget, surpassing your average monthly expenses, and the balance on your bank card is lower than usual.	80	0	4	2	10	4	0
Toothpaste While on a trip to the store, you remember that you're running out of toothpaste at home, and you consider two brands of toothpaste that you usually use.	0	68	6	0	18	8	0
Smartphone from the mobile operator You want to change your smartphone. Your mobile operator is running a promotion with a discount on exactly the smartphone you need. However, upon reviewing the details, you realize that the operator's offer is only for new customers, i.e., those who are switching from another provider. Unfortunately, this promotion does not apply to you, and you will have to buy a new smartphone without a discount.	2	12	50	12	10	8	6
Apartment on the secondary market You are looking for an option to buy a property on the secondary market. You have viewed several apartments, and one particularly caught your eye. The realtor confirmed the cleanliness of the documents and the possibility of the transaction. However, in your opinion, the price is somewhat inflated by the seller and could be lower.	2	14	8	56	12	4	4
Banquet at an upscale restaurant You are hosting a banquet at a trendy restaurant. The establishment has excellent cuisine, a pleasant atmosphere, and great service. You are reviewing the menu and placing an order.	10	4	12	4	62	8	0

Table 2 (continued)

Scenario cases / Rules and mechanisms for decision making	1. Payment doubts	2. Price comparison	3. Feeling the fairness of the price	4. Appropriateness of bargaining	5. Matching price to value	6. Trade-off between price and functionality	7. Adjustment for supply instability and price increases
New laptop You are choosing between three laptop models. The first has a large screen, a super-powerful processor, and a discrete graphics card. The second has a medium-sized screen, a mid-range processor, and an integrated graphics card. The third has a relatively small screen, a weak processor, and an integrated graphics card. The first laptop is the most expensive, the second is of average price, and the third is the cheapest.	0	4	2	0	8	82	4
Personal car You want to purchase a new car of a specific model in a particular configuration. The dealership you approached for the purchase informed you that there is only one such car left in stock, and it has a minor paint surface damage. The next batch of cars will arrive no earlier than in a couple of months, and by that time, their price in rubles will most likely increase. As an alternative, the dealership offered a car of the same model but in a more expensive configuration and at a higher price.	2	2	4	2	10	12	68

Source: Developed by the authors.

participants (28%) stated that cost-based pricing (costs plus expected profit) prevails among the retailers they are familiar with.

The results of the second part of the study, in which experts acted as buyers, are presented in *Table 2* and *Fig. 2*, where the shares of economic agents willing to follow a particular rule and/or decision-making mechanism regarding price acceptability depending on the situation are indicated. Three important conclusions can be drawn from the obtained data.

Firstly, although the dominant tendencies to use certain decision-making mechanisms depending on the case largely coincide, there is still no complete unanimity among the interviewed individuals — there is a noticeable range of opinions. For example, in the case of buying an apartment, more than half of the experts (56%) noted the appropriateness of bargaining. However, for 14%, comparing prices was a priority; 12% would first look at the correspondence between price and value, and 8% would start with the fairness of the price. This means that the consumer paths to forming judgments about prices and making purchases are quite varied.

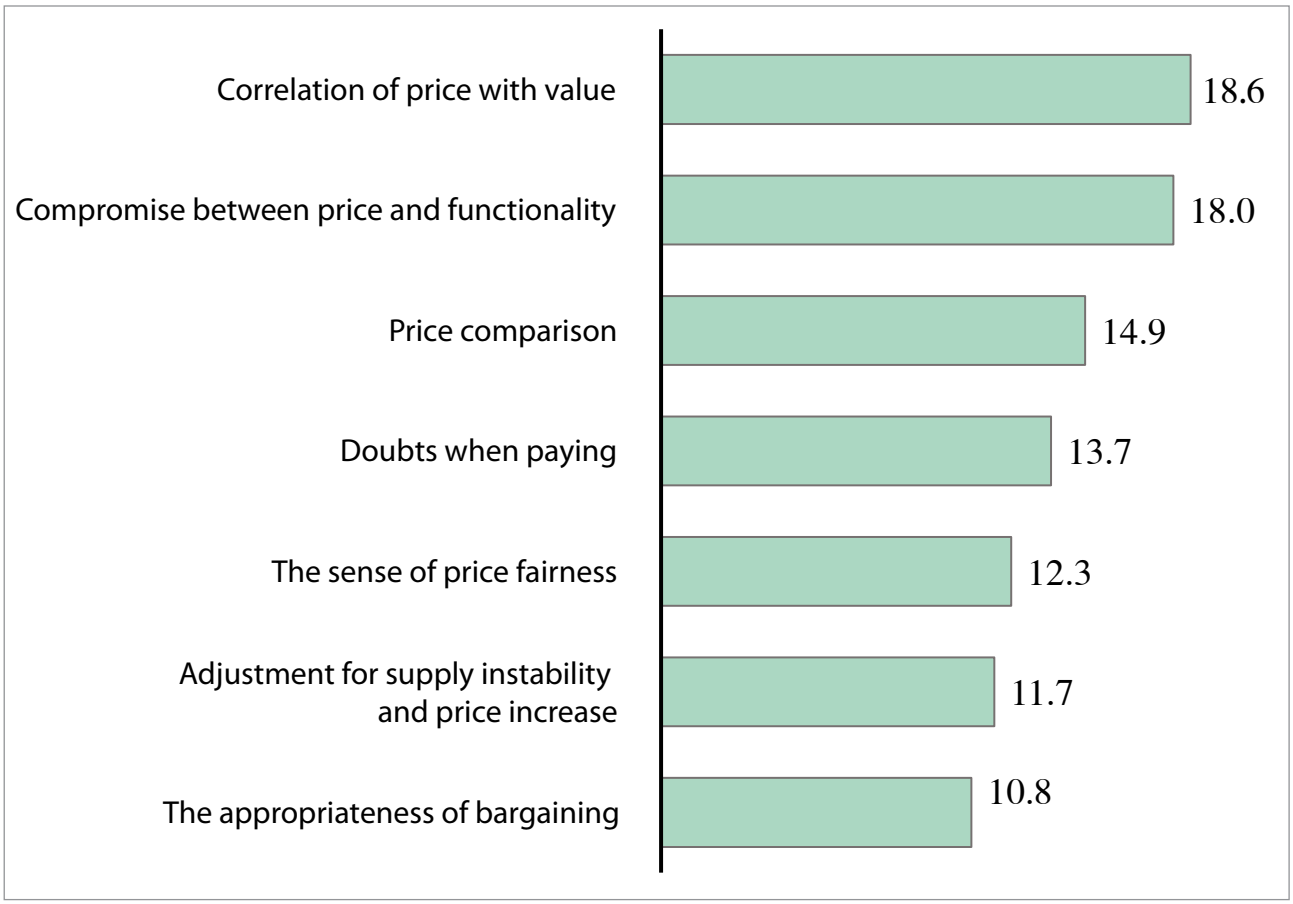

Fig. 2. **Frequency of Resorting to Various Mechanisms and Rules Regarding Retail Prices for Decision Making by Russian Economic Agents (in per cent)**

Source: Developed by the authors.

Secondly, connections have been established between the specific content and context of the purchase (product or service, discretionary or essential, large or small, etc.) with certain dominant rules of price perception and the most commonly used mechanisms of consumer choice, namely:

- 80% of survey participants, when asked whether to spend on an unplanned purchase of an expensive desk lamp, responded that they would follow the "Doubt at Payment" rule, considering whether they are about to spend more than they can afford and listening to their inner voice, feelings, and emotions;
- when buying toothpaste, 68% of the interviewed will use the "Price Comparison" mechanism and see how the offered product price compares to the market average and the prices of similar products;
- consider the feasibility of purchasing a smartphone from "their" mobile operator, 50% of the study participants will do so, guided by the "Perception of Price Fairness" according to their personal opinion on whether it is reasonable and justified;
- thinking about the offer to buy an apartment on the secondary market, 56% of experts will inquire about the "Possibility of negotiation", i.e., whether the price will be a subject of discussion with the seller regarding the likelihood of its reduction;
- when ordering a banquet at a trendy restaurant, 62% of experts will follow the "Price-

Value Ratio" rule, weighing whether the requested price matches the level of service and the establishment's image;

• when choosing a laptop, 82% of experts will make a "Compromise between price and functionality" provided that the computer has the required user options and technical specifications;

• when purchasing a new car, 68% of respondents will make an "Adjustment for supply instability and expected price increase", considering whether another opportunity to buy will arise and what will happen with the price.

Thirdly, decision-making mechanisms vary in terms of universality and frequency of application. The rules "Price-Value Correlation" and "Compromise between Price and Functionality" are mentioned more frequently than others. When considering the organization of a banquet, as well as the purchase of toothpaste, an apartment, a car, a desk lamp, and a laptop, respectively 62, 18, 12, 10, and 8% of the study participants will follow the first rule. In contrast, 82, 12, and 8% will follow the second rule.

Overall, the study allows us to draw several general conclusions, namely:

• the perception of retail prices by Russian consumers is pluralistic in nature; it is ambiguous and multifaceted.

• the reaction of an economic agent to a price can arise spontaneously and often occurs irrationally.

• buyers consciously or unconsciously adhere to certain stereotypical approaches and resort to standard decision-making mechanisms regarding prices;

• when forming a personal opinion about the price and feasibility of a purchase depending on the situation and informational context, consumers are guided by various internal motives, emotions, techniques, and restrictive rules, such as payment doubts, price comparison, the sense of price fairness, the appropriateness of bargaining, correlating price with value, the compromise between price and functionality, adjusting for supply instability and price increases;

• the observed changes in product offerings under current conditions, possible disruptions in individual product supplies, and rising inflation can lead to the formation of an opinion about the lack of alternatives to the current price and push towards accelerating the planned purchase.

CONCLUSION

It can be acknowledged that under modern economic conditions, the principle of utility maximization in rational consumer behavior is good for explaining how free markets reach equilibrium without any regulatory intervention. However, this rule proves insufficient for accounting for the peculiarities of the cognitive processes underlying the perception of retail prices of specific products by mass Russian consumers, which should be taken into consideration in practical pricing.

The main scientific result of the conducted research is the confirmation that the contemporary perception of retail prices by Russian economic agents is ambiguous, individual, and subject to cognitive distortions. It is based on the use of certain internal decision-making rules and the application of a number of characteristic mechanisms, and it significantly depends on the context of the specific case and the presentation of informational content. The final attitude towards the price is formed due to personal psychological traits and tendencies, activated consciously or unconsciously. All this expands the practical basis for price formation in Russian retail and indicates a conceptual direction for further study of the nature of retail prices.

Limitations of the results and directions for further research. The conducted study raises new questions that require further scientific

inquiry. Based on an analytical review of previously published papers, seven mechanisms and rules of perception of retail prices by economic agents were identified and examined. However, it is not obvious that this list is exhaustive and definitive. In addition to the identified seven, other equally important algorithms may be discovered, for example, those related to the use of discount-bonus systems and anchor prices by sellers [32–34].

Another aspect of the problem is identifying the relationship between the mechanisms and principles of decision-making under consideration and how they interact, whether there are any common motives and fundamental factors underlying these mechanisms, and whether there is some initial basis from which all these rules derive. In this regard, it can be assumed that the activation of any fundamental principal triggers others. Moreover, it seems that different consumer psych types have specific characteristics in making price-related decisions — for example, misers may lean towards one mechanism of price perception, while spendthrifts may lean towards another. The assumption that people use different rules depending on the context is intuitively appealing in terms of seeking answers to the posed questions. To approach an explanation of how economic agents link a particular mechanism of purchase decision-making in a specific situation, it would be useful to construct a decision tree that takes into account the rational and irrational components of this process.

And finally, without rejecting the assumptions that economic agents may have sufficiently stable purchasing preferences, are mostly inclined to maximize consumer utility, and are not limited in cognitive abilities, it is advisable to continue exploring the possibility of modifying the classic price-demand relationship by introducing empirical adjustments that take into account the psychological aspects underlying spontaneous judgments about prices and irrational product preferences of domestic retail consumers.

All the issues raised by the authors of the article indicate the need for continued research, the results of which are intended to deepen today's understanding of how retail prices are perceived by Russian economic agents, as well as to assist domestic entrepreneurship in improving retail pricing for consumer goods and services in our country. The results obtained and the conclusions drawn during the work should be used in teaching management disciplines in higher education institutions that prepare specialists for work in the modern economy of Russia.

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Territorial Self-Government: From Local Communities to Self-Governing Community

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ABSTRACT

Territorial self-government represents a historical stage in the development of human civilization, emerging as a tool for regulating social relations at the sub-state level within the boundaries of local communities. It operates in the interests of these communities and with their direct participation. This form of governance originated during the intensification of class struggles between feudal lords and the citizens of free cities, ultimately granting the latter special rights as municipal corporations. However, the concept of "territorial self-government" is not identical to "local self-government," as it is not confined to city boundaries but serves as a mechanism for territorial distinction at various levels. The functional diversity of territorial self-government is explained by historical, economic, and political factors that shaped the administrative-territorial systems of modern states. Today, it acts as a means of distributing powers between different levels of public authority in addressing pressing social issues. The study aims to identify the characteristics and criteria of self-governance in territories and their role in enabling local communities to attain the status of self-governing entities. Recognizing these characteristics will help establish stable boundaries for the activities of self-governing communities using the so-called Functional Self-Governance Limit (FSG). This concept is necessary for evaluating (within socially accepted and rational limits) the costs of using a centralized governance model versus resolving community issues primarily through internal resources. Using the method of typological groupings, the study classifies different types of local communities in Russia based on selected criteria. The article also presents key indicators for assessing the FSG of municipal formations and examines conditions that facilitate both the transformation of individual civic attitudes into collective interests and the acquisition of self-governing status by local communities.

The findings contribute to the development of a modern concept of local self-government in Russia and inform adjustments to ongoing municipal reforms.

Keywords: territorial self-government; regional self-government; governance; local community; self-governance criteria; self-governing society

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INTRODUCTION

Self-government is the most important achievement of civilization: a product of society to seek and solve a significant part of its problems independently, relying on the initiatives and public activities of ordinary citizens. It is a historical phenomenon emerging as an instrument able to solve traditional governance problems and it operates in opposition to the expansion of the subordinate sphere, which has limited possibilities for centralization. Initially, as an object of study, governance was analyzed from the perspective of the interests of a corporate entity, which seeks to improve the productivity of a company producing any product or service. This concept led us to turn to the experience of regulating complex processes and systems by identifying regularities and basic principles of effective managerial activity. The foundation of stable nation-state formations has led to the study of management mechanisms in order to rationalize ways of managing multiple territorial complexes, involving a combination of various political, economic and social aspects of functioning and reproduction of these complexes. The emphasis on the self-governance of territorial entities has led to an awareness of the need to separate state interests from local interests. Within the framework of self-governance, the need to meet the local interests began to be considered as a system of administrative activities based on current agreements between members of the local community. However, there raises the question of the specifics of territorial self-governance, its main types, criteria for self-governance and their implications in specific organizational forms.

MANAGEMENT AND SELF-GOVERNANCE

Man is a controlling creature. The ability to control is one of the generic properties of a human being. Man manages available resources, time, household chores, etc. Man builds a certain logic chain of actions in order to satisfy his needs. However, the ability to manage anything does not arise immediately, but during one of the stages in the process of mastering the objective world, within which Man is developing in continuous interaction. To learn managing the composition of elements in this world, or somehow influencing the processes which occurs in the depths of the world, Man must study this world to understand how best to adapt to its changing nature and how to use it. Man fulfills these concepts, comprehends the secrets of the surrounding reality and begins to manage tiny fragments of such a complex-structured world, dividing his management activity into various functional blocks.

Management is a goal-setting activity of a subject to reach a target result by means of a specially developed system of actions. Management is always aimed at the sphere beyond the subject, one must reveal and implement the method of its influence.

Management is a timeframe-limited process that enables an individual to achieve his goals in an environment studded with many opportunities and limitations. To materialize the opportunities and neutralize the influence of limitations, the individual elaborates a behavior pattern designed to bring the goal closer by performance of at least four types of actions: observation, development of a sequence of actions, control and regulation. The observation stage implies the collection and preliminary processing of relevant information, as well as the identification of contributing and counteracting factors of influence. The stage of development involves a sequence of actions: designing a plan and a schedule to achieve the goal and objectives. The stage of control involves the implication of a preliminary scheme of intermediate indicators, which accompany the process of achieving the goal. The stage of regulation is the procedure aimed to adjust current activities and coordinate the inter-relationship of the participants in the process.

The need for self-management occurs when the objects previously are subject to managerial ma-

nipulation and begin to operate as supplementary centers of managerial influence. Their activities in this field can have no coordination with the activities of the subject of influence dealing with this object.

Self-management is a set of managerial functions of a certain subject, which, being an object of management, is able to perform managerial functions independently — in whole or partially. Domestic scientific literature formulates the main features of self-government, namely:

- independent style, associations of volunteers among citizens in a social community, formation by volunteer's bodies to manage activities of the given community, which are undoubtedly and unconditionally accountable and controlled by it;
- the right of the social community to determine the main objectives and directions of its activities;
- the existence of rules of behavior for the social community, determined in various corporate standards [1, p. 99].

Self-governance can possibly operate in the so-called entities of solidarity, which have three other factors: reciprocity, transitivity and consent. Individual contributions to these entities are caused by a pure altruism, when an individual ignores potential benefits or profit from his/her contribution. On the contrary, such an individual expects similar contributions of reciprocity from his/her counterparts, whose material well-being also depends on similar behavior of other members of the entity. The level of contribution depends on the extent to which other members expect to benefit from the implicit contract, thus enabling all of them to achieve the goals of their own personal interest.

Participation in decision-making in such entities of solidarity assumes that all participants have similar common skills and equal access to insider's information. If this is does not happen because of "bounded rationality", participants may find the activities of such an entity counter-productive, which leads to a high level of tension [2, p.10]. In small enterprises that use common technologies individually or in small groups, such relationships of reciprocity use to develop much easier, than in larger entities. A self-managed solidarity-based entity would not operate in view of unequal access to information and different qualifications of its members. Individual self-interests always conflict with collective interests, they should be put in harmony by establishing certain institutions that promote the norms of reciprocity.

Reciprocity means the willingness of members of a social community to help each other on a basis of parity for the sake of an objective they are willing to reach. For example, it may be an uncultivated plot of land or a broken bridge that requires joint effort for reconstruction. A lack of reciprocity leads to alienation of the people living in the local territory, their lack of interest to work together and solve the current problem.

Mutual consent, as a concept of self-governance, implies both the ability to compromise by the members of the entity when making socially important decisions, and the development of rules and compromise restrictions that determines the foundation of the mechanism to unite and harmonize their interests. Consent is possible, when members of solidarity-based entity have an adequate assumption of the content of the transaction deals and equal access to the information regarding to the deals.

Transitivity is an indication of community's self-organization, which allows distributing different types of social services among its members through the community's institutions without any administrative support from above. Transitivity reflects the dynamic aspect of self-governance: its aim at the community's reproduction and at the expansion of its composition of elements. It is also an associate of stability of communication links meanwhile preserving certain roles in the community and ensuring its patterns of information's distribution. The property of transitivity

implies restrictions on potential participation of the third parties and processes of transmission of unauthorized traffics through internal channels beyond the control of the community members. Transitivity explains the diffuseness of boundaries between self-governing communities, their mobility and inclination to change.

Self-governance occurs in different areas: production, culture, social, etc. It can be corporate, sectoral, territorial, etc. An object acquires a self-governing status when it becomes autonomous within the established managed system. As a rule, this happens, when the latter can function furthermore only by means of self-development of its constituent parts, due to which it obtains the capability to be transformed qualitatively into a new kind of entity.

Initially, self-management was more inherent in the corporate sphere, as a follow up of decomposition of large production systems into relatively autonomous and specialized subdivisions. The labor movement developed and trade unions were organized to consolidate the interests of workers from different production units and to protect them from the employers, thus, it led to the emergence of corporate self-management [3]. As these professional associations grew in number and influence, the big capital owners had to reckon with them. Now the question arises: why should a manager of a company who runs a network of subdivisions has to give up the right to regulate processes at this level and allow the subdivisions to fulfill their functions independently and under their own responsibility? The reasons for such decentralization are the following:

- the impossibility of fully controlling the work of such units;
- high level of costs (material, organizational, personnel, etc.) for the administration of management activities;
- increasing efficiency of subdivisions which start to operate in an autonomous regime.

Thus, the logic of the development of industrial production, differentiation of the product range, deconcentration of share capital, as well as active role of trade unions, contributed to the expansion of corporate self-governance.

Territorial self-governance emerged later as a follow-up of a network of national State authorities and the assumption of the need to consolidate the interests of the state and its regions. State authorities did not want and were unable to create a comprehensive set of control measures to ensure stability within their borders, which generated the need to involve regional elites in this process.

Hoping for the support of the elites, the State authorities considered granting the regions the right of self-governance as a concession.

Self-governance is the implementation of activity within the regulated subject itself, aimed to develop the governed sphere from inside, with no reference to the reaction of the third parties [4]. Thus, the distinction between management and self-governance can be regarded in the same way, as the definition between external and internal objectives. In the self-management regime, the object of management acts simultaneously as subject, whereas in management the first one is separate from the second one by a certain system of relations.

One of the most significant methodological problems is the transformation of governance into self-governance, within the framework of which the transfer of a certain part of administrative functions to the controlled subject allows it to gain benefits from the independent position. This means that the above-mentioned activities carried out at a lower management level will imply the replacement of purely administrative functions by measures of direct participation by citizens.

THE DEVELOPMENT OF TERRITORIAL SELF-GOVERNMENT IN EUROPE AND RUSSIA

In the context of territorial development, management activities are subject to the same constraints as at the enterprise level. However, territorial management implies taking into account

not only business efficiency, but also social, environmental and other issues.

Management activities deal with the same limitations in territorial development as in corporate level. However, territorial management requires to take into account not only business efficiency, but also social, environmental and other issues.

As the sphere of control expands throughout the developed territories, the central power subsequently faces problems related to monitoring and blocking its ability to subdue the local elites in the sprawling periphery of the world-system.

The role of self-governance, as an instrument to rationalize governance at the territorial level, was described successfully by both M. and R. Friedmans: "As the scope and role of government expand to cover a larger area or population or to perform a wider range of functions, the connection weakens between the governed and the governors. Citizens no longer obtain reliable information — not only about all the current issues of a vastly expanded agenda, but also about all the issues of paramount importance. The bureaucracy needed for the functioning of the government is expanding and it becomes more and more wedged between the citizens and their elected representatives. The bureaucracy becomes, on the one hand, a mechanism to provide special interest groups with power to achieve their objectives, and, on the other hand, it operates as the instrument of an independent special interest, thus acting as an important component of a new class." [5, c. 331]. Self-government seems to be one of the possible options to overcome bureaucracy, to acquire the ability of society for independent decision- making on relevant issues.

The territorial or local self-government originated mainly due to the transition from feudal to industrial society [6]. Medieval cities became self-government centers, they concentrated material and productive assets regulated by their own legal institutions [7]. The decentralization process also occurred in the format of town mergers. Thus, such regions acquired a special political status, distinguished by a significant autonomy and developed traditions of local self-government. One of the first examples of such a process in Europe was the formation of a vast territory stretching from Italy in the south to the Netherlands in the north [8].

With the emergence of the European Union (EU), the trend intensified towards the expansion of regional self-governance. The regions of European countries obtained the right to interact directly with centralized EU funds, bypassing the intermediary role of national governments [9]. However, not all EU members among Eastern European countries adopted regional self-governance, only a little more than half of them. [10].

The scientific literature of European countries gives different assessments of such process. For example, according to D. Leška, the creation of eight regions in Slovakia, within the framework of the new regionalization did not bring any benefits. The main indicators were lack of interest of citizens, low participation rate at elections to the regional government and the differences between the most and least developed regions of the country did not decrease [11]. In Poland, despite the trend towards recentralization since 2015, this process did not gain public support. Many local communities in these countries found out the capacity of regions to attract foreign investment directly as a very positive factor [12].

As a result, Western experts admit that the EU has not yet developed a single coherent research programme on regional self-governance, which could allow taking into account a variety and socio-economic levels of regions developing under the conditions of territorial self-government [13]. The system of territorial self-government at the level of municipalities seems to be much more sophisticated, developed in view of deep traditions of European cities. Self-governance in Europe has been visualized from the standpoint of freedom and democracy, reflecting the need of local communities to use their right to unite the population to solve pressing public problems.

Besides, not every country has a division into regional and local self-government, it makes no sense in a two-tier system of territorial government (state-province).

In Russia, the process of forming local self-governance was also developing ambivalently.

By the dissolution of the Soviet Union, the Law "the General Principles of Local Self-Government and Local Economy in the USSR"[1] established a model of local self-government that did not provide for a clear separation of state and local authorities. According to this document, in addition to district, city, town, settlement and village councils of people's deputies, local self-government bodies were regional and krai (area) authorities empowered to organize economic and socio-cultural services for districts and cities on a contractual basis, to carry out inter-territorial activities, and to provide financial assistance to balance local budgets. However, the adoption of the Constitution of the Russian Federation in 1993 made it possible to separate the system of state administration and local self-government. The article No. 12 of the country's basic law, which provides for the separation of powers between the state and local authorities, contributed to the consolidation of the municipal status exclusively for subregional administrative-territorial units.[2] At the same time, uncertain legal status of local government and low level of budgetary allocations did not allow the self-governments to benefit well from their activities. In addition, the existing system of intergovernmental fiscal relations actually triggered an expansion of the format of local government bodies. As a result their number dropped dramatically from 28.000 to 12.500 starting from the late 1980s until the entry into force of the provisions of Federal Law No. 154-FZ "On the General Principles of the Organization of Local Self-Government in the Russian Federation" in 1996[3] and an increase in the radius of municipal services to the population. The majority of local government units in this timeframe period were districts and cities.

Such a course of local self-government reform in Russia contradicted the basic principles of local self-government aimed to reduce the social distance between the authorities and the population and to involve ordinary citizens in the process of local community management. Therefore, in 2003, to support the municipal reform the Government adopted the Federal Law No. 131-FZ of 06.10.2003 "On General Principles of Organization of Local Self-Government in the Russian Federation".[4] It was a step to return to the settlement level in the organization of local self-government, to create a two-tier system of local government and separate powers between its regional and settlement bodies.

However, by the middle of the first decade of the 21st century, economic and geopolitical trends did not allow the existing system of fiscal federalism to ensure the reproduction of most of municipal settlements in accordance with the provisions of the Federal Law No. 131-FZ "On the General Principles of the Organization of Local Self-Government in the Russian Federation". The transition to a single-tier system of local self-government (municipalities and city districts) planned within the framework of the 2024 counter-reform project will contribute to a sharp reduction in the number of municipal entities and their spatial expansion [14]. This raises an important methodological question about the

[1] Law of the USSR of 09.04 1990 No 1417-I "On the General Principles of Local Self-Government and Local Economy in the USSR". URL: https://base.garant.ru/5228211/

[2] Constitution of the Russian Federation (adopted by popular vote on 12.12.1993 with amendments approved during the all-Russian vote on 01.07.2020). Art. 12. URL: https://www.consultant.ru/document/cons_doc_LAW_28399/ec531d2938f351bcb3a9b2f1b50a6f119eac231a/

[3] Federal Law of 28.08.1995 No. 154-FZ "On General Principles of Organization of Local Self-Government in the Russian Federation". URL: https://www.consultant.ru/document/cons_doc_LAW_7642/9436b4e0a8aef2b83c35f4a11ce3c1ee4fb26354/

[4] Federal Law of 06.10.2003 No. 131-FZ (ed. 08.08.2024) "On General Principles of Organization of Local Self-Government in the Russian Federation". URL: https://www.zakonrf.info/doc-15671746/

limits of self-governance of the territory, its legal and economic content.

CRITERIA OF SELF-GOVERNMENT

The territory at the local level singles out in the nation-state formation in accordance with the willingness of the inhabitants to develop it jointly and to establish certain rules within its borders. As to the localization, it can be made in accordance with a number of criteria. There are at least seven of them: *economic, ethno-national, geopolitical, communal, trans-territorial, religious and class criterion*. The choice of these criteria depends on the underlying factors: both for the formation of the boundaries of the self-governing community and for its ability to set and solve socially significant goals independently with support on its own sources.

The economic criterion implies the isolation of a territorial entity to obtain a certain material advantage related to the ability of receiving investment funds, benefits or preferences. For example, such a status may be granted to local communities the rights of a free trade zone, etc.

The ethno-national criterion presupposes the boundaries to be established in view of the affiliation of community members to a particular ethnic or national way of life. This can be determined in some legal acts of the settlement, its name and degree of autonomy. This regards mono-ethnic settlements, as well as those where more than one ethnic community is settled.

The geopolitical criterion is manifested in the establishment of the boundaries of a territorial unit, which are determined by the political interests of the country, security considerations, a specific nature of its geographical location, primarily near the border. According to this criterion, such a territorial entity is authorized to have a certain legal status, in combination of the interests of the local community with the interests of the nation.

An important role in determining the boundaries of municipalities has the *municipal criterion*, regarding the ability of the municipal infrastructure formed in the territory to meet the needs of the community in terms of vital resources. Such infrastructure determines the parameters of development and the degree of anthropogenic development of the territory.

There is also a large number of territorial units formed by the merger of previously independently developing settlements. *The trans-territorial criterion* is intended to demonstrate the advantage that settlements derive from such consolidation.

The religious criterion manifests itself in the community's efforts to establish rules based on the dominant religion in the territory. In Russia, for example, certain religions, like Islam or Christianity are vividly visible. This criterion is usually reflected in a municipal legal act, but it may also be represented in traditions and rituals promoted by community members.

The class criterion is the least institutionally expressed in Russia, where settlements are represented by the type of construction and public utilities in accordance with material and property status of their inhabitants. It is rather difficult to ensure class homogeneity in a territory that has been formed within a long period of time, such territorial formations are established in newly built areas and try to acquire a certain autonomy in the form of homeowner association (HOA) or territorial public self-government (TPS). A peculiar example in the development of such a settlement is the TPS "Sokol Settlement" in Moscow.

Each criterion corresponds to formal and informal characteristics to identify different types of local communities (see *Table*).

Upon gaining the right to self-government, local communities are solving a number of important objectives, such as the following:

- preserving their national and socio-cultural identity;
- gaining economic advantages over other territorial entities;
- minimizing the cost of maintaining municipal infrastructure;

Table

Classification of types of local communities in accordance with self-government criteria

Criterion	Characteristic types of local communities	Forms of identification
Ethno-national	Auls, uluses, national districts, villages	The composition of ethno-national settlements approved by the laws of the constituent entities of the Federation
Geopolitical	Border area, geostrategic area	The Strategy for the Spatial Development of the Russian Federation up to 2025 establishes a list of geo-strategic territories and border municipalities that receive priority state support for the modernisation of their socio-economic sphere
Economic	Territories of advanced development, special economic zones, territorial development zones	The list of territorial (municipal) entities of the respective status established by decisions of federal and regional authorities
Class	Areas with high housing costs and quality	As a rule, it has no the status of an administrative-territorial unit, but is identified by the cadastral and market value of land resources
Transterritorial	Municipal and urban districts	Established by decisions of the legislative authorities of the constituent territories of the Federation through transformations and mergers of administrative-territorial units of the primary level
Communal	Rural, mountain and remote villages	Determined by the laws of a constituent entity of the Russian Federation through separate allocation of separate administrative-territorial units on the basis of their position in the centralised system of life support
Religious	Settlements and districts, mainly in Dagestan and Chechnya, where religious organisations of modern Islam (Juma mosques, madrassas, etc.) play an important role in society	The status of municipal units as religious settlements is informal, as the legislation excludes the substitution of secular power by religious institutions

Source: Compiled by the author.

- providing protection against unauthorized flows of people or goods into their territory;
- providing certain social groups of the population with the opportunity to live comfortably with an adequate level of income;
- widening the possibilities for development of the territory, improving the quality of the environment, connection to supply networks, etc.

However, not all of the criteria mentioned above are equally involved in the mechanisms of self-governance of municipalities, each region has its own model. The general picture is determined by circumstances that sometimes go beyond the scope of these criteria.

An increase in the size of a settlement usually leads to an erosion of its homogeneity and,

consequently, to a limitation of many aspects of these criteria. Therefore, the aspiration for self-governance may weaken with increasing area of the territory of a municipal unit.

One of the key and underdeveloped issues is the definition of the boundaries of self-governance. Its resolution determines the capability of a local urban or rural settlement to solve their objectives as a self-governing unit.

FUNCTIONAL LIMITS OF SELF-GOVERNANCE

The ability of a local community to exercise the right of self-governance is determined by the desire of the major part of the community members to obtain independence and the availability of internal reserves for self-development. It sets the parameters for the municipality boundaries and the optimal spatial framework for self-management. *The functional limit of self-governance* (FLS) can become a methodological basis for justification of establishment of such boundaries.

FLS reflects the socially accepted and reasonable limits of the cost ratio in case if the community chooses a model of centralized municipal management or makes a decision to become autonomous or independent.

Both economic and social factors can influence the choice of such a decision. In case of a local community, the transfer of powers regarding the issues of local establishment to a higher territorial level always presupposes the risk of losing control due to the changes, which may occur in its territory. Asymmetrical relationship in terms of contributing to the solution of national problems may lead to another risk situation, as well as receiving so-to-say "assistance" from above in solving local problems. At the same time, rejecting the principles of self-governance makes it possible to focus upon the implementation of the most important local issues. Besides, local communities use to delegate most of its powers to higher administrative echelons.

The degree of self-governance of any municipality can be assessed by means of several indicators, such as the following:

- the share of municipal own resources in its budget expenditure which is quite easily identifiable from the local government reporting;
- the value definition of the volume of municipal services provided to the community, which directly depends on the capacity of the municipal budget and the capacity of its social component;
- the ratio of local citizens' participation in socially significant decisions, which reflects citizens' activity in public life and their ability to timely use funds from external investors.

The expenditure in the system of self-governance usually has a narrower cycle. It is assessed primarily from the point of view of solving current public objectives.

Self-governance is such a state of the social system, which transforms individual aspirations into a collective interest that ensures the satisfaction of every citizen's needs. However, the possibilities to ensure such harmonization are quite limited, besides, it is rather complicated to maintain it, when the territory of the local community expands.

In order to define the functional limit of self-governance, one should be ready to answer the question: at what territorial level do people begin to consider public problems as their personal ones? The answer is the following: the higher is the territorial level, the more distant these problems seem to be from an individual's point of view in his/her everyday life.

A person is unable to cope with the majority of them. At the same time, he/she becomes less receptive to taking part in their discussion. The loss of the subject's personal interest in solving socially significant problems of local importance leads to the risk of unbalanced integrated development of his/her settlement, growing apathy of citizens and dependence on support of the superiors.

CONCLUSIONS

This article has allowed us to analyses the nature of self-governance as a historically developed phenomenon of civilization and its certain characteristics and peculiarities. Some of its types, such as regional, local or territorial public self-governance, do not reflect the full diversity of possibilities of this legal format, which is the most important instrument of self-governance and self-organization of society. This diversity is determined by a certain set of criteria that characterize, both institutionally and conditionally, the types of self-governing communities. Their formation makes an objective process. It is regulated by public authorities by means of granting privileges and preferences, which provide additional rights and freedoms to the parties involved in different types of arrangements. Not each social community can become self-governing and obtain the status of a municipality: one must have proper characteristics and attributes. The article emphasizes the role of the functional limit of self-governance as an instrument to assess territorial self-governance within the boundaries of a particular type of territorial unit, characterized by the degree of independence in solving urgent public problems.

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