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The Concept of Scientific Management of Sustainable Development of Modern Domestic Economy

A.R. Akhmetshina[a], A.V. Abramova[b]
[a,b] Kazan (Volga Region) Federal University, Kazan, Russia;
[b] "Grid company", JSC, Kazan, Russia

ABSTRACT

This article shows the results of research, analysis and systematization of historical information, scientific works, and regulatory and legal documents in the subject area under consideration in order to synthesize the Concept of scientific management of sustainable development of subjects of modern domestic economy.

The results of the work are based on a systematic approach and the scientific and practical experience of the authors. The results of a retro-perspective analysis of management science through the prism of scientific and technological development of Russia in the XX–XXI centuries are presented. The forecast indicators of Russia's socio-economic development in the field of achieving technological sovereignty are shown. Theoretical and practical significance of the work done consists in the formation and presentation to the scientific and business community of promising conceptual directions of sustainable development of economic entities through the development of adaptive strategy; deployment of industry clusters; introduction and commercialisation of innovative technologies; differentiated application of elements of scientific management; formation and development of social capital, taking into account the requirement of protection from cyber threats in the era of industries 4.0 and 5.0.

Keywords: sustainable economic development; scientific management; innovative technologies; industry cluster; scientific and technological development; lean production

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INTRODUCTION

The demand for a general concept of managing the activities of economic entities that is relevant to modern trends is due to the need to ensure their sustainable state and development.

We consider domestic enterprises and organizations as economic entities, the aggregate performance indicators of which influence the dynamics of development of the national economy in the region of presence and the State as a whole.

As a whole, the management of enterprise is a single process, within which the subject of management influences the object of management to implement the subject of management and obtain target results of activity against the background of the influence of internal and external environmental factors (*Fig. 1*). As a system of organizational elements, we visualize strategic goals, organizational structure, production process, technologies (production secret know-how), labour jobs, and production factors.

To single out an effective promising technology for managing the sustainable development of subjects of the domestic economy, we conducted a research of modern trends in science and practice within the context of transformation of the socio-economic paradigm in the 20th-21st centuries.

In the period of 1917–1991, our country was one of the world leaders in the main macroeconomic and social development indicators, as well as a leader in industrial and space power [1]. The reform of the scientific organization of labor (SOL) in the USSR is closely related to the state policy and the level of scientific and technological development. *Table 1* shows the key events that, in our opinion, determined significant results in the development of national scientific organization of labor.

After the collapse of the USSR and the change of its socio-economic paradigm, scientific, educational, production and technological systems had a hard time of degradation with transition to the practice of import of foreign advanced technologies in exchange for raw materials. This period is characterized by decline of science and production, as well as by deterioration in the quality of the education system. Over time, the latter was even interpreted primarily as a service. There was a loss of common ideological valuable guidelines. This led to formation of a model of consumer behavior, within the framework of which society perceives aspects of the surrounding reality in monetary associations and does not seek to contribute to sustainable development of

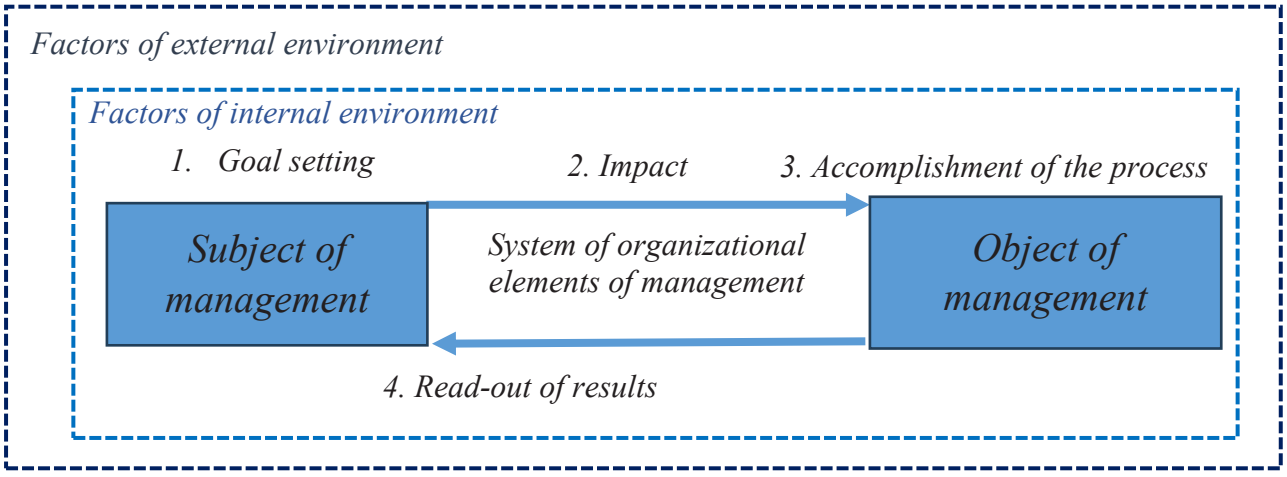

Fig 1. **The author's interpretation of the general concept of management**

Source: compiled by the authors.

Table 1

USSR: Influence of scientific and technological development on the progress of scientific organization of labor

State Leaders Historical milestones [2]	Key Events in the Field of Scientific and Technological Development	Highlights of Scientific Organization of Labour
Vladimir I. Ulyanov (Lenin) (1917–1924) 7 years Foundation of scientific organization of labor [4]	Decree on "Regulations of inventions"[a] [3]	Freedom of technical creativity announced
	Decree on "Electrification of the R.S.F.S.R (GOELRO Plan)"[b]	Electric power industry is launched to lay the foundation for the economy
	Establishment of the Central Institute of Labor	Scientific, social engineering and research institutes were created
	1st and 2nd Conferences on Scientific Organization of Labour[c]	General concepts, definitions and tasks in the field of scientific labor
Iosif V. Dzhugashvili (Stalin) (1924–1953) 29 years The period of industrialization [2]	1st and 3rd Five-Year Plans for the socio-economic development of the State (1928–1942)[d]	Growing productivity, mashrooming factories. Education and patriotism propagated.
	Political repressions. Scientific Organization of Labour shut down. (1936–1938)[c]	Shift towards administrative-command management, development of planned economy. Political propaganda strategy.
	World War II (1939–1945) The Great Patriotic War (1941–1945)	The surge of productivity due to increased output, reduced stoppages, and overtime work
	Rapid expansion of military-industrial complex (1942–1944) [5]	The USSR surpassed Germany in the average annual production of military equipment and weapons
	4th –5th Five-Year Plans for national socio-economic development (1946–1955)[d, e]	Revival of economy. Growing nuclear potential
Nikita S. Khrushchev (1954–1964) 10 years Scientific and technological development	6th –7th Five-Year Plans for national socio-economic development (1956–1965)[d, e]	The first in history launch of a satellite and a flight into space. Development of electric power industry: commissioning the world's first nuclear power plant in Obninsk
	Foundation of infrastructure for the development of high-quality education, science, production [2]	Mshrooming educational and scientific centers to lay foundation for scientific and technological progress
Leonid Brezhnev (1964–1982) 18 years Inertial development	8th Five-Year Plan for national socio-economic development (1966–1970)[d, e] [8]	Launch of the first Soviet moon-rover
	9th Five-Year Plan for national socio-economic development (1971–1975)[d, e] [9]	Mechanization and automation of labor. Growing share of raw materials in economy (oil and gas)
	Commissioning electric power facilities	Escalation of electrification

Table 1 (continued)

State Leaders Historical milestones [2]	Key Events in the Field of Scientific and Technological Development	Highlights of Scientific Organization of Labour
Yury Andropov (1982–1984) 2 years Strengthening of law and order	10th Five-Year Plan for national socio-economic development (1976–1985) [d,e] [10, 11]	Building of networks of hydroelectric power stations, factories, railways (Baikal-Amur Railroad)
		Anti-Corruption policy, strengthening labor discipline
Mikhail Gorbachev (1985–1991). 6 years Perestroika	12th-13th Five-Year Plans for national socio-economic development (1986–1995) [d,e] were not fulfilled due to the launch of "perestroika of economic system" [1, 12]	Collapse of the USSR, change of the socio-economic paradigm: the formation of a market economy is generated

Source: compiled by the authors.

Notes: a — Decree of the Council of People's Commissars of the RSFSR of 30.06.1919 "On inventions (Regulations)". URL: https://istmat.org/node/38265?ysclid=lzcg916fjq749274310 (accessed on 04.02.2024);

b — Decree of the Council of People's Commissars of the RSFSR dated 06.07.1921 "On the management of public electric power stations of the RSFSR approved the GOELRO plan developed in 1920 (State Plan for the Electrification of Soviet Russia)". URL: https://istmat.org/node/46277?ysclid=lzcgc65gin927151257 accessed on 04.02.2024);

c — 100 years of the GOELRO plan. Kommersant. URL: https://www.kommersant.ru/doc/4626294?ysclid=lsoaq3mjxd792527994 (accessed on 15.02.2024);

d — The Federal portal of the history of Russia. Five-Year Plans (introduction of five-year plans for the development of the national economy). URL: https://histrf.ru/read/articles/piatilietki-vviedieniie-piatilietnikh-planov-razvitiia-narodnogho-khoziaistva-event; Thirteen times five. From the history of the Soviet Five-Year Plans. URL: https://histrf.ru/read/articles/trinadtsat-raz-po-piat-iz-istorii-sovietskikh-piatilietok (accessed on 31.01.2024),

e — Five-year plans. The Great Russian Encyclopedia. URL: https://bigenc.ru/c/piatiletnie-plany-10bb59?ysclid=lzig5asex0290622305 (accessed on 30.01.2024).

professional communities, as well as the region of presence and the state, as a whole, through creative activities.

Since the 2000s, the vector of Russia's development has been aimed at restoring national scientific and technological spheres by means of borrowing foreign practices, integrating into the global scientific-educational space, production and technological chains.[1,2]

Starting from 2016, Russia entered the current reality of the 4th Industrial Revolution (industry 4.0),[3] within which it faces transformation of the global paradigm with deployment of robotics in

[1] Resolution of the Government of the Russian Federation of 20.05.2023 No. 1315-r "On approval of the concept of technological development for the period up to 2030". URL: https://www.garant.ru/products/ipo/prime/doc/406831204/?ysclid=lzcgxiqt8n295796765

[2] Critical technologies provide current solutions to solve the most important production problems in the creation of high-tech products (in the field of microelectronics, machine tool building, bioengineering, materials processing and others). Cross-cutting technologies are considered to be promising technologies of inter-industry significance that determine the future potential in the economy and individual industries in the medium span of time (artificial intelligence technologies, new materials, quantum computing and communications, energy storage, communication systems and space systems).

[3] Industrial revolutions (new industries) represent a transformational change in the global paradigm via the introduction of technological innovations and make an impact on a significant increase in productivity. To date, three industries, so to say, passed the no-return point and have become obsolete: water-and-steam-energy-powered mechanization of production (employed since 1784), the emergence of assembly lines and the establishment of electrification (since 1856), automation of production using electronics, the development of computers and the Internet (since the 1960s). The current industry is called 4.0 and at present, there are forecasts that the humanity enters the phase of industry 5.0 in the near future [6].

production, implementation and rapid development of machine intelligence. The 2020 pandemic triggered the applied use of digital technologies: remote employment with personal computers, online platforms, contactless interaction services. It is predicted, that society will enter the period of the 5th Industrial Revolution (industry 5.0) to pass potentially the point of singularity, after which there will be a rapid and uncontrolled penetration of artificial intelligence technologies in all spheres of socio-economic activity. Geopolitical situation determines the speed and volume of implementation of the critical mass of developments in the field of technological innovations, which are in line with such trends as digitalization, energy efficiency and decarbonization [7].

Currently, the management conditions of economic entities are characterized by a high uncertainty of the external environment and a shortage of available resources. At the same time, the priority of Russian national socio-economic development is aimed to ensure technological sovereignty for sustainable development during the period of deglobalization and transformation of the global paradigm [7]. The solution to such critical problem deals with the achievement of certain indicators, which determine the level of progress in the field of three interrelated target benchmarks,[4] namely:

[4] Resolution of the Government of the Russian Federation of 20.05.2023 No. 1315-r "On approval of the concept of technological development for the period up to 2030".

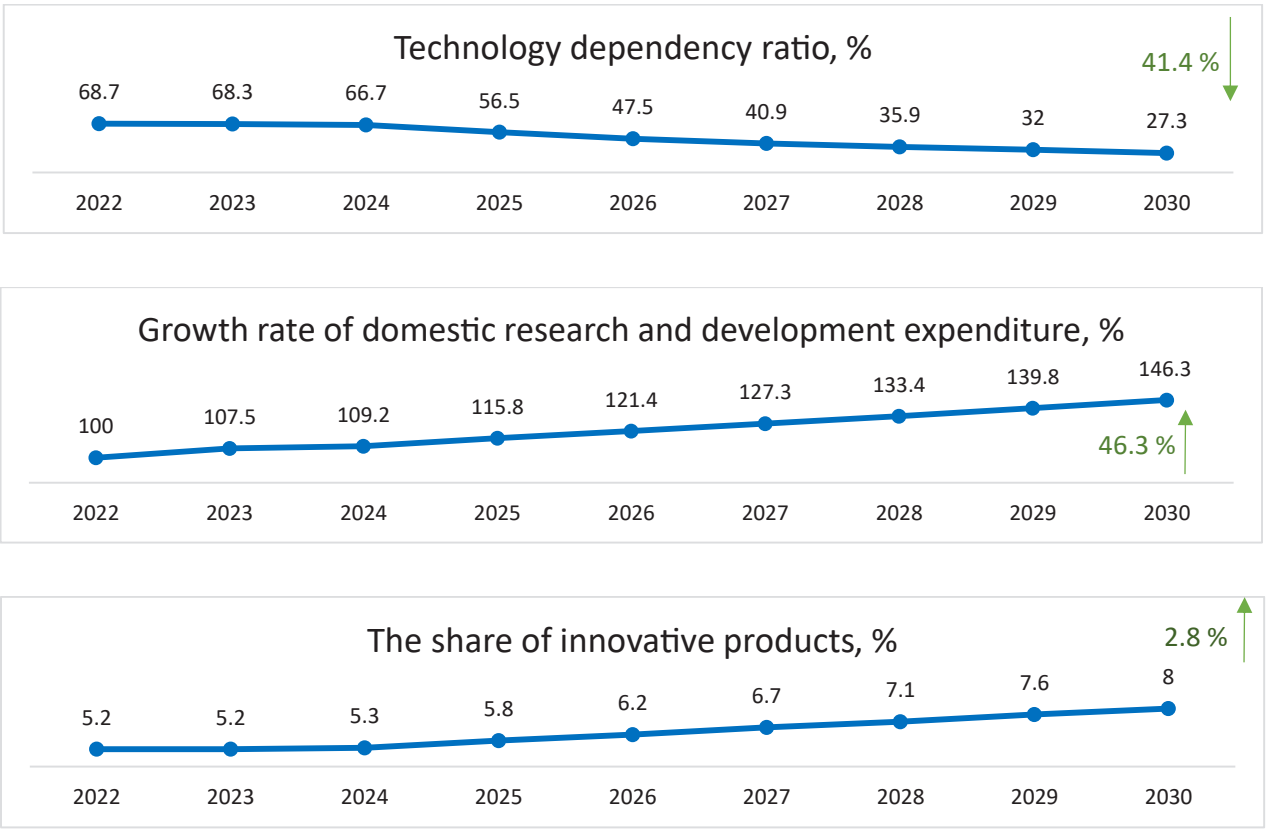

Fig. 2. **Forecast of the dynamics of key indicators of technological independence of the Russian Federation in terms of technology reproduction**

Source: compiled by the authors according to the Decree of the Government of the Russian Federation dated 20.05.2023 No. 1315-d "On approval of the concept of technological development for the period up to 2030". URL: https://www.garant.ru/products/ipo/prime/doc/40683 1204/?ysclid=lzcgxiqt8n295796765 /

1. Reproduction of critical and cross-cutting technologies[5] taking into consideration of the possibility of forming a mutually beneficial partnership with friendly states. *Fig. 2* shows the forecast of the dynamics of key indicators defining the target benchmark. Analysis of the presented data allows us to conclude, that the condition to achieve technological sovereignty requires, and first of all, a decrease in technological dependence of Russia by increasing expenditures of economic entities to run research and development of innovative products.

2. Growth of investment and innovation activity of organizations. Investment and innovation activity are perceived, as a system of targeted actions to provide economic entities with highly effective technologies, advanced equipment, new scientific and practical knowledge using investment resources. *Fig. 3* indicates the forecast of dynamics of key indicators characterizing this

URL: https://www.garant.ru/products/ipo/prime/doc/406831204/?ysclid=lzcgxiqt8n295796765

[5] Critical technologies provide for the current solution to the most important production problems in the creation of high-tech products (in the field of microelectronics, machine tool building, bioengineering, materials processing and others). Cross-cutting technologies are considered to be promising technologies of inter-industry significance that determine the future potential in the economy and individual industries in the medium span of time (artificial intelligence technologies, new materials, quantum computing and communications, energy storage, communication systems and space systems).

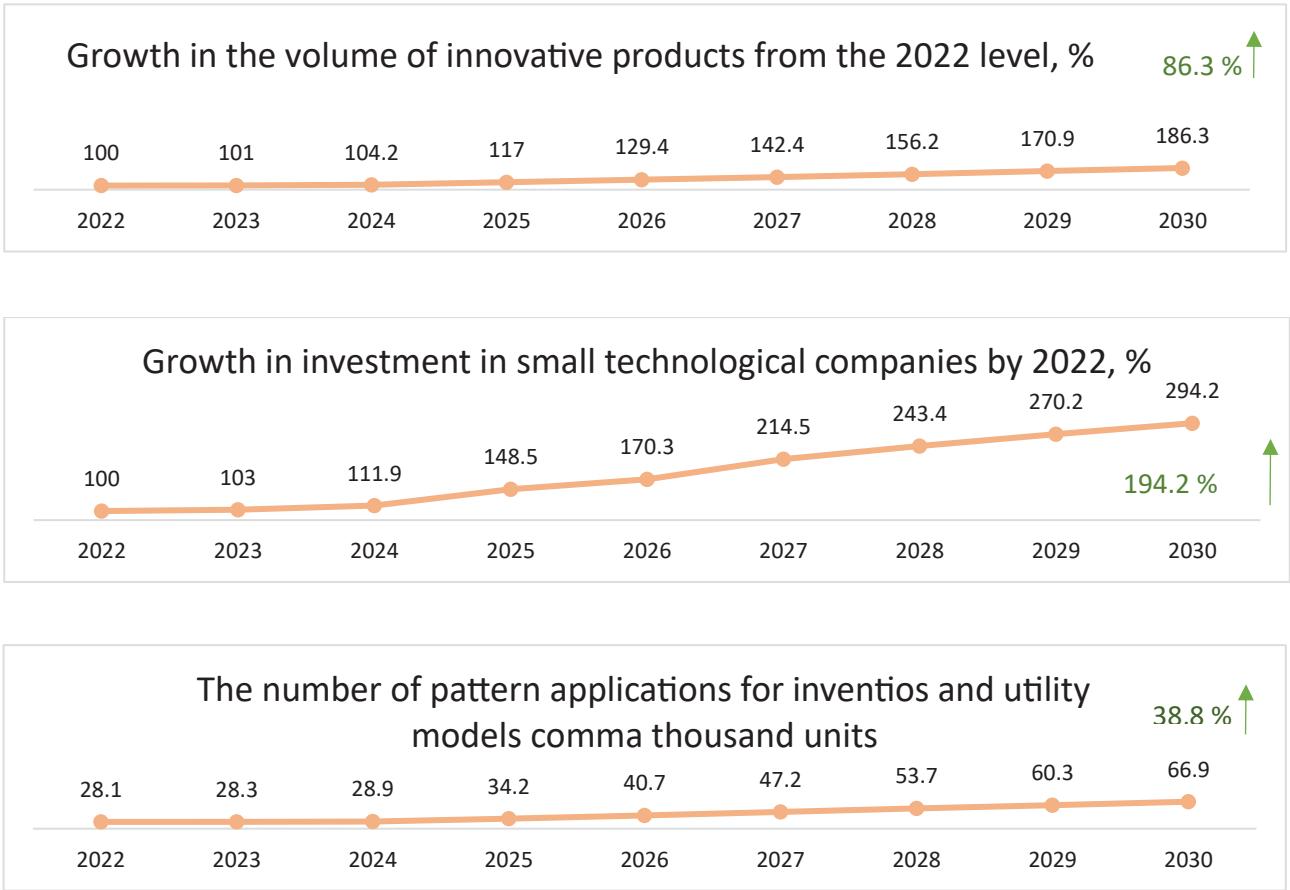

Fig. 3. **Forecast of the dynamics of key indicators of technological independence of the Russian Federation in terms of investment and innovation activities**

Source: compiled by the authors according to the Decree of the Government of the Russian Federation dated 20.05.2023 No. 1315-d "On approval of the concept of technological development for the period up to 2030". URL: https://www.garant.ru/products/ipo/prime/doc/40683 1204/?ysclid=lzcgxiqt8n295796765/

Fig. 4. **Forecast of the Dynamics of key indicators of technological independence of the Russian Federation in terms of formation of infrastructural conditions**

Source: compiled by the authors according to the Decree of the Government of the Russian Federation dated 20.05.2023 No. 1315-d "On approval of the concept of technological development for the period up to 2030". URL: https://www.garant.ru/products/ipo/prime/doc/40683 1204/?ysclid=lzcgxiqt8n295796765/

target benchmark. Analysis of their values shows that the basis of technological sovereignty is a significant increase in the volume of innovative products, which is achieved by increasing the volume of investments in small technological organizations. At the same time, domestic innovative tehnologies are subject to patenting.

3. Modernisation of production assets to form a quality infrastructure for research and development of innovative technologies. *Fig. 4* presents a forecast of the dynamics of key indicators characterising the third target benchmark. The analysis of their values indicates a tendency to increase of domestic technological innovations in all sectors of the economy in the domestic and international markets

RESULTS

On the basis of our research we have worked out a conceptual approach of sustainable development of economic entities in the era of current (4.0) and prospective (5.0) industries, taking into consideration the trends of deglobalisation, high uncertainty and turbulence of the global paradigm, including the following directions (*Fig. 5*).

Fig. 5. **Directions of sustainable development of economic entities**

Source: compiled by the authors.

1. The first direction: ***Strategic Management for Sustainable Development*** is based on the scheme of development strategy adaptive to potential short and long-term changes in the external and internal environment of the research object, such as:

• Analysis of markers and trends of objective and prospective reality.

• Conducting expert strategic sessions with the use of foresight modelling method.[6]

• Organisational design and modification of organisational elements aimed to increase the systemic value of manufactured products along with creation of development strategies for some of them and formation of product portfolios.

• Preventive monitoring of values of strategic performance indicators. To develop the strategy, it is necessary to define dynamic panels of significant indicators in the activity.

• Updating the development strategy in functional areas of activity and all hierarchical levels of management of the object of research (participation of experts is required).

2. The second direction: ***Deployment of clusters in all sectors of the national economy to revive technological sovereignty.***

Within the frameworks of clusters, it is possible to recreate complete production chains of in-demand final products within the state borders. This direction contributes to development of import

[6] Foresight modelling (from English term foresight) — it is a technology to building a concept of development of the research object, a set of measurable long-term goals and ways to achieve them, which is provided by an expert method through the team work [9].

substitution. The implementation of the cluster approach can lay the foundation for more active investments and innovation activities for the regional economy. In such event, it is necessary to develop a system of integrated management of the latter[7] on the scale of industry clusters, which is due to the need for effective coordinated use and development of the potential of the involved entities [10].

The structure of such investment and innovation cluster should include advanced research centers, which are capable to carry out the volume of work dealing with implementation of investment and innovation projects, as well as effectively interact with production companies, which definitely ensure implementation of their innovation priorities [11].

[7] Investment and innovation activities within the framework of an industry cluster presuppose a system of targeted actions to provide regional industry entities with innovative and effective technologies ("production secrets", machines and equipment, devices, tools and accessories, scientific and practical competencies) using investment resources.

3. The third direction: ***Intensification of investment and innovation activities for development, application and commercialization of innovative technologies,*** which allows to ensure a progressive development of economic entities on the life cycle curve of the organization via the implementation of investment and innovation policies in terms of development, application and commercialization of technologies (*Fig. 6*).

In this case, objects of implementation are the following: technological solutions (production secret know-how), generated and upgraded means of production (equipment, machines, tools, devices), information technology (software products, achievements in the field of artificial intelligence), theoretical and practical competencies (in the field of training and consulting programmes), new technologies from the external environment (based on the results of their study, research and adaptation).

We have identified alternative sources of innovative technologies of commercial potential in the internal and external environment of organisations (*Fig. 7*).

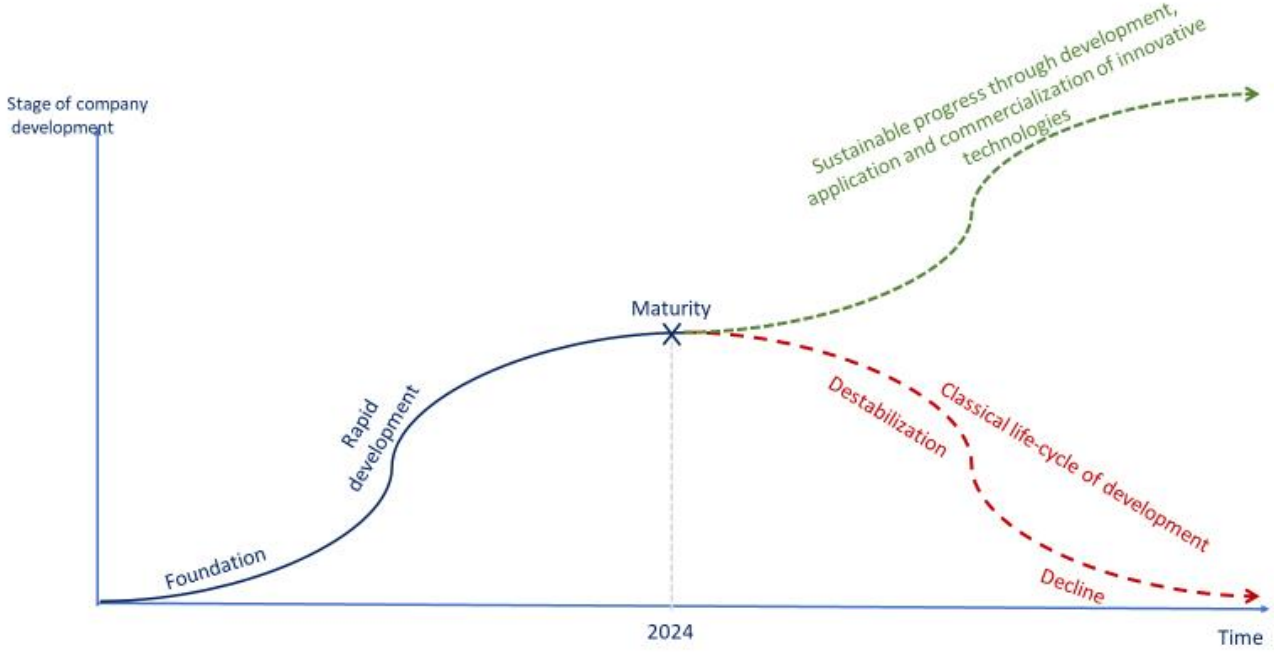

Fig. 6. **Development of economic entities through the implementation of investment and innovation policy**

Source: compiled by the authors.

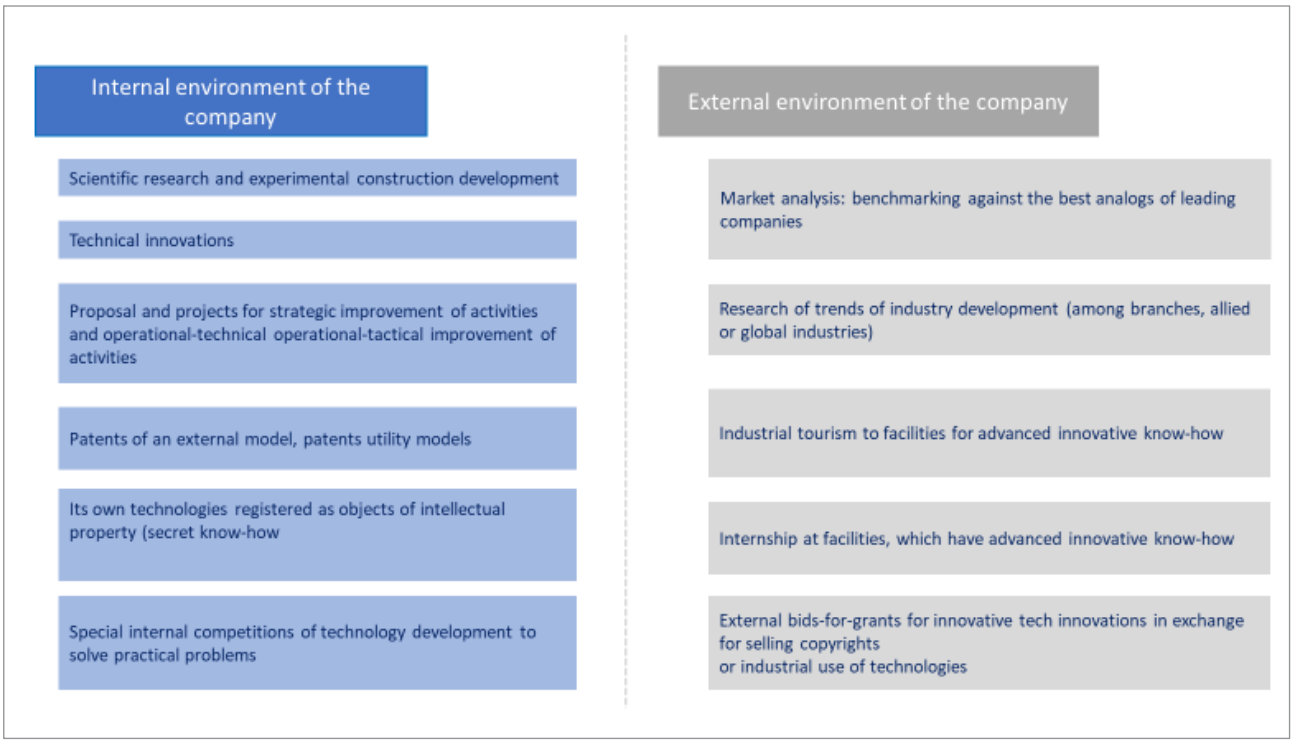

Fig. 7. **Sources of innovative technologies**

Source: compiled by the authors.

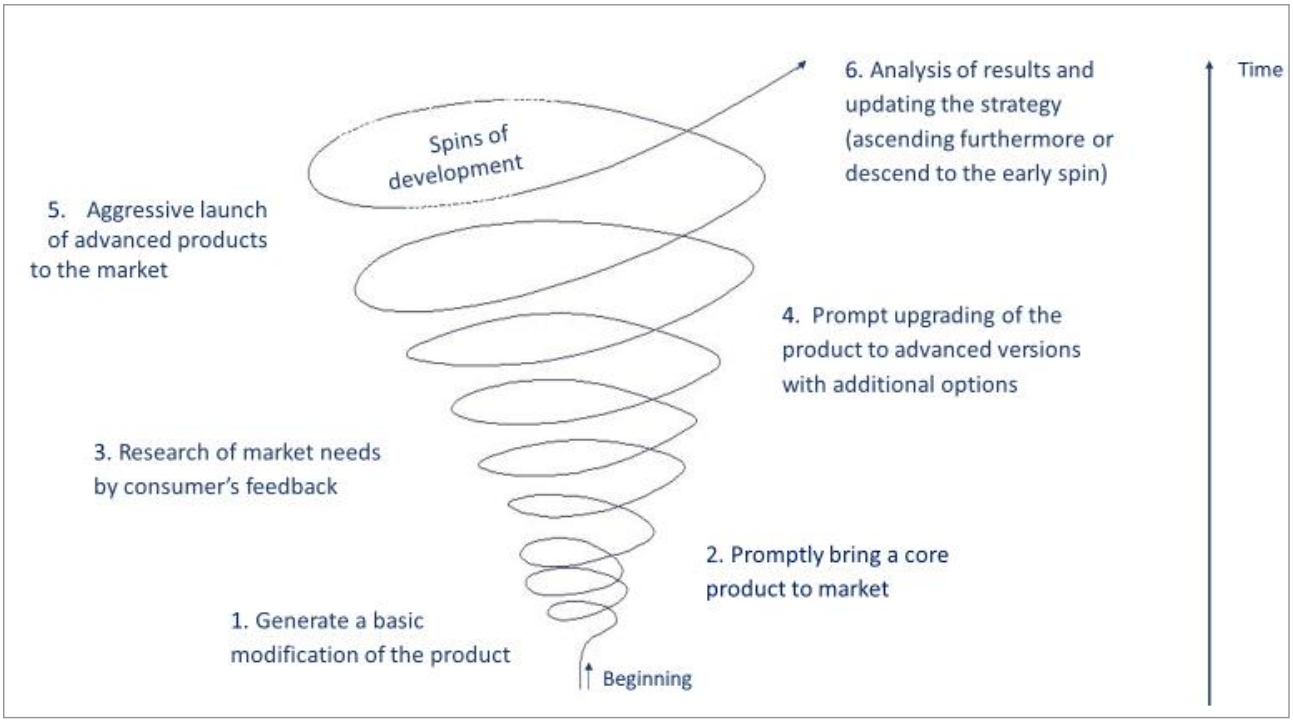

Fig. 8. **Principles of commercializing innovation technology**

Source: compiled by the authors based on [12].

Fig. 8 presents the following key principles: generating and commercial use of innovative technologies (products) — see the diagram of the ascending spiral of development accordance with the approach of researcher E. Ries.

We have conducted a comparative analysis of alternative options of employment labor factors of production in the process of development of innovative technologies (*Table 2*), which may be in demand primarily in the course of implementing innovations and investment activities in large corporations of vertically integrated structures.

The key areas of implementation of investment and innovation policy are the following:

- technological knowledge (secret production know-how);
- developed and upgraded means of production (equipment, machines, tools);
- information technologies (software products, developments in the field of artificial intelligence);
- theoretical and practical competencies (training programs, consulting);
- new technologies from the external environment (based on the results of study, research and adaptation).

These directions provide the following opportunities: competitive advantages by means of use of advanced technologies, additional profit via their

Table 2

Comparative analysis of alternative options for development and commercialising innovative technologies

Options	In-house structures of the company			Outsider or outsource company
	Company of strict hierarchy	"Freedom islands" [12]	Integrated structure	
Description	A functional unit is set up in the company to manage the entire lifecycle from development to commercialization of startup	Project-based temporary activities for specific startups, with experts and units of the company	A structural unit is set up in the company to launch, keep records of startups with experts from other divisions	A subsidiary daughter company or independent legal entity provides the opportunity to implement new types of activities, operates with high efficiency of decision-making, mobility of activities, less control from supervisory authorities. At the same time, it is necessary to verify the source of financing, means of investment of innovative activities to work out aspects of legal and financial interaction with such company.
Good option: reason	Formalized functionality, predictable result, direct controllability	High quality of specialized knowledge	Combines advantages and eliminates disadvantages of a tough hierarchy with "Freedom Islands"	
Bad option: reason	Limited competence in the field of specialized issues	No direct levers of control in a bureaucratic organization, reduction of quality due to distraction to the main type of activity	Risks of leakage of sensitive information must be curbed and eliminated in advance, which is of the potential benefit for the company and system of incentives for experts must be defined	

Source: compiled by the authors.

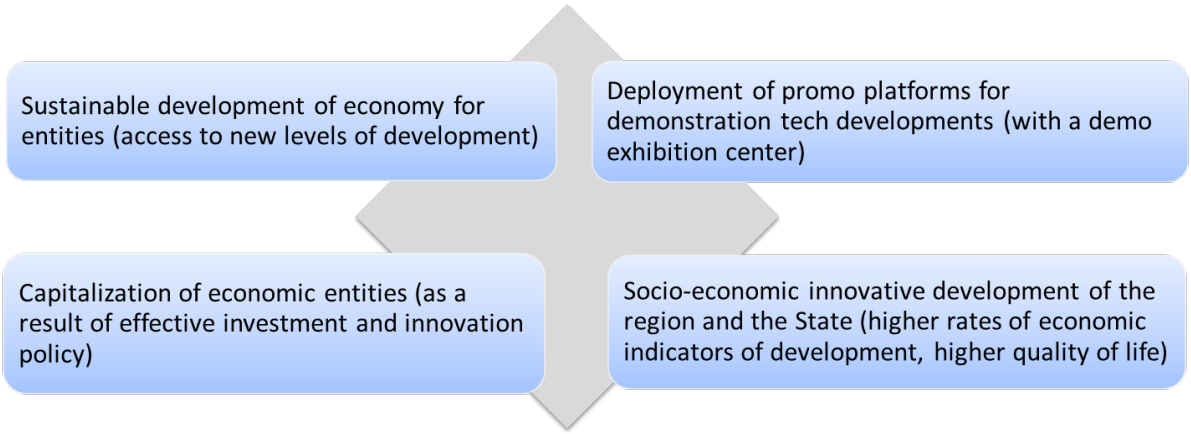

Fig. 9. **Prospective results of the development of innovative technologies**

Source: compiled by the authors.

commercialization and strengthening technological sovereignty of the State. Prospective results of such enterprises ensure development through the implementation of investment and innovation policy in the field of innovative technologies, as it is presented in *Fig. 9*.

4. The fourth direction: ***Differentiated scientific approach towards the management activities of economic entities*** (depending on the type of management object) — is characterised by variability and includes the following methods or types of approaches:

- system approach analyses managing formation and implementation of development strategy (with the foresight modeling method to balance the factor of high uncertainty and variability of the external environment);
- contingency approach analyses management with tactical plans of measures within the framework of projects for sustainable development;
- process approach of management for economic entities in implementation of production processes is based on technologies to ensure a sustainable state and development to balance the factor of limited resources.

5. The fifth direction: ***Introduction elements of lean production (taking into account specific features of economic entities) as a modern formalized technology of scientific management organization.*** Lean production in modern Russia is a highly effective concept, that combines scientific technologies for research and analysis of business processes in the organization. It also has a set of practical tools to improve its activities (taking into account the requirements of minimizing non-production losses, maximizing product values and increasing the degree of customer focus through the disclosure and use of the potential of production factors) [7] (*Fig. 10*).

As a result, organizational elements are redesigned in view of both the provision of maximum value, or utility of the process from the point of view of consumer to consumers of the process) within the framework of operations eliminated which consume enterprise resources, but do not add value from the customer's point of view. A system of interaction between the same-type productions entities must be developed for optimization of changes in production processes.

In this case, it is necessary to take into account specific features of the organization's activities (which are characterized by the presence of a single center and management model). The key features are the following:

- organization and management structure;
- type of production processes and type of manufactured products (services rendered and work performed);
- level of specialization and consistency of processes;
- geographic location of the organization.

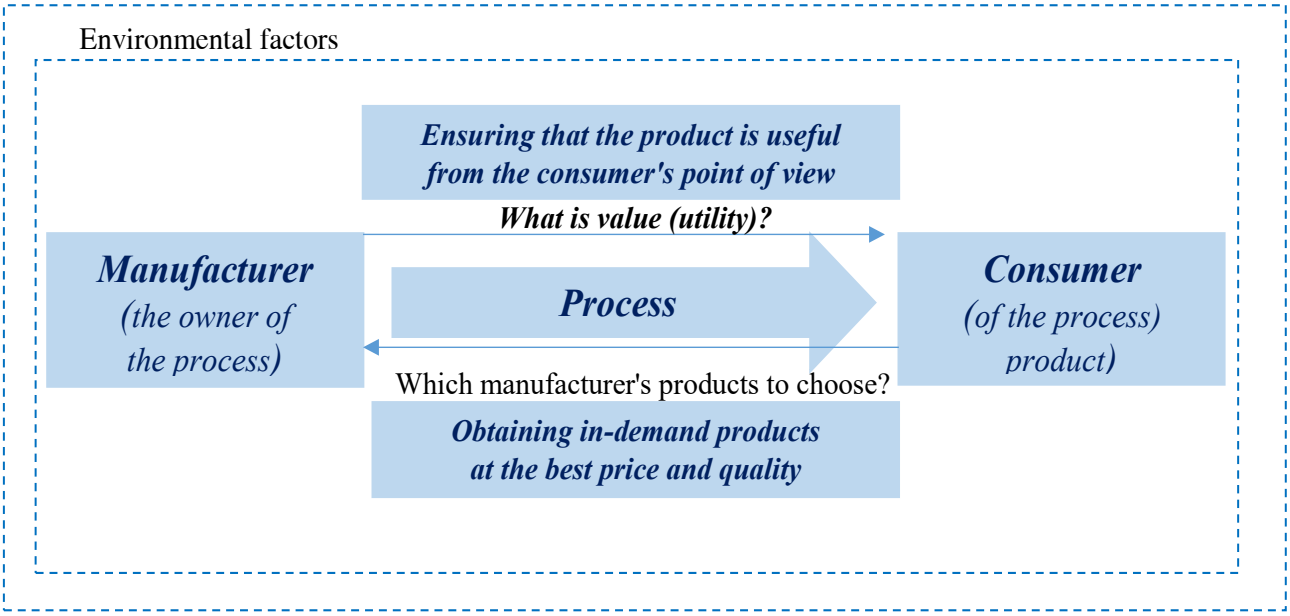

Fig. 10. **View on implementation of production processes via aspects of lean production**

Source: compiled by the authors.

6. The sixth direction: **Development of social capital in order to ensure effective economic entities by increasing the level of effectiveness in the use of production factors**.

The possibility of prospective sustainable long-term development of any considered business entity is conditioned by an effective use of production factors. At the same time, the key indicator of the enterprise's ability to effectively expand its business is the availability of high-quality human resources with a single system of values and the way of thinking, which means, that employees perform their professional duties to work as productively as possible to achieve their goals.

The main task of a manager at any level of management is to activate labor resources through the correct use of human potential and its development. To achieve this result, it is necessary to run a continuous educational process of the economically progressive-minded population with all-round knowledge elaborated from pedagogy, andragogy and neuropsychology etc. within the framework of uniform national high-value guidelines [8].

7. The seventh direction: **Managing the development by means of intensification of technological development and implementation.** Economic entities operate in extremely unpredictable times in the face of uncertainty about the future and worldwide transformations of the global paradigm. At the same time, digital technologies are rapidly developing everywhere. During the Coronavirus pandemic (specifically, starting from 2020), the global population started a widespread transition to remote work, as well as massive development of online platforms and contactless services for interaction between consumers and contractors. Currently, there appeared a critical mass of technological innovations based on digitalization. High-quality implementation of this area implies the need to create mechanisms for protection against attendant cyber threats in all areas of socio-economic activity.

CONCLUSIONS

Based on the abovementioned, one can come to the conclusion, that in order to ensure sustainable development, it is advisable for economic entities to use the concept of scientific management of

sustainable development proposed by the authors of the study, namely, in the following way:

- elaborate an adaptive strategy for sustainable development;
- intensify investment and innovation activity regarding formation, application and commercialization of innovative technologies;
- use modern high-efficiency technologies (including cluster policy, elements of scientific management, lean production) to improve the efficiency of introduction of existing production factors, as well as to ensure scientific and technological independence;
- provide continuous training, education and development of high-quality labor resources;
- ensure safe application of technologies in the era of industries 4.0 and 5.0.

It is necessary to take into account the feasibility of modifications, as well as boundaries and areas for application of the elements of scientific management concept for sustainable development of economic entities regarding the types of production, their geographic location, specific features of internal organizational elements and the impact of environmental factors.

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ABOUT THE AUTHORS

Alsu R. Akhmetshina — Dr. Sci. (Econ.), Professor, Director of the Institute of Management, Economics and Finance, Director of the Higher School of Business, Kazan (Volga Region) Federal University, Kazan, Russia
https://orcid.org/0000-0001-8317-6500
Alsu.Akhmetshina@kpfu.ru

Anastasia V. Abramova — Cand. Sci. (Econ.), leading specialist of the department of organization and development of lean production Management of JSC, "Grid company", Kazan, Russia; Associate Professor, Department of Enterprise Economics, Institute of Management, Economics and Finance, Kazan (Volga Region) Federal University, Kazan, Russia
https://orcid.org/0009-0005-5300-4130
Corresponding author:
abramova19191@rambler.ru

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