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# Information and Service Support of the Mechanism of Industry Functioning in the Single Digital Space

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## ABSTRACT

The functioning of industry in the context of the creation and development of a single digital space of the Russian economy requires the development of an appropriate mechanism, in which information and service support for the digitalization of business processes of industrial enterprises should play a key role. The purpose of this study is to build a model of the mechanism for the functioning of an industrial enterprise in a single digital space (hereinafter referred to as the SDS) as well as to characterize the information and service support for the control and governing functions of this mechanism. The categorical apparatus of the digital economy and digital technologies, methods of classification, comparative analysis, functional and systemic approaches were used as the methodological basis of the study. The results of the work were the construction of a conceptual model of the mechanism of functioning of an industrial enterprise in a single digital space, based on the principle of optimality and capable of adapting to the needs of a particular industrial enterprise, as well as the identification of the basic functions of the management activity of an industrial enterprise in the single digital space, and the characteristics of the information and service support mechanism, which is digital services (technologies) that ensure management activities and interaction of actors of the business ecosystem in the single digital space. The conclusions drawn from the results of the study can be applied in practice by the management of companies when developing their own mechanism and strategy for digitalizing business processes in order to increase the efficiency of functioning in the single digital space industry.

***Keywords:*** single digital space; industrial enterprise; functioning mechanism; information and service provision and support

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## INTRODUCTION

The digital transformation taking place in the world is leading to major changes in the economy and society. A new round of technological progress continues to widen the gap between different states, changing economic, technological, and social models of decision-making and behaviour. The Ministry of Industry and Trade has initiated the 4.0 RU project, which demonstrates a long-term benchmark for the formation of a single digital space for the digital coordination of industrial enterprises. The implementation of this project involves the use of an ecosystem approach (including digital ecosystems), the theoretical and practical aspects of which are disclosed in the works of [1–6]. In addition, the effectiveness of digital transformation of industry largely depends on the development of digital platforms, which is the subject of publications [7–8], as well as on the corresponding state support — its features are reflected in the studies[1] [9–10]. At the same time, at the level of specific enterprises it is necessary to create a mechanism for their functioning in a single digital space using a systematic approach and the principles of improving the efficiency of complex systems, as well as managerial mechanisms to ensure a technological breakthrough, described in the works of [11–14].

The basis for building a single digital space is the comprehensive introduction of digital technologies at all stages and levels of industrial production. The formation of such cyber-physical environment provides an opportunity to reduce the time to bring new products to the market; to increase the degree of production flexibility, product quality, efficiency of production processes, and ultimately — to bring the country's industry to a fundamentally new level. Various types of digital services are considered by the authors of [15, 16]. According to the estimates of Allied Market Research, by 2030 the size of global investments in digital technologies may reach USD $ 698.48 billion.[2]

The purpose of this study is to create a model of the mechanism of functioning of an industrial enterprise in single digital space, the key component of which is information and service support of the control functions of this mechanism.

The information base of the study includes: regulatory legal acts that reveal the understanding of the essence of digital technologies, single digital space industry, the mechanism of functioning of industrial enterprises in single digital space; works of Russian and domestic researchers on the subject of the article; thematic publications in the media; statistical data from open sources.

## RESEARCH METHODOLOGY

The following methods were used in the course of the work: analysis of regulatory and legal documents in the field of digitalisation of the economy and industry in Russia, methods of empirical research (observation, comparison, data collection and study), comparative analysis, synthesis of theoretical and practical materials, modelling and methods of business process management, system, and functional approaches.

Modern trends and requirements for the digitalisation of industry, single digital space, information, and service support of the mechanism of functioning of industrial enterprises are defined in accordance with such regulatory and legal documents as:

[1] Digital Ecosystems in Russia: Evolution, Typology, Approaches to Regulation. E.T. Gaidar IEP (official site). URL: Issledovanie_jekosistem_Otchet.pdf (accessed on 26.04.2024).

[2] Allied Market Research. URL: https://www.alliedmarketresearch.com/investment-banking-market-A06710

President's Address to the Federal Assembly on 29.02.2024.[3]

Order of the Government of the Russian Federation No. 1632-o dated 28.07.2017 "On Approval of the Digital Economy of the Russian Federation Programme'.[4]

GOST R 57700.37–2021 National Standard of the Russian Federation. Computer models and modelling. Digital twins of products. General provisions.[5]

Order of the Ministry of Industry and Trade of Russia No. 2091 dated 23.06.2016 "On Approval of the Concept of Development of the State Information System of Industry'.[6]

Methodological recommendations for digital transformation of state corporations and companies with state participation.[7]

To visualise the scientific results, the graphical and tabular form of information presentation was used.

## RESULTS

### Model of the mechanism of functioning of an industrial enterprise in a single digital space

The mechanism of industry functioning in a single digital space is still poorly studied, insignificantly reflected in the scientific literature and has not yet had a sufficiently developed practical implementation.

At the same time, there are various approaches to the interpretation of the management mechanism of systems. The most commonly used is the functional approach, which is based on the general idea of their work as a managed process of achieving some set of target functions (strategic, tactical and operational levels) on the basis of assessing the compliance of the obtained results with the specified efficiency criteria (target parameters of functioning) [11].

For business ecosystems of industrial enterprises (as the main form of industry functioning in a single digital space), a set of target functions lies in the digital transformation of business processes and digital interaction with actors. This implies such management of resources (potential), which would ensure the achievement of the results of the enterprise's activities in the digital environment, as outlined by the management at the micro level, and at the macro level — the goals of industrial development in single digital space (effects) declared by the state in strategic documents. Goals and objectives are detailed by subsystems corresponding to the basic functions of mechanism management (planning, organisation, motivation, control, coordination) and/or specific functions of production activity, for each of which criteria and performance indicators are established.

When choosing the latter, the principle of optimality, which exists in two forms, is most often used: 1) the principle of maximising the effect with given resources; 2) the principle of saving resources while necessarily achieving a given effect [12]. In general, there are three types of efficiency criteria that exhaustively characterise the quality of mechanism functioning in the course of achieving the main objectives of the business ecosystem:

1) results, which allow assessing the mechanism's ability to fulfil the set tasks

[3] President's Address to the Federal Assembly 29.02.2024. URL: http://www.kremlin.ru/events/president/transcripts/messages/73585 (accessed on 25.06.2024).

[4] Order of the Government of the Russian Federation No. 1632-o dated 28.07.2017 "On Approval of the Programme "Digital Economy of the Russian Federation". URL: http://static.government.ru/media/files/9gFM4FHj4PsB 79I5v7yLVuPgu4bvR 7M0.pdf (accessed on 21.06.2024).

[5] GOST R 57700.37–2021 National Standard of the Russian Federation. Computer models and modelling. Digital twins of products. General provisions. URL: https://docs.cntd.ru/document/1200180928 (accessed on 23.03.2024).

[6] Order of the Ministry of Industry and Trade of Russia No. 2091 dated 23.06.2016 (ed. 12.08.2021) "On Approval of the Concept of Development of the State Information System of Industry'. URL: https://base.garant.ru/71721830/ (accessed on 15.06.2024).

[7] Methodological recommendations on the digital transformation of state corporations and companies with state participation. URL: https://digital.gov.ru/ru/documents/7342/ (accessed on 10.06.2024).

by measuring the degree of compliance of the achieved results with the planned ones (*efficiency*);

2) economic, which is used to assess the degree of achievability of given performance indicators (effects) given the available resources by measuring the ratio between the cost of effects and resources (*resource intensity*);

3) temporal, which makes it possible to determine the speed of fulfilment of the set task by assessing the probability of meeting certain (directive, planned, technical) deadlines (*promptness*).

As a result, according to the authors, the mechanism of functioning of the business-ecosystem of industry on the basis of the principle of optimality should implement the strategy of results management and represent an interrelated set of social and personnel, organisational and production, financial and economic and information-service components of the potential of industry, as well as methods and tools of its embodiment to achieve the goals and objectives of intraproduction and ecosystem interaction of all participants and stakeholders in a single digital space.

The main actors in this case are industrial enterprises. The conceptual model of the mechanism of their functioning in a single digital space is presented in *Fig. 1*.

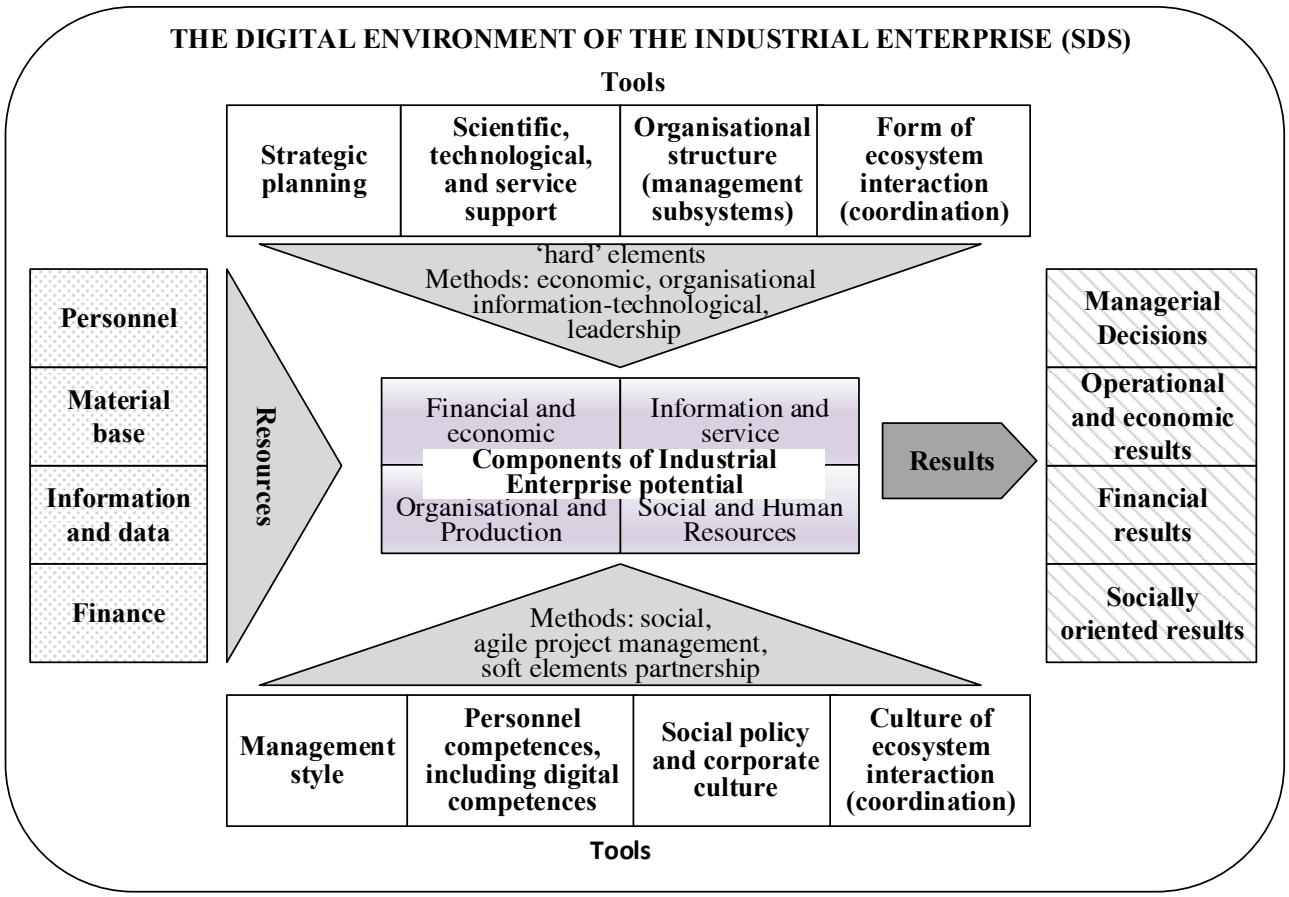


*Fig. 1.* **The conceptual model of the mechanism of functioning of an industrial enterprise in the ecosystem of a single digital space (SDS)**

*Source:* compiled by the authors.

It includes the elements identified at the first stage of the R&D work that constitute the ecosystem basis of a single digital space: strategic goal-setting (at the level of the state, industry and individual enterprise); financing; human capital; science, technology and digital services; material infrastructure; entrepreneurial culture; communications, including in the digital environment.

Only optimal interaction of all components of the potential of an industrial enterprise and tools for their realisation will activate the mechanism of its functioning in single digital space. Potential represents the created conditions (opportunities) capable of ensuring maximum performance of an industrial enterprise in a single digital space in accordance with managerial decisions relevant to the set tasks. As for the methods and tools, they are the means of realising the available opportunities, which can have a "hard' or "soft' character, determined by direct or indirect influence on the achievement of the set tasks in ecosystem interaction with other industrial enterprises and authorities of regional and federal levels.

The presented conceptual model can be extended to the mechanism of a holistic ecosystem of single digital space industry, taking into account the adaptation to the industry specifics of resources and applied tools; at the same time, the organisational structure will be transformed into an institutional one, and the potential and results of functioning will represent a synergetic set of opportunities and achievements of all actors of ecosystem interaction in single digital space.

Thus, the quintessence of the proposed mechanism is the organisation of managerial decision-making processes in a single digital space, which has a significant impact on the achievement of expedient and purposeful functioning of all elements and parts of the business ecosystem of industry. At the same time, the mechanism should:

1) adequately respond to environmental impacts, including those of a negative nature (operational and tactical management tasks);

2) objectively assess the effectiveness of management processes based on selected criteria of efficiency of the entire business ecosystem and its elements (control tasks);

3) ensure the availability of the required volume and quality of resource provision (planning tasks);

4) reflect quantitative (measurable) and qualitative parameters of functioning (accounting tasks);

5) plan on the basis of identified trends and regularities of the business ecosystem functioning (tasks of forecasting and strategic goal-setting).

The universality of the proposed mechanism lies in the fact that, if necessary, it can be adjusted to the industry specifics of the industrial enterprise, the form of coordination within the business ecosystem, as well as the chosen competitive strategy of its development [13].

The development of this mechanism is conditioned by the improvement of all its structural elements, including tools and methods. In particular, information and technological methods involve the introduction of new digital technologies, automated and robotic equipment, up-to-date technical standards and procedures, the latest results of research and development, as well as management decision-making in all areas of the business ecosystem. Agile management methods do not focus on rigidly defined work processes, but on high-level values of interaction, depending on the situation in the team and the relationship with the customer and aimed at the final result.

However, it is obvious that without the development of various components of the potential it is impossible to obtain qualitative results in a given timeframe, despite

the most modern management methods and tools.

Financial and economic potential provides financing, economic planning and forecasting of the industrial enterprise functioning processes (joint projects in the business ecosystem), material stimulation and encouragement of employees.

Organisational and production potential determines the material and technical, organisational, and structural support of production processes of each industrial enterprise and their coordination interaction in the business ecosystem.

Social and human resources potential determines the quality and sufficiency of labour resources of industrial enterprises, the level of their professionalism, emotional satisfaction, moral motivation and readiness to perform their production functions.

In the context of our research, it is necessary to emphasise the information and service potential (provision) of the mechanism under consideration. This is the least studied component of the potential, and it has, however, significant importance both for its development and for the organic implementation of the developed concept of single digital space of industry as a whole, since this concept is based on the business ecosystem, including a set of own or partner services used in the process of interaction between industrial enterprises and providing them with competitive advantages.

Under information and service support (ISS) we will understand an interrelated set of information resources and tools that allow an industrial enterprise (an actor of the business ecosystem) to perform the functions of supporting production and management activities in the single digital space of industry.

Instrumental means are broadly understood as hardware and software. The former includes means of computing and communication technology, including wireless communication channels, and the latter includes system and application software products that allow solving problems in a given subject area. Thus, all kinds of information systems, databases, hardware and software complexes, telecommunication, and computer technologies, etc. are considered as tools. It is important to understand that information carriers and devices for its storage, transmission and processing can be both material and virtual, but, of course, to function in a single digital space, first of all, digital solutions and virtual environment are required. In other words, in further consideration of service support, the emphasis will be placed on modern software of the digital economy, i.e., digital services (digital technologies).

## ANALYSIS OF INFORMATION AND SERVICE SUPPORT FOR INDUSTRY OPERATING IN A SINGLE DIGITAL SPACE

For a comprehensive disclosure of this type of provision it is necessary to define:

1) types of information resources used in the functioning of industry in single digital space;

2) basic functions of management activity, the digitalisation of which increases the efficiency of an industrial enterprise in a single digital space;

3) digital services (technologies) that ensure management activity and interaction of business ecosystem actors in a single digital space.

Let us explore each of these points in more detail.

1. All types of information resources and data used in the functioning of industry in a single digital space can be traditionally divided into external and internal, which will be relevant both for an individual actor and for the entire business ecosystem (*Fig. 2*).

| | |
|---|---|
| External information and data | Macroeconomic and sectoral information, official statistics |
| | Scientific and technical information |
| | Legal information and information of state structures |
| | Thematic information (data on geological exploration, meteorology, etc.). |
| | Financial and market information (stock exchange, competitors, etc.). |
| | Other external information and data from open sources and online resources. |
| Internal information and data | Reporting and current documentation |
| | Fonds of production literature, archive funds |
| | Data from hardware devices and sensors (internet things) |
| | Databases of structured and unstructured data (Big Date) |
| | Internal local normative acts, standards, instructions, regulations, methods, etc. |
| | Other internal information and data, including personal data |

*Fig. 2.* **External and internal information resources of the business ecosystem in the SDS**

*Source:* compiled by the authors.

Information and data can be of time-preserved value (as an archive) or a source for management decision-making, which in a single digital space requires the use of various digital services, as well as technologies for their acquisition, processing and transmission, examples of which will be given below.

It should be noted that for a business ecosystem operating in a single digital space, new principles of information and data management apply, which determine the requirements for the functionality of modern software based on digital technologies. It is assumed that information and data initially have a digital form or can be transformed into it (using digitisation) (*Fig. 3*).

2. The basic functions of management activity, the digitalisation of which increases the efficiency of an industrial enterprise in a single digital space, can be classified on various grounds. Taking into account the proposed model of the mechanism of functioning of an industrial enterprise, it seems most appropriate to single out the functions of resource, process and result management (*Fig. 4*).

It is allowed to expand them in each group depending on the detail or industry specification of resource, process or resultant components of the enterprise functioning. In particular, if necessary, management of auxiliary processes (infrastructure maintenance, technical support) can be singled out or industry specifics can be taken into account — for example, the process of metalworking management in machine building is selected.

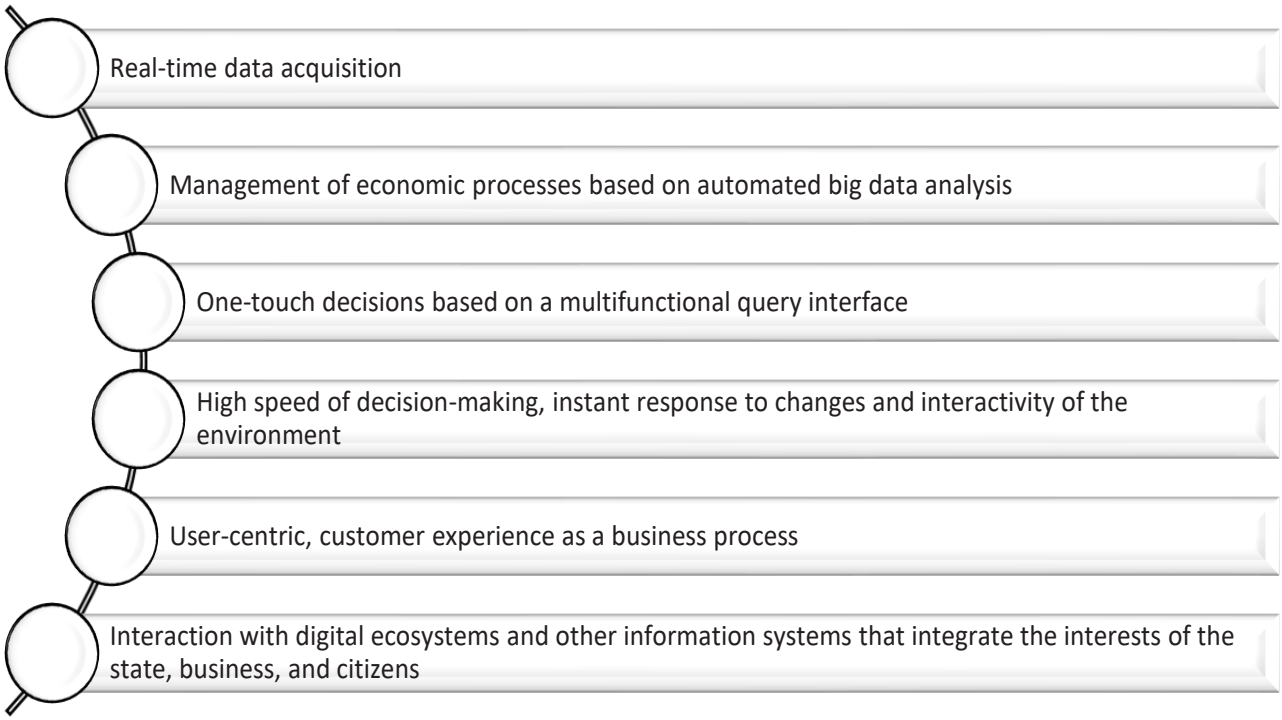


*Fig. 3.* **Principles of information and data management based on digital technologies**

*Source:* compiled by the authors.

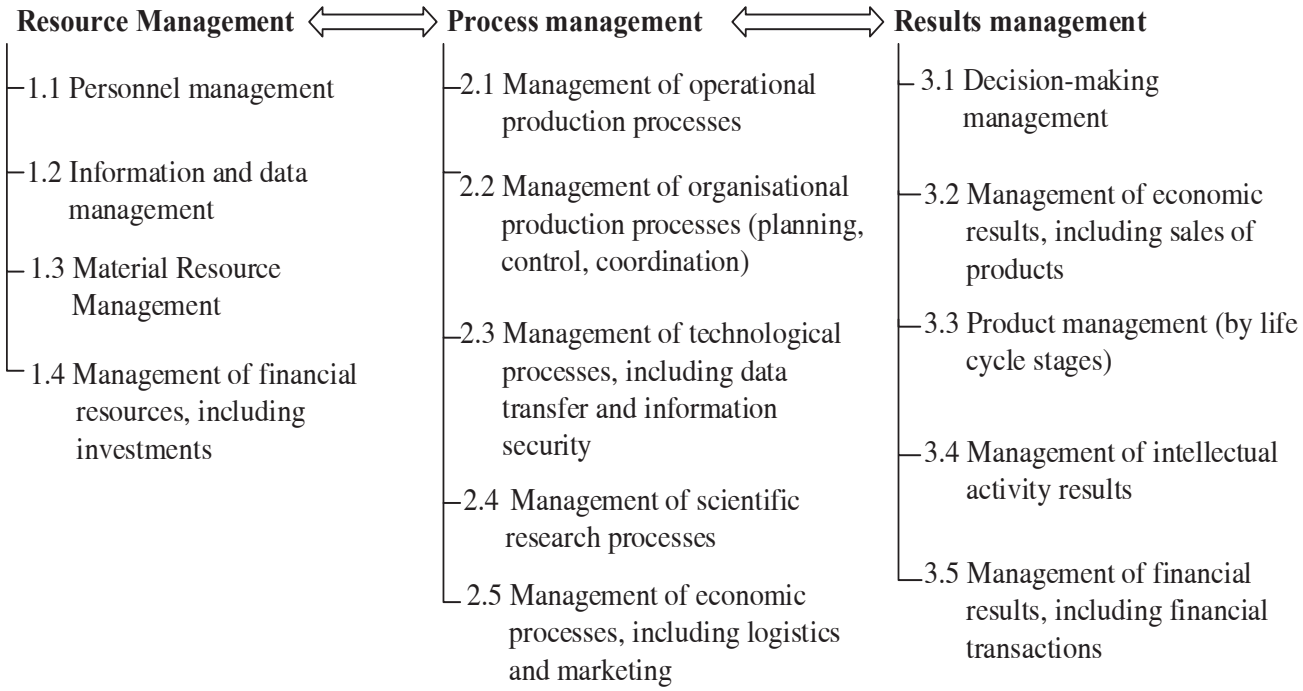


*Fig. 4.* **Management functions of an industrial enterprise**

*Source:* compiled by the authors.

It should also be noted that functions in a business ecosystem may be spatially dispersed across different actors, which requires additional special software tools for effective spatial data management, in particular, spatial databases.

Existing digital services (technologies) can provide automated support for each management function or combination of functions. Depending on target settings, specific ecosystem objectives, needs and financial capabilities, actors make decisions on the development, purchase, or partner access to service software of different levels of complexity — from simple databases to complex digital platforms that automate all the main management functions of a business ecosystem. Let us consider the latter in more detail from the point of view of their use for the realisation of the highlighted management functions.

3. Digital services (technologies) that ensure managerial activity and interaction of business ecosystem actors in a single digital space.

The most relevant of them, most often used in industry, are presented in the *Table*, and the numbers of managerial functions that these digital services allow to realise, taking into account their inherent advantages and disadvantages, are presented in *Fig. 4*.

Historically, DBMS (data base management system) and ACS (Automatic Control Systems) are considered to be the first digital services that implement management functions, which in various modifications are still used by many domestic enterprises; however, modern digital technologies are significantly expanding the capabilities of these electronic systems to the level of platform solutions and ecosystem communications. Cloud technologies, digital platforms and operational digital twins play a special role in this. According to Tadviser, the volume of the cloud services market will reach RUB 140 billion in 2025 and (according to surveys) 85% of Russian companies plan to use cloud technologies.[8] Interest in the development of domestic digital platform solutions in industry is also growing. In particular, Rostech State Corporation's Techmash Concern plans to launch a digital industrial design platform based on Russian software by 2025, which will cover the entire product development process — from the development of a prototype of a promising product to its launch into production.[9] As for digital twins, from 1 January 2022, Russia (for the first time in the world practice) applies the national standard "Computer models and modelling. Digital twins of products'.[10] At the same time, digital twins that can reproduce a business process or the work of the entire enterprise (business ecosystem) are essential for improving the mechanism of functioning of an industrial enterprise in a single digital space. Thus, the main trend of information and service support of industrial enterprise activity is the aggregation of traditional and new digital services (technologies) capabilities for the implementation of management functions; and in the conditions of geographically separated actors and geographically dispersed resources of the business ecosystem, spatial databases (SDB), which can become a universal tool for organising business processes and functioning of the entire industry in a single digital space, are of particular importance.

[8] Cloud services (the Russian market). Tadviser. URL: https://www.tadviser.ru/index.php/

[9] Rostech creates a Russian digital platform for industrial design. Rostech (official website). URL: https://rostec.ru/media/pressrelease/rostekh-sozdaet-rossiyskuyu-tsifrovuyu-platformu-dlya-promyshlennogo-proektirovaniya/ (accessed on 23.03.2024).

[10] GOST R 57700.37–2021 National Standard of the Russian Federation "Computer models and modelling. Digital twins of products'. URL: https://docs.cntd.ru/document/1200180928 (accessed on 23.03.2024).

*Table*

**The relationship between digital services (technologies) and management functions implemented with their application**

| Digital service (technology) | Functional | Types/Tools, examples | Advantages and disadvantages of implementing management functions |
|---|---|---|---|
| Cloud technologies (cloud computing) | Enabling remote users to process data and IT infrastructure as an Internet service | Types: PaaS — ready-made software platform as a service; SaaS — software as a service; IaaS — infrastructure as a service (data storage, server, network resources); BPaaS — business process as a service; DBaaS — database as a service; SECaaS — security as a service, etc. Examples of cloud providers ProCloud, Softline, Timeweb Cloud[a] | Functions: 1.2, 2.3, 2.4, 2.5. Advantages: availability; cost-effective, large computing power, flexibility, security. Disadvantages: Requires uninterrupted and high-speed internet access; dependence on ISP; risks of losing control of data |
| Artificial Intelligence (AI) and Big Data (BD) | Intellectual support of decision-making, including on the basis of methods of processing large arrays of heterogeneous and poorly structured data | AI tools: neural networks; image and speech recognition; machine learning; genetic algorithms; data visualisation, etc. Examples of AI programmes: Rationale; Taskade; GitHub [15]. Big Data tools: Data Mining; predictive analytics; simulation modelling; spatial and statistical analysis, etc. Examples: Apache Hadoop; Apache Spark; NoSQL; SAP HANA | Functions: 1.2, 2.2, 2.4, 3.1; 3.3; 3.4. Advantages: Automation, transparency and speed of decision-making; reduced probability of errors in device interaction. Disadvantages: interoperability, information security and data protection vulnerabilities; ethical concerns |
| Distributed computation | Partitioning a large computational task into subtasks that can be processed independently by individual nodes in the network | Tools: cluster computing; parallel computing; distributed ledger systems (blockchain); distributed storage applications (BitTorrent; IPFS); deep neural network training applications (TensorFlow CNTK); data ecosystems in value chains (Automotive Network e.V. Catena-X)[b] | Functions: 1.2, 1.4, 2.3, 3.1, 3.2, 3.5. Advantages: Improved performance, high scalability; fault tolerance; flexibility; cost-effective. Disadvantages: startup costs; compatibility; high power costs; network vulnerability; data consistency issues across nodes |
| Internet of Things (IoT) | Interaction of physical objects among themselves or with the external environment by reading data from sensors of devices, their subsequent transmission and processing for decision making | Examples of tools: Arduino IDE — electronic devices and related software; Kinoma — hardware and programmable device for IoT prototyping; Apache NetBeans — IoT application development platform; MQTT — messaging protocol in IoT; Wireshark — network traffic analyser[c] etc. | Functions: 1.2, 2.1, 2.3, 2.4, 3.2, 3.3. Advantages: automation of processes, reduction of labour costs; reduction of waste, improvement of service quality, cheaper production, and logistics. Disadvantages: poor data security; incompatibility of software from different manufacturers |

*Table (continued)*

| Digital service (technology) | Functional | Types/Tools, examples | Advantages and disadvantages of implementing management functions |
|---|---|---|---|
| Digital platforms | Provide integration of data and digital services (technologies) into a unified information system to enhance analytical capabilities, create more value, including by ensuring synergy in the business ecosystem | Examples of industrial DP: FLCS DP (Full life cycle system for digital enterprise products) — a Russian platform for creation and management of product lifecycle, enterprise, and production management[d]<br>Zyfra Industrial Internet of Things Platform (ZIIoT) — a platform for automation of business processes of production management, which includes a ready-made set of solutions and a built-in development environment for solving local tasks by the enterprise;<br>GE, Siemens, etc.<br>Examples of other DPs:<br>Infrastructure: General Electric Predix, ERA-GLONASS;<br>Instrumental: Java, SAP HANA, Bitrix;<br>Service-application: electronic banking (Tinkoff); online trading (R Trader), etc. | Functions: 1.1–1.3, 2.1–2.5; 3.1–3.4.<br>Advantages:<br>speed and efficiency of transactions, reduction of transaction costs; optimisation of business processes; supported "smart manufacturing'; interoperability; system integration; information security; synergy of interactions; expansion of the product sales market.<br>Disadvantages:<br>high cost of in-house development; labour-intensive customisation of DP for specific business processes; risks of failures in digital services; reduction in the number of jobs |
| Digital twins and virtual / augmented reality technologies (VR/AR) | Possibilities of building digital models of objects, systems, processes for diagnostics, design, modernisation, forecasting, simulation, including on the basis of VR/AR technologies | Types of digital twins:<br>informational — tracks parameters, e.g., equipment in real time;<br>simulation — creates operating conditions and predicts properties, behaviour in different situations;<br>operational — simulates the entire business process or operation of the entire system.<br>VR/AR technology tools:<br>VR/AR content development tools, motion capture, graphic design, sensorics, 3D models, etc. | Functions: 2.1–2.4, 3.1–3.3.<br>Advantages: productivity growth; control and transparency of production processes; preliminary hypothesis testing in a virtual environment; optimisation based on data analysis; speed and validity of decision making.<br>Disadvantages: incomplete coincidence with physical reality, difficulty in combining, analysing, and processing heterogeneous data |
| Additive technologies[e] | Manufacturing prototypes and finished products using 3D printing | Types of technologies: FDM — layer-by-layer build-up from plastic filament;<br>SLM — selective laser fusion of metal powders; SLS — selective laser sintering of polymer powders; SLA — laser stereolithography in photopolymer processing | Functions: 1.3, 3.1–3.3.<br>Advantages: accelerating the creation of new products and prototypes, reducing material consumption and minimising waste; high-precision creation of parts with complex geometry.<br>Disadvantages: high labour intensity; significant equipment costs; limited printing materials |

*Table (continued)*

| Digital service (technology) | Functional | Types/Tools, examples | Advantages and disadvantages of implementing management functions |
|---|---|---|---|
| Robotics (RT) and Sensorics | Automation of production and other systems using robots with sensor technology | Tools: digital RT tools for human-machine interaction; tools for sensor-motor coordination and spatial positioning; telemetry and telecontrol; tools for integrating and synchronising heterogeneous sensor data | Functions: 1.3, 2.1, 2.3, 3.3<br>Advantages: Routine, dirty, hazardous work, as well as those requiring high precision and repeatability.<br>Disadvantages: Increased maintenance and repair costs, higher energy consumption, higher costs of regular renewal, reduced number of jobs |
| Database management systems (DBMS) | Storage and management of data tables based on inbuilt data processing tools and a special query language (SQL, JavaScript, Python etc.) | DBMS types with examples:<br>1) local (on one server) and distributed (on different servers, including cloud servers);<br>2) relational (data tables are linked — PostgreSQL, MySQL); object (MongoDB); non-relational (data can be unstructured — (Oracle NoSQL Database); value-key (access to identified data by key — Redis, Memcached), etc. | Functions: 1.1–1.4, 2.1, 2.3–2.5, 3.2–3.5.<br>Advantages: Routine, dirty, hazardous jobs and those requiring high precision and repeatability.<br>Disadvantages: Increased maintenance and repair costs, higher energy consumption, higher costs of regular renewal, reduced number of jobs |
| Automated control systems (ACS) | Solving tasks of planning and management of various types of resources and activities of the enterprise on the basis of a set of software and hardware, information and linguistic, organisational and technological means and actions of qualified personnel | Types of ACS: ACSE — ACS of the enterprise, including production and sales of products (ERP, CRM-systems); ACS TP — ACS of technological process, equipment (MES-systems); CADS — computer-aided design system; AIPCS — automated information processing and control system (SCADA, ETL, BI), etc. | Functions: 1.1–1.4, 2.1–2.3, 2.5, 3.2–3.5.<br>Advantages: Routine, dirty, hazardous work, as well as those requiring high precision and repeatability.<br>Disadvantages: Increased maintenance and repair costs, increased energy consumption, increased costs of regular upgrades, reduced number of jobs |

*Source:* compiled by the authors.

*Note:* a — ProCloud is the best cloud provider: the ranking has been announced. TADVISER. URL: https://www.tadviser.ru/index.php/Новости: ProCloud_стал_лучшим_облачным_провайдером:_обнародован_рейтинг (accessed on 21.03.2024); b — Blockchain. TADVISER. 15.06.2022. URL: https://clck.ru/3F9oBS (accessed on 21.03.2023); c — Top 10 IoT Tools to Consider in 2024. URL: https://www.geeksforgeeks.org/top-iot-tools; d — What is SPWC. URL: https://цифровоепредприятие.рф/about-sprgc/ (accessed on 22.03.2024); e — Additive technologies — what they are and where they are applied. URL: https://old.sk.ru/news/b/press/archive/2019/09/18/additivnye-tehnologii-_1320_-chto-eto-takoe-i-gde-primenyayutsya.aspx (accessed on 22.03.2024).

## CONCLUSIONS

The conducted research allows us to draw the following conclusions:

1. The considered mechanism of functioning of the business-ecosystem of industry is based on the fundamental provisions of the concept of a single digital space, is oriented on the strategy of results management in a single digital space and represents an interrelated set of organisational and production, financial and economic, information and service and social and human resources components of the potential of industry, as well as methods and tools of its implementation to achieve the goals and objectives of intra-production and ecosystem interaction of all participants (actors) and stakeholders within various forms of coordination (clusters, supply chains, consortia, industrial platforms).

2. The information and service support of the mechanism is proposed to be understood as an interrelated set of information resources and tools that allow the actors of the business ecosystem to perform the functions of managing resources, processes, and results in a single digital space on the basis of the identified principles of information and data management using digital technologies. The industrial enterprise's choice of information and service support for the mechanism of its functioning in single digital space should be carried out depending on the realised management functions (*Fig. 4*) and the advantages and disadvantages of the main types of existing digital services that support these functions (*see Table*) within the mechanism.

The obtained results and conclusions of the scientific research can be used by the management of industrial enterprises in developing (on the basis of the proposed model of the mechanism of functioning in a single digital space and characteristics of digital services to support management functions) their own strategies for managing the digitalisation of business processes, taking into account industry specifics.

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