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STUDY OF THE FEATURES OF THE IMPLEMENTATION OF DIGITAL ECOSYSTEMS BY FOREIGN INDUSTRIAL ENTERPRISES: THE EXPERIENCE OF THE RUSSIAN FEDERATION

The article the definition of «digital ecosystem» is reviewed and various features of its application in the industrial production sector are examined on the basis of the study of Russian industrial enterprises; the main scientific research related to the study of the features of the implementation of digital ecosystems, their role and significance for industrial enterprises has been structured; the design and elements of these ecosystems were also investigated, an assessment of the current state of digitalization of production processes at enterprises was carried out, as well as the benefits of their use in the production. The purpose of the article is to study digital ecosystems adapted to the tasks of industrial enterprises. The research demonstrates that the use of digital ecosystems creates new potential for enhancing an industrial enterprise's productivity and competitiveness. State initiatives to create digital ecosystems ensure the interaction of Russian companies with its partners and suppliers; based on the analyzed sources, successful examples of the implementation of digital ecosystems in the operations of Russian Federation industrial companies are considered.

Keywords: ecosystem, digital ecosystem, digital platform, business processes, digital transformation, components of digital ecosystems, digital economy, industrial enterprises, complex integrated industrial structures, industrial production.

Кілт сөздер: экожүйе, сандық экожүйе, сандық платформа, бизнес-процестер, сандық трансформация, сандық экожүйенің құрамдас бөліктері, цифрлық экономика, өнеркәсіптік кәсіпорындар, кешенді біріктірілген өнеркәсіп құрылымдары, өнеркәсіптік өндіріс.

Ключевые слова: экосистема, цифровая экосистема, цифровая платформа, бизнес-процессы, цифровая трансформация, компоненты цифровых экосистем, цифровая экономика, промышленные предприятия, сложные интегрированные промышленные структуры, промышленное производство.

JEL classification: O14

Introduction. Modern working conditions of production activities in a rapidly changing environment require from industrial companies to be highly adaptable. Industrial businesses are compelled to collaborate with stakeholders based on their shared interests, making the development of an ecosystem essential and necessary. The formation of an ecosystem of industrial companies is aimed at finding the best ways to create value.

The article aims to study the main aspects of the implementation of digital ecosystems by industrial enterprises of the Russian Federation.

The following tasks are identified: exploring the core of the idea of digital ecosystems while analyzing the contemporary scientists' research works; considering the key elements and crucial ecosystem levels of digital ecosystems of industrial companies; identifying the benefits and effects of the use of digital ecosystems in manufacturing enterprises.

The working hypothesis of the study is the assumption that there is an interest of the scientific community, government agencies, and management of Russian industrial enterprises in the nature and positive impacts of digital ecosystems, as well as in figuring out their economic expediency to forge a solid digital relationship, access to current innovations and quick transformation of entire sectors.

American scholar James Moore in his Harvard Business Review article titled «Predators and prey: a new ecology of competition» first presented the idea of an ecosystem in the context of economics [1]. He defines a business ecosystem as an economic community of interconnected businesses and people that manufactures goods and services that are extremely useful to consumers who are also the participants of the ecosystem. Suppliers, manufacturers, competitors, and other stakeholders that make up the ecosystem

follow the directions of the leading companies. The function of ecosystem leader is the most important and drives the ecosystem community towards shared visions, getting a return on investment, and achieving a mutually supportive role.

In the article «Platforms and Ecosystems: Enabling the Digital Economy» written by Michael G. Jacobides, digital ecosystems are characterized as interconnected entities with a modular architecture that are not governed by hierarchical structures [2].

Professor of Harvard Business School, Marco Iansiti with scientist and inventor, Roy Levien in their joint publication «Strategy as Ecology» describe business ecosystems as a free network of technology providers, distributors, manufacturers of products and services, and other organizations that have an influence on the design of their own offering [3].

According to the analysts of Gartner company, when a transition takes place from a traditional value chain to fast and wide-ranging networks, digital ecosystems are the upcoming phase of growth in the digitalization of company processes [4].

Expanding market segments that use ecosystems comprise financial services, manufacturing, trade, supply and logistics.

Literature Review. Numerous scholars have studied the formation and evolution of ecosystems in various industries. For example, Subramaniam M., Iyer B., Venkatraman V. in their publication «Competing in digital ecosystems» distinguish between productive digital ecosystems, which include the production, sale of a product and provision of a service to a customer, and consuming ecosystems, which evolve through the consumption of the goods sold and services provided [5].

Ecosystems, according to the platform approach, determine how actors organize their activities on digital platforms [6-7]. For instance, Camarinha-Matos L.M. and Afsarmanesh H. in their work «Collaborative networks: Reference Modeling» have defined digital ecosystems as collaborative networks made up of heterogeneous and geographically dispersed entities cooperating via the Internet to achieve common goals.

The ecosystem is seen as the result of a shift in collaboration from traditional participant-to-participant to inter-organizational collaboration.

Participants in the ecosystem can be classified according to the industry, sector or geographical location [8-11]. In particular, Babkin A.V., Fedorov A.A., Liberman I.V., Klachek P.M. in their publication «Industry 5.0: concept, formation and development» substantiate that digital platforms and ecosystems that ensure the interaction between different participants are a new subject of economics and governmental influence.

The principles of business model operation in the context of digitalization, the impact of ecosystem participant cooperation on stimulating innovation in enterprise activities, and potential risks are considered [12-14]. Thus, Balashova E.S., Maiorova K.S. in the article «Analysis of directions digital technologies are introduced into industrial complex» determined that the digital transformation of industrial companies requires a systematic vision of digitalization at the industry level. In this regard, the state industrial policy encourages industrial growth and import-substituting production.

As a result, ecosystems are emerging as a new way of organizing the provision of complementary goods and services to consumers, which are provided by a number of cooperating and competing companies.

The study by Nikitaeva A. Yu., Serdyukov R. D., and Fedosova M. N., titled «Regional drivers of digital ecosystems' development of industrial enterprises», is particularly noteworthy. In this study, industrial enterprises in the South of Russia were analyzed, and their business models were evaluated for compliance with the ecosystem approach. In accordance with the results of the study, the business model of «Rostselmash» Group of Companies meets the requirements of the digital ecosystem.

The «Rostselmash» Group of Companies is successfully expanding its «client ecosystem», thereby increasing the value of the company's goods and services for its clients and strengthening long-term relationships.

Rostselmash Group of Companies employs SAP ERP, SAP CRM, and HRM-system technologies in its operations, and the enterprise's technological and business processes are automated by establishing a single information loop.

According to the conducted research, it is obvious that modern digital ecosystems are becoming an integral and vital part of the business processes of complex integrated structures that influence the life cycle of the company's goods and services [15].

Methods. The following research methods were used in the paper: content analysis to organize and structure the main scientific research related to the formation of digital ecosystems, their role and importance for industrial companies. Throughout the context of this method, the scientific literature issued

in the scientific databases Web of Science, Google Scholars, and RSCI have been studied; method of analysis that enabled to evaluate the level of digitization of business production processes; method of graphic interpretation, which resulted in visualization of the acquired information.

Results. Collaborating organizations in a digital ecosystem are digitally connected and create value for the end consumer, platform owner, and all participants. The platform is the foundation of the ecosystem, where participants develop their products and services. Thereby, the digital ecosystem broadens the concept of the traditional business ecosystem by emphasizing the importance of digital technologies (figure 1).

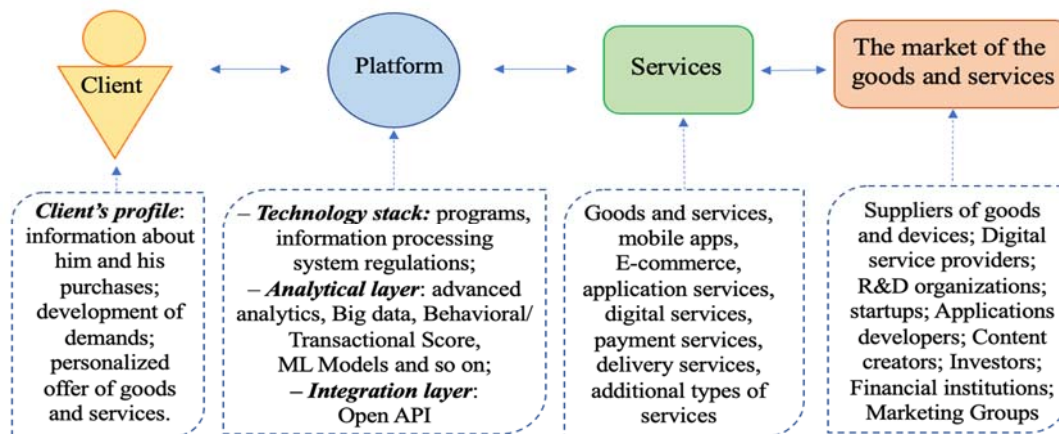


Figure 1. Digital ecosystem's representation*
* Compiled by the authors

According to the research conducted by the international consulting company McKinsey, the ecosystem approach can help businesses generate more revenue, cut operating expenses, and form cost-effective partnerships. Additionally, from a strategic perspective, a partnership like this enables businesses to access innovations provided by digital technologies and the ongoing transformation of industries.

The primary innovator company is the core of the ecosystem, and the other participants sell their products and services by leveraging the ecosystem's opportunities. Apple, Intel, IBM, Nokia, Ford, SAP, and Cisco are examples of successful ecosystem participants.

In accordance with a study carried out by the global consulting firm PricewaterhouseCoopers, there are four crucial ecosystem levels that make up the digital ecosystem (figure 2).

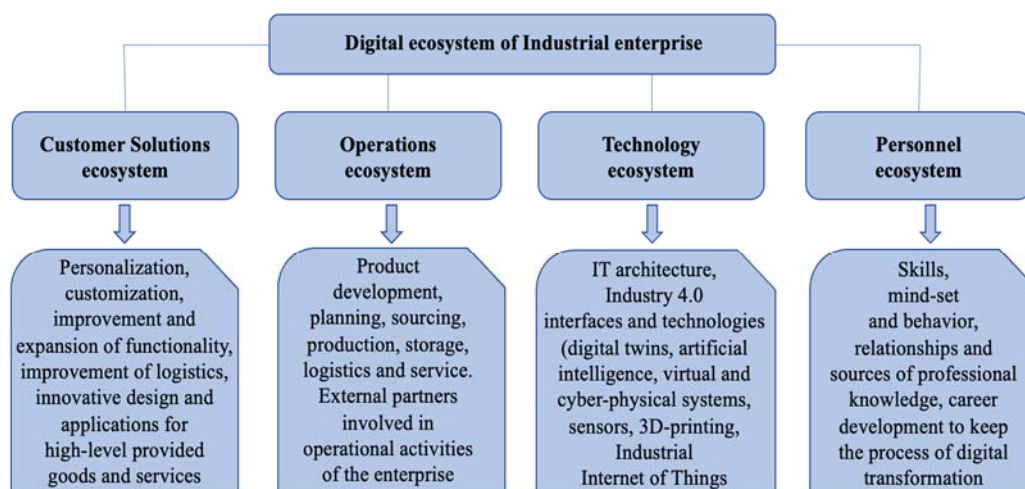


Figure 2. Critical ecosystem levels of digital ecosystem*
* Compiled by the authors

A company's operations ecosystem can be represented by corporate systems, such as ERP and CRM. The technological ecosystem enables improvements to the rest of the ecosystem levels. The HRM system, time tracking systems, biometric systems, and other systems comprise the personnel ecosystem. The recent quick growth and widespread use of digital technologies caused a major impact on significant economic

and social areas. «Industry 4.0» provides the end-to-end digitalization of all physical assets and their integration with other value chain partners into the digital ecosystem. The member companies of the Alliance for Artificial Intelligence in Russia, including PJSC «Sberbank of Russia», LLC «Yandex», Mail.ru Group, PJSC «Gazprom Neft», PJSC «MTS», and Russian Direct Investment Fund (RDIF) are the leaders of Industry 4.0 in the field of artificial intelligence. So, in 2021, Russia ranked 42 out of 64 countries in the World Digital Competitiveness Ranking (60.271 out of 100 points). The United States led the rating, taking first place (100 points) (table 1).

Table 1

Positions of Russia in the Digital Competitiveness Index in 2017-2021years*

Position	2017	2018	2019	2020	2021
Positions of Russia in final ranking:	42	40	38	43	42
Position of Russia in the rating's three subindices:					
Knowledge (personnel, education system and concentration of science)	24	24	22	26	24
Technology (regulatory practice, capital availability and the level of technology)	44	43	43	47	48
Future readiness (adaptability, business flexibility and IT integration)	52	51	42	53	47

* Compiled by the authors¹

It deserves to be noted that several Russian Federation industries, including mining, manufacturing, telecommunications, banking, and education, have a dominant share of digitalization in their respective fields. Russia has some industries that use cutting-edge digital solutions, for example, the use of the Internet, RFID technology and ERP systems in the manufacturing sector. Therefore, in 2021, 90.4% of manufacturing companies had access to broadband Internet, 27.6% of them used cloud services, and 29.6% of all organizations applied ERP systems (table 2).

Table 2

Digitalization of Russian business in 2021*

Business enterprise sector	Business digitalization index	Share of organizations using digital technologies in the total number of organizations, %				
		Broadband internet	Cloud services	ERP-systems	E-commerce	RFID-technologies
Total	32	86.0	29.1	23.3	14.6	8.2
Mining and quarrying	29	82.6	20.7	22.7	8.7	12.2
Manufacturing	36	90.4	27.6	29.6	19.6	12.0
Energy supply	30	87.4	20.9	20.9	13.1	8.7
Water supply, sewerage, waste management	25	78.8	24.1	6.7	10.6	4.3
Construction	25	78.1	22.3	10.9	8.6	6.4
Wholesale and retail trade	39	90.0	37.8	37.5	21.7	.0
Transportation and storage	29	80.8	22.9	20.2	11.7	11.1
Accommodation and catering	34	81.5	35.5	20.9	20.7	11.9
Telecommunications	45	92.0	42.4	46.1	28.1	13.9
IT industry	36	95.7	38.3	23.7	11.4	9.1
Real estate activities	24	78.8	21.7	7.5	7.1	4.1
Professional, scientific and technical activities	27	85.2	24.4	12.1	6.4	4.8
Financial sector	34	93.8	38.5	17.0	13.8	7.6
Education	35	90.3	42.0	13.7	14.6	15.3
Healthcare	30	92.4	34.5	5.6	11.6	4.4

* Compiled by the authors²

¹ World Digital Competitiveness Ranking 2022. – URL: <https://www.imd.org/centers/wcc/world-competitiveness-center/rankings/world-digital-competitiveness-ranking/>

² Digital Economy Indicators in the Russian Federation. – URL: <https://www.hse.ru/en/primarydata/iio>

Overall, Russian businesses intensified the application of digital technologies between 2020 and 2021. For example, the use of cloud services increased by 1.4%, the big data technologies increased by 3.4%, the Internet of things increased by 0.7%, and RFID technologies increased by 1%.

To further digitalize industrial enterprises, in October 2022 Russia launched the digital ecosystem of the national project «Labor Productivity»³. Companies with a turnover of more than 400 million rubles in the trade, construction, agriculture, transportation, and manufacturing industries will be able to benefit from it. At the same time, the share of foreign participation should not exceed 50%.

The «Labor Productivity» ecosystem will provide enterprises with access to services that will assist them in making various business decisions, ranging from selecting the direction of digitalization of local processes and specific standard solutions based on a domestic software product to implementation, selection of appropriate support measures, and accompaniment assistance. This will reduce business costs as well as save time. The national project's participants will have access to low-interest loans, tax preferences, and assistance in eliminating bureaucratic obstacles.

According to the Ministry of Economic Development, the national project «Labor Productivity» has already involved over 2.6 thousand enterprises from 82 regions. It is expected that by the end of 2024, this number will reach about 5000 companies. Thus, 67 companies have already signed 167 initial export contracts worth more than 7.2 billion rubles for the supply of goods to Germany, Italy, the Czech Republic, India, Belarus, Turkey, Egypt, the United States, Saudi Arabia, Singapore, China, and other countries.

The digital economy is primarily associated with long-term scientific and technological forecasting, which is performed 10-15 years in advance. As a result, in the context of the economy's digital transformation, the development of digital platforms is a top priority.

The Russian Federation developed the multidimensional digital platform «The Industrial State Information System» (ISIS) to consolidate civil projects from military-industrial complex organizations⁴. ISIS makes it easier for manufacturers and consumers to find high-tech products through its interactive catalog, which contains 9.5 thousand items. The annual volume of electronic transactions exceeds 1.2 trillion rubles. The ISIS platform offers the enterprises financial and information services, trading platform services, technology and personnel transfer services, and services for interacting with government officials.

Due to the automation of many traditional business processes, Russian industrial enterprises are currently undergoing a transformation into digital businesses, and changing the way of interacting with customers, suppliers, and competitors within the industry ecosystem.

PJSC «Magnitogorskii metallurgicheskii kombinat» (MMK) – One of the top Russian companies in ferrous metallurgy. The company's digital platform includes basic software products in seven key areas of MMK information system development and operation. The chosen software products enable the unification of approaches to organizing the collection and storage of primary data from various sources, as well as the unification of tools for developing applied digital services aimed at improving the efficiency of the enterprise's business units⁵.

A single digital platform allows to optimize the timing and cost of digital project implementation while also ensuring a multiple increase in the scale of digitalization. These indicators reflect the efficiency of the enterprise's business units:

- cost savings of up to 25% on digital project implementation;
- support costs reduced by up to 20%;
- up to 60% faster project implementation.

LLC «Gazprom Neft STC» has developed an IT – projects program ERA that coordinates technological processes within this oil company. The program's key performance indicators are expressed in increased oil production, increased oil recovery factor, and reduced capital and operating costs.

Thus, LLC «Gazprom Neft STC» established a digital ecosystem in the field of exploration and production, deep oil refining, which includes all aspects of activity, from geology to the process of disseminating knowledge among company divisions, as a result of the successful implementation of the ERA corporate program of IT-projects in 2018⁶. Engineers will be able to receive ready-made solutions for future work because of the invention of electronic advisers and cognitive assistants for processing information and calculations.

³ https://www.economy.gov.ru/material/directions/nacionalnyy_proekt_proizvoditelnost_truda/

⁴ <https://gisp.gov.ru/gisplk/>

⁵ Magnitogorsk Iron and Steel Works. – URL: <https://mmk.ru/ru/about/digital-transformation/elements/platform/>

⁶ <https://globalcio.ru/projects/367/>

When developing the ERA IT – projects program, a wide range of information and technology solutions were used from partnerships between Gazprom Neft and its own integrator, ITSC company, with the support of the world's leading vendors: IBM, Yandex, the Skoltech Institute, and others, as well as the Scientific and Technical company center.

Group of the companies «Sofia» has firmly established itself as the market leader in integrated materials and equipment supplies to the oil and gas and energy industries. In 2020, the company introduced a Unified Digital Ecosystem with an end-to-end tender sales process for 1C: ERP Enterprise Management to coordinate the collaboration of a number of businesses in an integrated digital ecosystem; to reduce the expenses of maintaining an IT solution: moving data from 1C:UPP to 1C:ERP; and the end-to-end automated tender sales and purchases process⁷.

The organization observed a 20% decline in personnel costs, as well as 100% quickening in management reporting, a 15% reduction in the cost of material and administrative resources, a 15% decrease in service delivery time, and a 15% increase in profits after implementing the digital ecosystem.

PJSC «Rosseti», the energy company in Russia, has begun the process of developing an end-to-end ecosystem. Thus, «Rosseti» company in 2017 initiated the digital restructuring of the power grid complex by altering the logic of processes and converting the company to risk-based management by means of the digital technologies implementation.

The construction of 84 digital substations, 22 grid control centers, and 38 digital districts of electric networks allowed to improve the power supply reliability indexes SAIDI (System Average Interruption Duration Index) and SAIFI (System Average Interruption Frequency Index) by one and a half times.

The company has implemented a CIM model (computer-integrated manufacturing) for a network of 35 kV and higher to ensure interaction with all counterparties (networks, consumers, and other subjects of the electric power industry). The «Digital Electrician» project provides for faster restoration of power supply.

The digitalization program for power grid infrastructure costs 1.3 trillion rubles, and as a result, the world's largest power grid company (2.35 million kilometers of power lines, 507 thousand substations with a total transformer capacity of more than 795 kVA) will become electric power ecosystem. As a result, PJSC «Rosseti», as part of the electric power triad «Generation - Transportation - Sales» has become the driver of digitalization of the entire economics⁸.

LLL «1C» has built a specialized ecosystem in the B2B sector based on the digital technology platform «1C: Enterprise». Its ecosystem includes millions of user companies, over 10,000 sales and implementation partners, and developers generating industry solutions on an open API platform⁹. «1C» company can expand its product offering, pursue vertical growth, and implement a market expansion strategy due to its partner network, involving 570 cities in Russia and the CIS nations.

«1C» company successfully competes with foreign firms in the field of management and accounting automation at various enterprises, ranking sixth among significant Runet companies with a capitalization of 2.3 billion US dollars in 2020. The openness of the 1C ecosystem to external actors such as add-on suppliers and developers, as well as the regulations for accessing its tools, foster flexibility and adaptability to external changes through conditions that allow a steady flow of innovation.

PJSC «KAMAZ» has begun the digital transformation of its operations as part of the implementation of the company's strategic development program until 2025¹⁰.

The digitalization of sales and servicing will make it easier for consumers to purchase KAMAZ vehicles and boost the efficiency of fleet management. The intelligent transport and information system ITIS-KAMAZ, which is installed on trucks of the K5 generation, improves the operational characteristics of the vehicle in terms of fuel consumption, part wearing, and logistical expenses. In addition, to efficiently solve client problems, the company introduced digital services in 2019: a virtual sales office truckinstock.com, logistics order management cargorun.ru, and an online rental platform for special equipment specsharing.ru.

By consolidating the business processes of service and dealer centers, the company is shifting to the «Car as a Service» business model. A significant task for PJSC «KAMAZ» is the development of new digital services using insurance and leasing services, as well as the development of a digital platform, where the car is an integral component of the Internet of Things. The data received from K5 cars, buses, and

⁷ A unified digital ecosystem with an end-to-end process of tender sales on “ «1C:ERP» in the SOFIA GC. – URL: <https://eawards.1c.ru/projects/edinaya-cifrovaya-ekosistema-so-skvoznyim-processom-tendernyh-prodazh-na-1s-erp-v-gk-sofiya-109389/>

⁸ Новый электросетевой комплекс России – цифровая электроэнергетическая экосистема. – URL: <https://www.elec.ru/publications/tsifrovyye-tekhologii-svjaz-izmerenija/6584/>

⁹ <https://1c.ru/>

¹⁰ «KAMAZ» Strategic development program. – URL: <https://kamaz.ru/en/about/development/strategy/>

electric buses on the server is used to develop new applications. PJSC «KAMAZ» is currently developing new digital services in multimodal and international logistics, as well as supplementary services based on data processing technology.

JSC «Izhorskii trubnii zavod» is a subsidiary of OJSC «Severstal». It is located on the territory of the industrial zone «Izhorskii zavod» in St. Petersburg’s Kolpinsky district. The products’ main customers are OJSC «Gazprom» and large overseas oil and gas corporations. The plant manufactures single-seam longitudinal electric-welded pipes for gas and oil pipelines, as well as general-purpose pipes with diameters ranging from 508 to 1420 mm and length of up to 18.3 m, with a production volume of up to 600 thousand tons per year.

The company’s website offers customers a product catalog on the «Severstal Market» online store, where a variety of financial options are offered, including installment purchases, postponed payment up to 30 days, business credit cards from affiliated banks Alfa-Bank and Sberbank, and online payment tools.

Furthermore, «Severstal» company is establishing the «Industrial.Market» marketplace for the B2B sector, where industrial and construction enterprises can get direct access to orders / purchases from the largest industrial customers of their products via a single platform (figure 3).



Figure 3. Main stages of work on the «Industrial.Market» platform*

* Compiled by the authors¹¹

In addition, the company developed the «Cometal» platform, which integrates the production capacities of more than 170 partner metalworking and machine-building enterprises to fulfill various orders. «Severstal» company ensures the safety of the transaction for both the customer and the contractor, as well as takes care of the logistics organization process.

«Sveza» company based in Ust Izhora, Kolpinsky district of St. Petersburg, is the world’s largest manufacturer of birch plywood. The structure of the «Sveza» company in Russia includes 7 plywood factories: NCJSC «Sveza Kostroma», NCJSC «Sveza Manturovo», NCJSC «Sveza Ust-Izhora», NCJSC «Sveza Novator», NCJSC «Sveza Verkhniaia Siniachiha», LLC «Tyumen Plywood» and LLL «Sveza Uralskii». The company produces more than 1.4 million cubic meters of wood-based panels per year.

The online store «Sveza» for B2B customers successfully operates on the company’s website¹². The products are supplied to over 80 countries and are used in the construction of skyscrapers, Olympic venues, mainline trailers and high-speed trains, eco-furniture and stylish interiors. «Sveza» company’s activity is focused on the global Sustainable Development Goals, that’s why it joined the UN Global Agreement in 2019 and is committed to follow its principles.

All these examples demonstrate that Russian industrial enterprises have started implementing digital ecosystems to optimize production, improve efficiency and increase market competitiveness. This enables them to lower costs, improve product quality and predict production processes more precisely.

Discussions. The openness of digital ecosystems to participants and government support provides a competitive environment and favorable conditions for service, device, and equipment manufacturers, resulting in an increase in the number of digital ecosystems and the availability of digital services.

In today’s world, the formation and operation of digital ecosystems is a primary concern for Russian Federation industrial enterprises. Digital ecosystems are the form of mutually beneficial cooperation with elements of competition that enables industry professionals to create and scale innovative, efficient and more sustainable solutions.

Conclusion. The research conducted by the authors allowed us to obtain the following results:

- the interest in the topic of growth and formation of digital ecosystems from the scientific

¹¹ «Severstal» official web-site. – URL: <https://severstal.com/rus/>

¹² <https://www.sveza.ru/>

community, government agencies and the industrial sector of the Russian Federation was confirmed; it should also be noted that the feasibility of creating, developing and adapting digital ecosystems in the activities of industrial enterprises and complex integrated structures, their impact on the life cycle of both the enterprise itself and its goods and services, is noted by many foreign researchers specializing in the field of digitalization of industrial production;

- the concept of a digital ecosystem is considered and the aspects of its application in the sphere of industrial production are analyzed;
- the examples of the practical implementation of digital ecosystems in Russian Federation industrial enterprises are considered.

It should be emphasized that partners-suppliers and partners-consumers are essential for the implementation of innovations. Cooperation with suppliers and consumers, as well as the exchange of expertise with manufacturers, is a key success factor that enables the sharing of a common infrastructure and platform interface. Ecosystems allow the development of new products that no one company could have produced on its own, as well as the establishment of shared solutions for the further transformation of manufacturing industries.

This research is funded by the Science Committee of the Ministry of Science and Higher Education of the Republic of Kazakhstan (Grant No. AP19680223).

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ШЕТЕЛДІК ӨНЕРКӘСІПТІК КӘСІПОРЫНДАРДЫҢ ЦИФРЛЫҚ ЭКОЖҮЙЕЛЕРДІ ЕНГІЗУ ЕРЕКШЕЛІКТЕРІН ЗЕРТТЕУ: РЕСЕЙ ФЕДЕРАЦИЯСЫНЫҢ ТӘЖІРИБЕСІ

Андатпа

Мақалада «сандық экожүйе» ұғымықарастырылып, ресейлік өнеркәсіптік компаниялардың мысалында оларды өнеркәсіптік өндіріс саласында енгізу аспектілері талданады; цифрлық экожүйелерді енгізу ерекшеліктерін, олардың өнеркәсіптік кәсіпорындар үшін рөлі мен маңызын зерттеуге байланысты негізгі ғылыми зерттеулер құрылымдалған; цифрлық экожүйелердің құрылымы мен құрамдас бөліктері, оларды өндіріске енгізудің артықшылықтары анықталды; кәсіпорындардағы өндірістік процестерді цифрландырудың ағымдағы жай-күйіне баға берілді; сандық экожүйелердің маңыздыэкожүйе деңгейлері зерттелді. Мақаланың мақсаты - өнеркәсіптік кәсіпорындардың міндеттеріне бейімделген цифрлық экожүйелерді зерттеу. Зерттеу көрсеткендей, сандық экожүйелерді енгізу өнеркәсіптік кәсіпорынның тиімділігі мен бәсекеге қабілеттілігін арттыру үшін жаңа мүмкіндіктер ашады. Сандықэкожүйелерді құру жөніндегі мемлекеттік бастамалар ресейлік кәсіпорындардың серіктестерімен және жеткізушілерімен өзара әрекеттесуін қамтамасыз етеді;

талданған дереккөздер негізінде Ресей Федерациясының өнеркәсіптік кәсіпорындарының қызметінде сандық экожүйелерді енгізудің сәтті мысалдары қарастырылды.

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ИССЛЕДОВАНИЕ ОСОБЕННОСТЕЙ ВНЕДРЕНИЯ ЦИФРОВЫХ ЭКОСИСТЕМ ЗАРУБЕЖНЫМИ ПРОМЫШЛЕННЫМИ ПРЕДПРИЯТИЯМИ: ОПЫТ РОССИЙСКОЙ ФЕДЕРАЦИИ

Аннотация

В статье рассмотрено понятие «цифровой экосистемы» и проанализированы аспекты их внедрения в сфере промышленного производства на примере российских промышленных компаний; структурированы основные научные исследования, связанные с изучением особенностей внедрения цифровых экосистем, их роли и значения для промышленных предприятий; выявлены структура и компоненты цифровых экосистем, преимущества их внедрения на производстве; проведена оценка текущего положения цифровизации производственных процессов на предприятиях; изучены критические экосистемные уровни цифровых экосистем. Целью статьи является изучение цифровых экосистем, адаптированных под задачи промышленных предприятий. Исследование показало, что внедрения цифровых экосистем открывает новые возможности повышения эффективности и конкурентоспособности промышленного предприятия. Государственные инициативы по созданию цифровых экосистем обеспечивают взаимодействие российских предприятий с его партнерами, поставщиками; на основе проанализированных источников рассмотрены успешные примеры внедрения цифровых экосистем в деятельность промышленных предприятий РФ.

