Components of the digital information technology platform of machine-building enterprises

S Belyakov¹,², G Belyakova³,⁴, D Fokina⁵,⁶,⁷ and A Ryzhaya⁶

¹ Department of Economics and management in the construction sector Institute of Business Process Management and Economics, Siberian Federal University, Svobodny pr. 79, Krasnoyarsk, 660041, Russian Federation
² Department of Customs Registration, Siberian State University of Science and Technology, 31 Ave named newspaper "Krasnoyarsk Worker", Krasnoyarsk, 660014, Russian Federation
³ Department of Economics and Business Process Management Institute of Business Process Management and Economics, Siberian Federal University, Svobodny pr. 79, Krasnoyarsk, 660041, Russian Federation
⁴ Department of Economics, Siberian State University of Science and Technology, 31 Ave named newspaper "Krasnoyarsk Worker", Krasnoyarsk, 660014, Russian Federation
⁵ Department of Digital Control Technologies Institute of Business Process Management and Economics, Siberian Federal University, Svobodny pr. 79, Krasnoyarsk, 660041, Russian Federation
⁶ Department of Logistics, Siberian State University of Science and Technology, 31 Ave named newspaper "Krasnoyarsk Worker", Krasnoyarsk, 660014, Russian Federation
⁷ E-mail: darya_fokina@mail.ru

Abstract. This article discusses the components of an information technology platform that allows you to virtualize and visualize all possible ways to support machine-building enterprises. Dedicated components allow enterprises to access the necessary information and analytical tools in real time. Among the necessary components, the article proposes a mechanism for involving machine-building enterprises in cooperative chains, reflecting the order of the integration interaction of regional programs and tools for supporting export-oriented manufacturers of machine-building products with international programs to support manufacturers.

Considering the importance of the current trends in technological transformation, for innovative development and successful competition in international markets, machine-building enterprises need to take advantage of modern platform technologies. Digital information technology platforms are turning into an important tool for cross-industry transformation, as they increase the efficiency of the digital ecosystem, facilitate the establishment of high-speed and reliable communication between enterprises of various industries, and support the process of co-creation of products and services by enterprises and organizations from different countries, industries, and time zones [1].
Today's digital platforms are "multi-lateral markets that use business models that enable manufacturers and users to create value together by interacting with each other." Multilateral platforms contain the necessary components that allow participants to interact with each other, facilitating the negotiation, search, exchange and execution of transactions.

Having considered the models of information technology platforms used by mechanical engineering enterprises [2], the following types were identified:

- internal (closed) information technology platform, which is part of the production and technological process of the enterprise or part of the supply chain, ensuring coordination between consumers and suppliers
- external (open) sectoral or cross-sectoral, where the leader or author brings together the needs and capabilities of the participating companies.

The open (external) and closed (internal) types of platforms used by enterprises undoubtedly have their advantages and disadvantages. Among the advantages of using platform interaction technologies in the course of the study, the authors identified the most significant ones. Among the possibilities of external ITP - platforms:

- fully reflect the real chains of production processes of users and participants;
- allow you to optimize and compile processes into the effective activities of participating enterprises;
- allow to distribute the activities of all participants and users into constituent processes;
- allow you to see the movement of the finished product or its component from any "point" of production in the present and past tense;
- are the basis for assessing the consistency of processes and actions of participants in all parameters - time, space, volume, quality;
- increase the degree of trust between participants.

Based on the analysis of the features of the digital transformations of the machine-building complex [3], the components were identified that have a positive impact on the development of the potential of machine-building enterprises.

Components of a digital information technology platform for machine-building enterprises [4], that contribute to innovative development:

- educational and training programs for platform members
- trade channels and applications for consumers of platform products and services
- information systems supporting the operational and technological areas of the platform participants
- a system of information and analytical tools aimed at developing platform participants
- an innovative accelerator - a system for creating intangible assets and innovative solutions
- the Internet of Things, connecting physical assets and the needs of platform and operating system participants
- system of regulatory and legal compliance of platform interaction
- security systems, data protection and access control
- a system of uniform standards for platform interaction, adapted to international platform solutions
- information management and analysis systems based on available data and analytics, allowing to automate decision-making based on data analysis.
Summarizing the experience of foreign and domestic scientists and practitioners, with the help of a questionnaire survey of the heads of export programs of machine-building enterprises of the Krasnoyarsk Territory, the components of the information-technological platform of machine-building enterprises were identified (See table 1).

**Table 1. Components of the digital information technology platform of machine-building enterprises.**

| ITP platform components | Description of ITP components | Features implemented by components |
|-------------------------|-------------------------------|-----------------------------------|
| Information systems supporting the operational and technological areas of the platform participants | resident enterprises: the ability to compare services, giving preference to the most convenient and profitable, to reduce costs and labor costs to ensure interaction with partners and government agencies; - service providers - access to a wide range of customers, increase operational efficiency and reduce costs; - government agencies - the emergence and launch of innovative products on the market. | Optimization of time and resource of platform residents, increasing productivity and efficiency |
| Trade channels and applications for consumers of platform products and services | - reducing the cost of creating and withdrawing services and tools to support machine-building enterprises; - reducing the costs of enterprises for foreign economic activity due to access to competitive services; - introduction and transition to electronic legally significant document flow. | Reducing costs for consumers and other interested parties |
| Security, data protection and access control systems | - transparency of operations; - verification and quality control of outgoing and incoming digital data, the quality of the used subject model, the quality of the tools used; - the degree of trust in the counterparties of the platform increases. | Reducing risks for stakeholders |
| System of information and analytical tools | - virtualization ensures the quality and availability of support tools for export-oriented machine builders; - visualization of offers of logistics, insurance, financial and other services in the field of foreign economic activity. | Creation of accessibility for stakeholders, development of platform participants |
| Platform information management and analysis systems | - uniform rules and standards for developing services for export-oriented manufacturers; - ease of use, intuitive interface and the ability to integrate with other platforms - convenience and applicability for all participants and interested users | Possibility of application in various fields, industries, regions |
| Educational and training programs | - availability of retraining programs for specialists, taking into account the changing needs of enterprises and organizations - adaptation of educational programs for the development of future labor competencies and functions - opportunities for career and staff growth of platform participants | Opportunities for developing the human resources of platform participants |
During the study, the results of which are presented in the article, the authors conducted a survey, in which the heads of foreign trade departments of enterprises of the Krasnoyarsk Territory took part, and the respondents identified the needs:

- reducing the costs of foreign trade participants for the organization of export-import supplies;
- increasing transparency and reducing administrative barriers. Increasing the attractiveness and availability of foreign economic activity for exporters through the creation of specialized digital services;
- search for service providers to organize the supply of high-tech products;
- effective organization of information exchange with enterprises and organizations in the system of industrial cooperation;
- reduction of administrative barriers and formalities in the organization and conduct of export activities;
• organization of legally significant document flow, including with government bodies, currency and foreign trade control bodies, interaction with which is necessary when conducting foreign economic activity.

The development and implementation of an open ITP will allow enterprises to receive in electronic form in real time information about existing instruments, about services for logistics, foreign economic activity, organization of transportation of products, insurance, customs operations, financial support of foreign trade transactions, obtaining permits, interaction with government bodies providing reporting.

The creation and operation of open information and analytical platforms complies with the norms of international law \[5\], does not require amendments of the EAEU Treaty, acts of the Supreme Eurasian Economic Council on the "single window" mechanism in the development of industrial cooperation in the EAEU and export-import activities.

The initiative for the development of an open ITP of cross-industry cooperation corresponds to the direction of the development of the digital agenda within the EAEU, with supranational programs: “Digital transformation of economic sectors and cross-industry transformation”, “Digital transformation of markets for goods, services, capital and labor”, “Digital transformation of processes management of integration processes ”, “Development of digital infrastructure and security of digital processes ” [6].

The development and implementation of ITP of machine-building enterprises, as one of the main objects of digital infrastructure, is the basis for the development of digital industry ecosystems, modern management systems for the socio-economic development of the region, a number of social projects. Within the framework of the open ITP of machine-building enterprises, it is planned to develop proposals aimed at improving regulation in the scientific, technological and innovation spheres.

During the study, the problems and needs of stakeholders - enterprises engaged in the export of high-tech products - were identified, in the solution of which the implementation of platform interaction would be most effective.

The goals of the proposal and solutions of ITP of cross-industry cooperation of machine-building enterprises are the development of architecture, standards and rules for electronic interaction, design tools and implementation of services for an open platform. Service providers can use the above developments to create services and host them on the platform. The developed services will be interoperable with each other, which will allow organizing a seamless information exchange between participants in the supply chain.

Key partners of the open ITP of cross-sectoral cooperation of machine-building enterprises: industrial enterprises interested in the development of industrial cooperation, regional government bodies, regional export support institutions, providers as suppliers of resources [7].

The support tools presented on the platform take into account the need for continuous adaptation to transformational changes in the external environment, aimed at creating export advantages for producers of non-primary products in the region. The platform allows you to visualize all available tools for supporting and organizing the production of high-quality competitive products that meet the technical requirements and standards of the international market.

At the moment, the development of the first version of the ITP is underway, some tools of which have been tested on potential users. ITP contains information on more than 20 tools to support the development of manufacturers’ comparative advantages, and allows generating several types of analytical reports. The platform is expected to expand the range of tools and indicators, as well as the ability to generate the necessary reports using machine learning technologies.

One of the necessary components of the information technology platform is a program developed and tested at machine-building enterprises for assessing the impact of information and analytical tools on the elements of the formation of foreign trade potential, which makes it possible to calculate its growth. Moreover, the program allows you to assess the impact of the proposed information and analytical tools for each element of foreign trade potential [8].

System of information and analytical tools for the development of machine-building enterprises:
• Support for the organization of export activities
• Organization of patenting, certification and licensing of goods
• Organization of participation in seminars, conferences, forums, thematic exhibitions, round tables
• Organization and implementation of special training programs
• Assistance in the formation of foreign trade and investment proposals
• Translation into foreign languages
• Conducting seminars on export activities
• Design expertise - study and assessment by experts of an entrepreneurial project for its commercialization
• Promotion of engagement in international business cooperation
• Promoting involvement in technological and scientific cooperation
• Assistance in finding potential partners
• Event monitoring - observation, assessment and forecasting of the state of the business environment
• Development, implementation and certification of quality management systems in accordance with the requirements of international standards, such as ISO
• Development of competencies and advanced training of personnel in the identification, formation, assessment and promotion of business partnerships
• Provision of information materials on general requirements for products and the general procedure for conducting conformity assessment
• Providing information on programs of state support of the enterprise at all levels
• Formation of a list of potential buyers who have shown interest and are ready to enter into substantive negotiations with the exporting company
• Organization of negotiations between a client and a potential buyer until the moment of agreement on the essential terms of a foreign trade contract
• Assistance in organizing patent protection of IP objects in international markets
• Provision of outsourcing services for non-core activities.

Experts and heads of export programs of industrial enterprises of the region selected the most significant, in their opinion, information and analytical tools for managing the development of foreign trade potential, then the experts assessed the impact of each instrument on the elements of forming the foreign trade potential of their enterprises. The analysis of the results of the survey made it possible to single out the most significant information and analytical tools, 20 of which received the maximum assessment of the impact on each of the elements of the formation of foreign trade potential. The subjects providing the selected information and analytical tools are indicated by the experts.

Based on the analysis of the obtained expert assessments, a computer program was developed that allows assessing the impact of the use of ranked information and analytical tools for the development of the foreign trade potential of machine-building enterprises. "The program for assessing the impact of information and analytical tools on the formation of foreign trade potential of machine-building enterprises of the Krasnoyarsk Territory" is intended to assess the impact of the proposed information and analytical tools on the elements of the formation of the foreign trade potential of machine-building enterprises of the Krasnoyarsk Territory, allows you to calculate the change in the foreign trade potential of an enterprise based on the choice of certain information and analytical tools.

The main functional capabilities of the program include: automated calculation of the impact of the use of each information and analytical tool on the level of foreign trade potential; automated calculation of the increase in the elements of foreign trade potential through the use of specific information and analytical tools.
The program is designed to improve the process of forming and managing the development of foreign trade potential of machine-building enterprises through the use of information and analytical tools available to machine builders by visualizing the level of the impact.

Open and multilateral information technology platforms are a tool for the development of engineering enterprises. Being one of the modern forms of organizing international trade and cooperative interaction of manufacturers of high-tech products, ITP is a communicative information and analytical tool.

As a result of the conducted research, based on the trends in the technological transformation of mechanical engineering enterprises, the following features of information technology platforms were proposed, the need for which is justified:

- to consider information technology platforms as the most important tools for non-market coordination of joint activities of enterprises
- use of the information technology platform of machine-building enterprises as a tool for developing the foreign trade potential of enterprises
- the platform allows virtualizing possible support methods, including information and analytical tools in real time.

Information and analytical platforms, as a powerful communication tool, are able to ensure the interaction of subjects interested in the development of the foreign trade potential of machine-building enterprises. Platforms are a platform for substantiating strategic priorities for the development of the industry. The basis for the growth of the foreign trade potential of enterprises is the use of the paradigm of open business processes, information technology platforms that ensure mutual coordination of the economic, environmental and social vectors of the region's development.

The use of platform technologies to organize the involvement of machine-building enterprises in cooperative chains makes it possible to reduce the time and scope of design work, since the description of the components of equipment, machines and systems that were designed earlier can be stored in unified data formats on network servers available to residents of the information and analytical platform. It facilitates the solution of problems of product integration into other systems and environments, adaptation to changing operating conditions, specialization of design organizations.

Acknowledgement

The study was carried out with the financial support of the Russian Federal Property Fund in the framework of the scientific project No. 19-010-00355.

References

[1] Choudary S, Marshall W, Van Alstyne and Parker G 2016 Platform Revolution: How Networked Markets Are Transforming the Economy-and How to Make Them Work for You Engineering

[2] Belyakova G, Belyakov S, Fokina, D and Shpak A 2020 2020 Formation of a model of information technology platform for the development of foreign trade potential as the basis for the technological development of engineering enterprises IOP Conference Series: Materials Science and Engineering 862(4) 042033

[3] Novikov S and Sazonov A 2020 Digital transformation of machine-building complex enterprises J. Phys.: Conf. Ser. 1515 032021

[4] Akberdina V, Kalinina A and Vlasov A 2018 Transformation stages of the Russian industrial complex in the context of economy digitization Probl. and Persp. in Man. 16(4) 201-11

[5] Karliuk M 2015 The Eurasian Economic Union: An EU-Like Legal Order in the Post-Soviet Space? Law. LAW. High School of Economics WP BRP 53/LAW/2015

[6] Eurasian Economic Integration: Facts and figures 2019 Retrieved from: http://www.eurasiancommission.org/ru/Documents.pdf

[7] Roud V and Vlasova V 2017 Cooperating with Universities and R&D Organizations: Mainstream
Practice or Peculiarity? *SSRN Electronic Journal* DOI: 10.2139/ssrn.3052193

[8] Belyakova G and Fokina D 2019 Assessment of the influence of information and analytical tools on the formation of the export potential of machine-building enterprises of the krasnoyarsky krai Certificate of registration of the computer program RU 2019663387, 16.10.2019. Application No. 2019661840