Formation conditions and theoretical and methodological aspects of assessment of the economy digital transformation level

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Abstract
The development of digital technologies in the economy requires the transformation of business processes at the level of organizations focused on a strategic perspective. In the digital economy, obtaining strategic competitive advantages is associated with the formation and development of the potential of organizations. The use of digital technologies leads to the introduction of new methods, tools and services that require infrastructural changes in organizations and contribute to the creation of new products (works, services) that increase the competitiveness and financial stability of organizations. The process of digital transformation of the economy is multi-stage, and each stage has goals, objectives and evaluation criteria. The first step towards the economy digital transformation is to assess the digital potential, digital maturity and readiness of organizations. The originality lies in the development of theoretical and methodological foundations for assessing the level of the economy digital transformation and in the development of promising areas. The author’s definition of the digital potential of an organization is given as the ability to perform activities to create, introduce, develop and implement information and communication technologies in the context of the transformation of business processes, business models in order to ensure strategic competitive advantages in the markets, financial stability and performance. The assessment methodology is proposed and the following groups of estimated private indicators have been identified: digital transformation of the organization, intellectual capital, customer interaction: service quality and customer satisfaction, online sales, business environment. Determined that digital transformation, as the technical and technological core of the digital economy, through the introduction of digital technologies, transforms the structure of the added value of the product by including the digital and intellectual component in the chain of its creation.

Keywords: digital economy, conditions, Republic of Belarus, Poland, digital transformation, digital potential, digital maturity, organization, assessment, strategy, development directions.

Introduction

The goal is to study the formation conditions, deepen the theoretical and methodological foundations for assessing the level of digital transformation of the economy of various countries and develop promising areas for its development.

The basis of the study is a systematic approach to the formation conditions and assessment of the level of digital transformation, digital potential, digital readiness and digital maturity of economic systems. For studying the readiness for
the digital transformation of the economy, general scientific methods of theoretical knowledge were used: statistical and logical analysis, synthesis, comparison, deduction and generalization, expert surveys.

Implementation of the economy digital transformation modifies traditional business processes, business models, increasing the prestige of the state, business and organizations. In modern conditions, digital transformation reflects the competitiveness of organizations and is a determining factor in developing a strategy for their sustainable development. The expediency of applying a systematic approach to the analysis of the conditions for the formation, assessment of the level and main directions of development of the digital transformation of the economy is substantiated.

Digital transformation of the economy can be studied: as a historical stage in the development of the national economy, providing for access to a qualitatively different, higher level of modern technological development; as a large-scale national project that provides for the implementation of a set of long-term developed measures. Considering the first approach, it should be noted that large-scale transformations (industrialization, electrification, complex mechanization and automation of production) corresponded to each stage of the technical and economic development of Europe and the USA countries. The achieved level of the productive forces development and the existing scientific, technical and human capital in Belarus create conditions for the digital transformation of the economy. Applying the second approach, it should be noted that the development of the information and communication technology sector in economically developed countries demonstrates a certain sequence: first, the appropriate infrastructure, conditions, prerequisites for the digitalization of the service sector are created, then starts the introduction and application of ICT in the real sector of economy.

**Material and methods**

Formation of a high-tech sector of the national industry and an increase in its knowledge intensity, as the achievement of key goals, is reflected in the National Strategy for Sustainable Socio-Economic Development of the Republic of Belarus until 2030 (National strategy for sustainable socio-economic development of the Republic of Belarus for the period up to 2030). Digital transformation of an industrial enterprise is the basis for the formation of the sector of intelligent industrial production through the development and implementation of modern information technologies and industrial integrated systems, this is the digital transformation of processes into intelligent management of production, quality and sales of products.

Policy paper of the informatization and communications field is the Strategy for the Development of Informatization in the Republic of Belarus for 2016–2022 (Strategy of Development of Informatization in Republic of Belarus for 2016–2022). Digital transformation strategies should be comprehensive in addressing interconnected policies, ensuring its coherency and coordination across all areas and sectors, shaping digital transformation, and engaging relevant stakeholders in its design and implementation. Implementation of the digitalization strategy requires administrative capacity, a clear division of labor and relationships between different levels of government. It is necessary to formulate a strategic vision of the country’s digital transformation in order to develop a coherent policy for the digitalization of the economy. It is important to justify how digital transformation contributes to the achievement of such goals as sustainable development, innovative development, and growth in the welfare of the population? This approach contributes to the formation of strategic priorities and the consistency of the goals of the development of society, the inclusion of the country in global
world processes.

The Republic of Belarus has developed the State Program “Digital Development of Belarus” for 2021–2025, one of the key tasks of which is the development of digital economy tools in various sectors of the national economy, providing for the use of advanced production technologies in production and processes of foreign economic activity, the formation of the necessary conditions to maintain and improve the competitiveness of Belarusian enterprises in the world market (State Program "Digital Development of Belarus" for 2021-2025).

14. The main task of developing the infrastructure of the Polish economy is its modernization, associated with the development of access to digital technologies, to the dominant information and communication technologies. It is the latter that have a significant impact both on changing consumption patterns and social ties, and on increasing the economic efficiency of production. Achieving this goal is associated with an increase in the number of “innovation platforms” as a means of supporting an effective technological complex. The proposed tools and solutions are contained in the programs “Digital Poland”, “Comprehensive Program of Informatization of Poland”, in the Law “On the Unified State Information and Communication Infrastructure” (Innovative Development of the Food Sector in the Republic of Belarus and Poland, 2021, Ayupov, A.N., 2020).

The main reason for the complexity of the transition to digital innovations in industrial enterprises is the lack of professional skills among employees (digital thinking, self-learning, working with data, flexibility and the ability to make decisions in the face of constant market changes). To analyze and activate the digital literacy of employees, it is necessary to test them in the following areas: information security, knowledge of Microsoft Excel and other programs, analytical data processing, modern communication methods and digital trends. The most significant factor is availability and development of a digital strategy (at the same time, the goals of the enterprise are planned: achieving an excellent customer experience, leadership in reducing costs, implementing new digital opportunities, developing digital competencies in a team, etc.), the underdevelopment of the appropriate infrastructure to ensure cybersecurity and development of direct sales channels.

Numerous economic literature works are devoted to the study of the problems of economic systems digitalization and processes. However, insufficient attention has been paid to the concept of the digital potential of an organization, assessment methods, quantitative and qualitative measurement. The term “digital potential” in relation to an industrial enterprise appeared in the scientific literature in 2010. The most common approach is to define the concept of “digital potential” as a characteristic of the capabilities of economic systems to use digital technologies. The concept of “digital potential of an enterprise” is a relatively new concept, both for foreign and domestic science. Explore the digital potential as the ability of an enterprise to carry out activities to create, implement and apply information technologies, ensure information security in order to meet the current or future needs of the enterprise (Gorodnova, N.V., Peshkova, A.A., 2018). Digital potential is a set of data itself, software and hardware for their storage and processing, and personnel using this data for management (Popov, E.V., Semyachkov, K.A., Moskalenko Y.A., 2019).

In general, when exploring digital potential, the following aspects should be taken into account: “potential” comes from the Latin “potentia” – strength, power, internal capabilities that exist in a hidden form and can manifest themselves under certain conditions; the concept of “digital” is used to denote a sign (quality, property) of an object associated with digital (information) technologies that have a certain life cycle and scope in an enterprise.

Digital industrial organization means an integrated set of digital models, methods and tools interconnected on the basis of a data management system. The main objective of the activities of organizations is the integrated
planning, evaluation and continuous improvement of the main and auxiliary structures, production processes and resources. The concept of digital transformation of an industrial enterprise is defined as a change in intra-production components, parameters and proportions, connections of the economic system of an industrial enterprise, which determine the gradual transition of an industrial enterprise to a new qualitative digital state (Danilchenko, A.V., Zubritskaya, I.A., Yakushenko, K.V., 2019).

The leaders in the formation of competitive advantages with the implementation of the digital transformation of the industry are the following concerns: Siemens, ThyssenKrup, Robert Bosch, BASF, Embedded Systems, Smart Factory, Robuste Netze, Cloud Computing и IT-Security, NV, Materialise NV, Limacorporate SPA, Medical Modeling, Inc.

The problem of the digital potential integral assessment, which allows assessing the ability of organizations to implement information technologies and transform business processes, is relevant and in demand. Such an assessment can be carried out in two ways: by forming a balanced scorecard system (BSC), taking into account the level of digitalization, allowing a systematic analysis of the performance of enterprises and based on an integral assessment. An integral indicator – “digital potential of the enterprise” – is proposed, reflecting the actual level and opportunities for the future, taking into account the factors and conditions of the external environment (this is the readiness of the industry for the formation of a digital environment, the readiness of specific key stakeholders of the enterprise to interact, the level of consumer friendliness, the degree of state support for digitalization processes. The proposed approach makes it possible to analyze both the current level of digitalization of individual processes in an organization and the opportunities for increasing digital potential. The readiness of industrial organizations to accept new transformational changes requires, along with the introduction of new information technologies in the processes of organizing their activities, a change in the business model (Kozlov, A.V., Teslya, A.B., 2019).

To assess the potential for business digitalization, the Industry Digitisation Index (IDI) proposed by McKinsey&Company is used, which includes 23 indicators grouped into three groups: assets, use and labor.

Digital potential is one of the elements of the enterprise economic potential and a distinctive feature of its assessment methodology is a modular structure that allows assessing the potential of enterprises of both full and incomplete cycles in the formation of flexible value chains in the digital economy. The methodology takes into account the basic principles and elements of the Industry 4.0 concept and the Technet roadmap (Frolov, V.G., Sidorenko, Y.A., 2020).

The growth rate of the enterprise digital potential is determined by the presence of both hardware and software, and taking into account the financial component (financial resource availability, liquidity indicators and financial stability ratios), which makes it possible to justify the possibility of implementing a digital strategy (Cherkashnev, R.Y., 2016).

Results and discussion

The results of the studies have shown that estimation of the digital potential of food organizations requires creation of a hierarchy of private indicators, that makes the basis for integral indicator formation. The following groups of estimated private indicators have been identified:

1) digital transformation of the organization: the level of business processes automation, scientific and information resources, return on investment in digitalization, income from new digital services;

2) intellectual capital: the presence of digital competencies and personnel capable of using digital technologies, the attitude of the team to digital innovations;

3) customer interaction: service quality and...
customer satisfaction, online sales;

4) business environment: level of competition, financial stability of the business, innovative products.

Since the listed indicators are of a different nature and can be estimated both by its quantity and quality, their formalization is proposed, which take values from 0 (at the lowest value of the indicator) to 1 (in the ideal case).

Figure 1 shows a diagram for assessing the digital potential of organizations in the food sector.

![Figure 1. Estimation of the digital potential of food organizations](image)

Source: suggested by the author

Data shown in Figure 1 demonstrates a low level of assessment indicators (business environment, customers interaction) for the food sector which requires the development of appropriate measures to activate and grow them.

Thus, the organization digital potential is its ability to perform activities to create, introduce, develop and implement information and communication technologies in the context of the transformation of business processes, business models in order to ensure strategic competitive advantages in the markets, financial stability and performance.

In the economic literature, most of the methods are based on the analysis of statistical data related to the assessment of the level of informatization, automation and digital maturity of organizations (readiness of organizations to internal and external changes associated with digitalization).

Digital maturity is a key indicator of the degree of readiness of the state and organizations to implement digital solutions in their processes. Digital maturity of the business is an assessment of its position relative to the leaders in the field of digitalization in accordance with given criteria, which determines their ability to offer the best value proposition to customers. Digital maturity is the ability of the organization to respond to technological developments, taking into account the realization of competitive advantages. There are two approaches:

the first is the assessment of the enterprise level of readiness for digital transformation;

the second is the assessment of the introduction of digital technologies and their impact on the formation of the business model of the enterprise and its competitiveness.

The general indicators of digital maturity assessment should be the following: strategy and business model, organizational culture and personnel, consumers and their experience, operational processes and digital technologies, value for the client (products and services of the company). At the same time, the digital maturity assessment provides for:

1) determination of the current level of maturity in the functional areas of the organization (structure, key resources, key processes, technologies);

2) identifying development priorities and setting goals in accordance with the digital strategy;

3) identification of priority areas, development of an action plan for the strategy implementation (Medvedeva, L.F., Arkhipova, L.I., 2021).

At the moment, large global consulting companies are analyzing the level of digital maturity and assessing the potential and dynamics of changes in organizations in the process of digital transformation. To assess the dynamics and effectiveness of implementation, the following digital maturity assessment methods are used:

1. Digital maturity model analyses digital
capabilities across six key dimensions (customers, business strategy, technology, production, structure and culture of the organization), which are divided into 28 subsections, including 179 indicators.

2. Digitization piano evaluates the most important elements of the value chain: business model, organizational structure, people, processes, IT capabilities, offers and interaction model against specific questions designed for each category. The model is aimed at identifying differences between the actual and forecast levels of each transformational category of organizations.

3. Acatech Industry Maturity Index 4.0 developed by the German National Academy of Sciences and Technology assesses digital maturity in four areas (resources, information systems, culture and organizational structure) taking into account stages of development and corporate processes.

4. Digital Transformation Index (analytical agency Arthur D. Little) is formed based on seven indicators: (strategy and leadership, products and services, customer management, operations and supply chains, corporate services and control, information technology, workplace and culture) (Barulin, E., 2021).

The methodology for calculating the level of digital maturity of the Russian Federation in key sectors of the economy and in the social sphere is based on three indicators:

1) number of specialists intensively using information and communication technologies;

2) expenses of organizations for the implementation and use of modern digital solutions;

3) level of digital maturity depending on the achievement of the target value of 2030 in ten sectors of the economy and the social sphere (in industry, agriculture, construction, urban development, transport and logistics, energy infrastructure, financial services, healthcare, education and science and public management).

The Chamber of Commerce and Industry of Russia distinguishes four levels of “digital maturity” of organizations: low (digital transformation carries risks), basic (transformation is possible, but requires clear planning of resources and tasks), advanced (the company has ongoing digitalization initiatives), high (digitalization integrated into the operating and production activities of the company). Organizations can get the status of a digital transformation leader (manage the growth of business value through innovation) or a digital transformation driver (create a digital environment for the integration of partners, suppliers, customers). Assessment is carried out in five areas: “goal setting, strategy, business model”, “organizational structure and processes”, “people”, “product”, “resources”. An alternative model of “digital maturity” is proposed by Deloitte analysts, which, along with the strategy and organizational structure of the organization, provides for the assessment of the application of technologies, work with clients and operational activities of the organization (Galiyeva, D., 2021).

The main technical and organizational conditions that allow organizations to increase their digital maturity are analyzed. These include: interconnected data, automation and technology integration, application of analytical findings in practice, strategic partnerships, specialist skills, flexible teams and a culture of Fail-Fast (trial and error method) (Field, D., Patel, S., Leon, G., 2021).

Methodology for assessing the level of digitalization has been developed by questioning top managers on 31 business processes. The pyramid of the digitalization process includes five levels: primary local, partial, complex, “smart” organization and digital ecosystem. Furthermore, in accordance with the digital transformation strategy, the target level of digital maturity of the organization, which is necessary for its implementation, is determined. To overcome the discrepancy between the current and target levels of the organization digital maturity, a digital transformation roadmap is being developed, in accordance with which a portfolio of projects is formed that ensures a balance of innovation and the achievement of the company strategic goals (Merzlov, I.Y., Shilova, E.V., Sannikova, E.A., Sedinin, M.A., 2020).
Digital transformation is a way of doing business that involves information and digital technologies, as well as the readiness of companies for internal and external changes, that is, digital maturity. The formation of the digital level in organizations is certainly related to the possibility of its financing (Derizemlya, V.E., Ter-Grigoryants, A.A., 2021).

Digital transformation is a large-scale adaptation of a business to the new conditions of the digital economy, which is being studied from different perspectives as:
- transformation of society — value systems, culture, relationships, institutions, etc.;
- transformation of technologies and their impact on economic processes;
- business transformation — markets, industries, competition, business processes, business models, etc.

Thanks to modern methods of project management and analytics, innovation centers and digital transformation centers are being formed in organizations, the essence of which is to actively search for and test new areas of business development, products and solutions. The digital maturity model is a tool that can be used to estimate the level of skills and competencies of an organization and develop measures to improve them (Kuzin, D.V., 2019).

A comprehensive assessment of the conditions and analysis is the first stage of the digital transformation of an industrial enterprise. Based on SWOT, PEST and strategic analysis, it is necessary to determine the goals that are the basis for the formation of the concept of digital transformation of an industrial enterprise. In addition to the main goal, i.e. to provide conditions for increasing the economic efficiency of production activities, the digital transformation of the industry is aimed at obtaining a synergistic effect from the implementation of ongoing activities (Danilchenko, A.V., Zubritskaya, I.A., Yakushenko, K.V., 2019).

To assess the speed of adaptation of enterprises to digital transformation, the BDI (Business Digitalization Index) is used. The calculation of this index is based on data on the organization’s use of: information transmission and storage channels (cloud technologies, corporate mail, instant messengers, automation systems, etc.); digital technologies of artificial intelligence, the Internet of things, 3D printing, electronic document management, etc.; Internet tools for promotion and development of the enterprise; digital information protection programs and the use of specialized anti-virus programs; assessment of the degree of involvement of management in self-development and development of personnel in the field of digital competencies (Veselovsky, M.Y., Khoroshavina N.S., 2021).

Figure 2 shows the business digitalization index of various countries in 2018 (Indicators of the digital economy: statistical collection, 2020).

![Figure 2. Business digitalization index of various countries](image)

Source: Indicators of the digital economy: statistical collection, 2020

The data shown in Figure 2 shows that the level of business digitalization is most developed in countries such as Finland, Belgium, Denmark, Sweden, Norway, Austria, Spain, Germany, Slovenia, Italy, Croatia, Czech Republic, Slovakia, Latvia, Russia, etc.

It is advisable to evaluate the effectiveness of digital transformation of enterprises in high-tech industries by stages of the digital transformation strategy. When evaluating the effectiveness, it is necessary to take into account the costs of implementing investment projects for the digitalization of economic processes within the considered stages of the product life cycle and the cumulative effect received by the organization as a
whole (Kokuytseva, T.V., Ovchinnikova, O.P., 2021).

Digital transformation, as the technical and technological core of the digital economy, through the introduction of digital technologies, transforms the structure of the added value of the product by including the digital and intellectual component in the chain of its creation.

Figure 3 shows the share of the ICT sector in gross value added in 2019 for various countries (Indicators of the digital economy: statistical collection, 2020).

![Figure 3. The share of the ICT sector in the gross value added of various countries](image)

Source: Indicators of the digital economy: statistical collection, 2020

The data shown in Figure 3 shows that in 2019 the highest share of the ICT sector in gross value added in the following countries: Hungary (6.1%), Czech Republic (5.9%), Sweden (5.6%), Germany (5.0%), Slovakia (4.8%), France (4.7%), Croatia (4.4%), Denmark (4.1%), Belgium (4.0%), Austria (4.0%), Poland (3.7%), Italy (3.6%), Greece (3.2%), etc.

The key areas of digital transformation include changing organizational culture, transforming business models and products, and ensuring the growth of enterprise flexibility (Trushkina, N., Rynkevich, N., 2020). At the same time, the need for highly qualified employees is increasing, especially for specialists in digital technologies, data analytics and graduates in the field of science, technology, engineering and mathematics. Modern methods of personnel search and training programs, formed taking into account the goals and objectives of Industry 4.0, are of decisive importance at the present stage and in the future.

Conclusions

Modern digital organization is one that actively integrates technology into products and services, uses IT solutions to actively interact with customers, technologies to make decisions and improve business processes. In general, digitalization is a continuous process aimed at improving the efficiency of functioning and sustainable business development. For business development, it is necessary to constantly introduce advanced technologies, improve the quality of service, the level of automation, as well as use modern tools for analyzing and evaluating the effectiveness of both individual investment projects and digital potential. Demanded direction is the development of an algorithm for intellectual analysis of business processes, which ensures a gradual transition from a questionnaire, reports to intelligent systems in order to make a profit and economic growth.

The main directions for the development of the economy digital transformation are as follows:

1) increase of expenses on digital transformation and innovations and more than half of the costs of ICT will be directed to these purposes. Organizations must develop a digital transformation strategy to increase competitiveness;

2) integrated application of software training, automation tools for efficient operation. Heads of organizations will invest in the development of sectoral strategies for its implementation;

3) a distributed cloud, that is, the distribution of public cloud services to different locations that operate in an accessible place and around the clock. Approximately 70% of organizations will implement unified technologies, tools and processes for hybrid management, define key
business performance indicators and improve IT infrastructure;
4) blockchain, which is able to transform the relationship in the implementation of activities, providing transparency and secure data exchange in business ecosystems;
5) providing users with access to technical knowledge (or business knowledge) through a simplified experience that enables the use of specialized tools and systems in professional activities.

References


