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HOME Revista ESPACIOS ÍNDICES / Index A LOS AUTORES / To the AUTORS

Vol. 41 (Issue 05) Year 2020. Page 26

# Digital economy development in Russia: main trends' analysis and assessment

## Desarrollo de la economía digital en Rusia: análisis y evaluación de las principales tendencias

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### Contents



**ABSTRACT:**
The article is devoted to a comprehensive assessment and analysis of the digital economy processes development in Russia. In a theoretical analysis, the authors consider institutional and infrastructural conditions aimed at eliminating the existing obstacles and limitations for the creation and development of high-tech enterprises in the digital economy. The level of digital technology adoption is determined based on the digitalization coefficient for key technology industries. The contribution analysis of the digital economy to Russia's Gross Domestic Production GDP is given with an assessment of its components in comparison with other countries. In conclusion, there are examined the import substitution development trends, Russia's export potential within digital economy development is being evaluated.
**Keywords:** Digital economy, technological transformation, Industry 4.0, digital companies

**RESUMEN:**
Este artículo está dedicado a una evaluación y análisis exhaustivos exhaustivo del desarrollo de los procesos de la economía digital en Rusia. En un análisis teórico, los autores toman en consideración las condiciones institucionales y de infraestructura destinadas a eliminar los obstáculos y limitaciones existentes para la creación y el desarrollo de empresas de alta tecnología en la economía digital. El nivel de adopción de tecnología digital se determina en función del coeficiente de digitalización para las industrias de tecnológicas clave. El análisis de la contribución de la economía digital al Producto Interno Bruto ruso se realiza con una evaluación de sus componentes en comparación con otros países. Para terminar, se examinan las tendencias de desarrollo de sustitución de importaciones y se evalúa el potencial de exportación de Rusia dentro del desarrollo de la economía digital.
**Palabras clave**: Economía digital, transformación tecnológica, Industria 4.0, empresas digitales

# 1. Introduction

Digital transformation is rapidly changing the current business environment, creating numerous opportunities for growth, improving business efficiency, reducing costs, improving customer experience and developing innovative business models. Today, companies of engineering, energy and chemical industries begin actively evaluating their product offerings and business models in keeping with digitalization. Traditional players experience digital transformation at many levels.

For companies that are close to the end consumer, the focus of attention is, first of all, on rethinking the channels and client interaction interfaces. The comprehensive approach includes the redesign of the company's key consumer offer by transforming it into an integrated solution or, possibly, a platform. Improving the operating model efficiency by using new approaches to automation using robotics and artificial intelligence is another development area. The digital transformation development also involves the effective and high-quality renovation of existing production and business processes based on the comprehensive advanced innovations implementation. An important step in the development process is the need to adapt renovated business processes to the digital economy requirements. The digital economy is a unique system of economic, social and cultural relations based on the use of digital information and communication technologies. In the digital economy, growth depends on the technology development rate, however such growth can be provided exclusively by man.

# 2. Theoretical analysis

Digital technologies are transforming the enterprise’s operating model, i.e. the procedure and methods for applying corporate strategy in daily activities, as well as increase the degree of investment efficiency and help to identify unique previously unknown opportunities in the market. An effective production digital transformation can be carried out only based on a general single platform, which will create a single independent digital system for organizing modern engineering. The modern design process is a symbiosis of three multilateral subsystems, including the process of developing the main provisions and requirements for the future product, the product management system organization and the direct product design, i.e. defining its future architecture. Digital transformation allows obtaining profit at the stage when the personnel directly involved in the production process receives all the necessary additional information for a more efficient production process organization, for example, uses augmented reality technologies. The four digital development technological foundations traditionally include big data, sociality, mobility and clouds (EEC, 2017; Efimushkin, Ledovskikh, Scherbakova, 2017; PWC, 2019).

Big data. In fact, big data is a mean, but not an end. It forms the essential foundation of the machine learning systems’ exponentially growing world, which pave the way for what can be called artificial intelligence (AI). This growing class of systems has led to fundamental changes in many industries due to the fact that it allows real-time adoption of a large number of decisions based on factual information in areas in which it was previously common to rely mainly on human judgment (for example, when choosing target audiences and commercial appeals within the framework of marketing campaigns).

Sociality. An important point associated with modern digital systems is the need to involve many users who perform various roles. If to take, for example, a traditional computational task, such as balancing an organization's balance sheet, then one person can handle it in the limit. Digital systems are largely based on the positive network effect formulated as follows: each new network node increases its value for all nodes already included in it. This quality is an integral characteristic of digital systems, as opposed to traditional IT systems, although its presence is not always obvious to the user or observer. Sociality can be used in solving a wide variety of tasks, both commercial and non-commercial, in private life or within an organization.

Mobility. Theoretically, access to any device that processes or stores information can be obtained from any point (at least in the urban part of the world), regardless of the purpose of use. A new generation of devices is being developed, such as drones or autonomous vehicles, which can move automatically while performing the assigned tasks. This opens up completely new horizons for targeted data collection and even physical action. This is facilitated by an increase in the number of networking technologies, including 3G, 4G and 5G, Wi-Fi and WiMAX, GPS and GLONASS, RFID, NFC, Bluetooth and others. Thanks to these numerous communication technologies, the so-called Internet of Things, machine-to-machine interaction networks (M2M), which automates important processes, especially in the field of measurement, control and monitoring, is becoming a reality. Their application areas include energy networks (“smart grids”), production management, transportation and logistics, marketing, security, customer relationship management, etc.

Clouds. The development of these systems is more in demand by IT specialists. The main commercial effect of the cloud technologies development lay in a SaaS business model creation, which means “software as a service”. This made it possible to transfer the cost of purchasing IT systems from the “investment” article to the “operating expenses”, which had numerous positive consequences for financial management. Such transactions have gained popularity, primarily in the field of small and medium-sized businesses, giving similar enterprises the opportunity to use

software applications that were available only to corporations in the past. Another decisive advantage of this model for small businesses is the ease of installation and software operation. Today, both CFOs (chief financial officers) and CIOs (chief information officers) of major corporations find the SaaS approach more promising for optimizing procurement budgets and improving internal customer satisfaction.

The scope of financing for the Russian program for the digital economy development will exceed 1.8 trillion rubles in the next five years. The most expensive program of the "Digital Economy" national project will be represented by the section "Information Infrastructure", 413.4 billion rubles will be allocated. Another 282 billion rubles will be spent on digital technology, 226.4 billion rubles prepared for digital public administration, 139 billion rubles will be spent on digital economy personnel, 18 billion rubles on information security, 1.6 billion rubles on the preparation of statutory regulation. By 2024, the government intends to fully implement a comprehensive digital transformation of the Russian economy and social sphere. Thus, it is necessary to develop legislation on digital technologies, modernize digital infrastructure, introduce digital practices in all key areas of the economy and public administration, and organize labor-training programs for the transition period. The creation of institutional and infrastructural conditions, the elimination of existing obstacles and restrictions for the high-tech businesses creation and development is carried out in six areas (Ilchenko, Babaev, 2004; Bughin, Hazan, Labaye, Manyika, Dahlstrom, Ramaswamy, Cochin de Billy, 2016).

1. Personnel for the digital economy. The education system development, which should provide the digital economy with skilled personnel. The transformation of the labor market, which should be based on the digital economy's requirements. The motivation system creation for the necessary competencies development and the participation of personnel in the development of Russia's digital economy.

2. Information infrastructure. The communication networks development, Russian data centers system development, the digital platforms implementation for working with data to meet the needs of citizens, business and government.

3. Information security. Achievement the state of protection for the individuals, society and the government from internal and external information threats, which ensures constitutional civil rights and liberties implementation, citizens' decent quality and standard of living, sovereignty and sustainable socio-economic development of the Russian Federation.

4. Digital technology. Creation of specialized support systems for search, applied research in the digital economy field (digital platforms' research infrastructure), ensuring technological independence in each of the areas of end-to-end digital globally competitive technologies and the national security.

5. Statutory regulation. A new regulatory environment formation that provides a favorable legal regime for modern technologies emergence and development, as well as for the economic activities implementation related to their use.

6. E-Government. Digital technologies and platform solutions implementation in the public administration and public services areas, including the citizens' and small and medium-sized enterprises' interests, as well as individual entrepreneurs.

The digital economy can be represented as a system, which includes economic, social and cultural relations based on the digital information and communication technologies (ICT) use. The digital economy is focused, first, on the set of necessary conditions development for the new innovative and unique digital technologies emergence, as well as on the production organization advanced trend models use. Information and communication technologies are the digital economy's tools; their composition is presented in detail in Table 1.

**Table 1**
Sales volumes carried out on the global ICT market for 2017 (billion dollars)

| № | Focus area | Value |
|---|---|---|
| 1 | Computer facilities | 368.7 |
| 2 | Telecommunication services | 608.1 |
| 3 | Software | 634.2 |

| | | |
|---|---|---|
| 4 | Technical outsourcing and Hardware maintenance | 475.8 |
| 5 | Telecommunications equipment | 331.8 |
| 6 | Technical consulting and System integration services | 573.1 |

In 2017, sales in the global ICT market are estimated as 4.1 trillion US dollars. For the successful business, functioning three elements are necessary in the digital economy: infrastructure (Internet access, software, and telecommunications), electronic business (conducting business through computer networks), electronic commerce (trade, goods distribution via the Internet).

# 3. The economy’s digitalization level and digital technologies’ contribution to GDP

At present, in Russia the digital economy is under a rather rapid and active development. From 2011 to 2015, the total digital economy of Russia increased by about 60%, it grows nine times faster than the country's GDP. As a result, already in 2015, the digital economy share reached 4.0% of GDP, and there is considerable potential for its further growth. It is extremely important for Russia to accelerate the digitalization pace and by 2025 achieve the ambitious, but quite realistic goal, which is to triple the digital economy size. Russian digital economy has received a significant development impetus over the past few years. Private companies succeeded, the labor market is being transformed, unprecedented infrastructure projects are being implemented with direct government support that increase the overall level of various digital services accessibility for the citizens and business (including small and medium), the Internet, mobile and broadband communication are widely used. Despite this, there is still a lag in key digital economy indicators in comparison to leading digital countries, in particular from the European Union. The access level to digital services in Russia is as follows (Skoltech, 2014; Tadviser, 2019):

- share of electronic commerce in total retail is 4.3%.
- share of organizations using CRM and PLM systems is 11%.
- share of citizens who made purchases online is 24%.
- share of citizens who received public services through the Internet is 29.5%.
- share of organizations having a website is 44%.
- mobile Internet penetration is 48%.
- Internet penetration is 75%.

The organizational and technical system of product lifecycle management (PLM-system) is of the most complex and resource-intensive transformational process. The system’s basis is a sign of dualism, which can be represented in the form: object-operation / material information. Material and technical support, which directly includes production itself, subsequent operation and utilization / processing, as well as various related processes occur in the physical environment, and they are fully accompanied by processes occurring in the information environment, which are implemented in a rather complex multifunctional computer environment. Therefore, in order to qualitatively increase the modern IT technologies application efficiency, it is necessary to transform processes carried out directly in the physical environment into so-called information problems. In turn, they can also be converted back to the physical environment. The conversion process is necessary for the future product life cycle optimal preparation, in other words, it is necessary to achieve a full correspondence between the information and physical environment.

Today, such a key indicator value for the digital economy development as the ratio between the digital economy’s volume and the country's total GDP is 4%, which is about 2.5-4 times lower than in the countries selected for comparison. Digital household spending accounts for 2.8% of Russia's GDP, this is the most significant contribution to the new technologies development, but it is still lower than the average for leading countries (3.8%). The share of government spending and private investment in GDP is also lower than in the considered countries, and the volume of digital technology exports is four times less than imports. If to bring the volume of Russian investment in ICT, including digital spending by households and companies’ and state’s investments, to the average level of the compared countries, the share of the digital economy in Russia will grow to 6% of GDP, which will allow Russia to take a place between India and China. Table 2 shows the contribution of the digital economy to Russia's GDP, and presents its components in comparison with other countries (Yashin, Grigoryan, 2015).

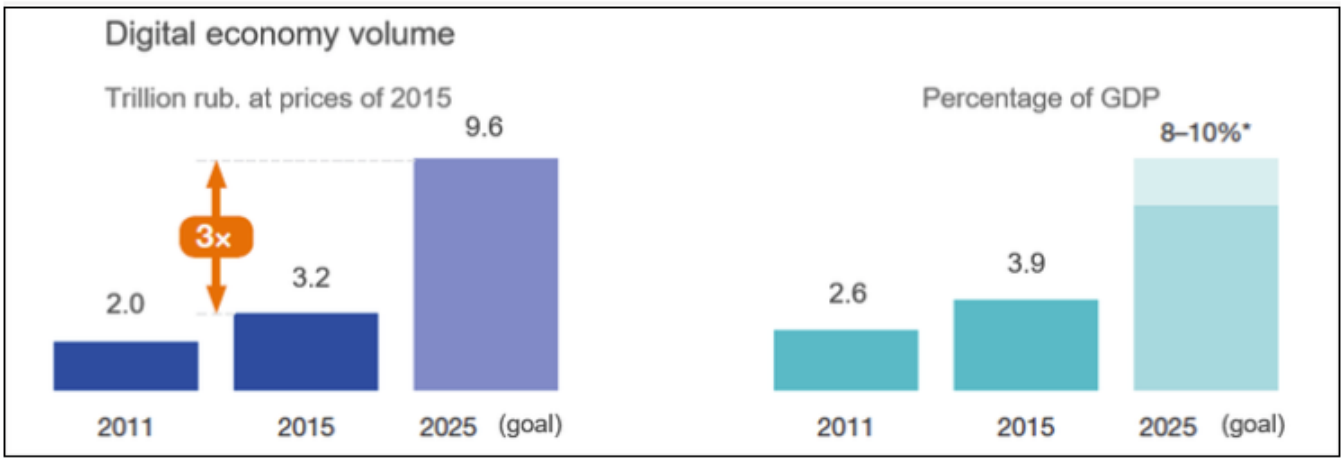
**Table 2**
The digital economy contribution to Russia's GDP compared to other countries

| Indicator (percentage of GDP) | USA | China | European Union * | Brazil | Russia |
|---|---|---|---|---|---|
| The digital economy size | 10.8 | 9.8 | 8.1 | 6.1 | 3.8 |
| Digital household spending | 5.2 | 4.7 | 3.6 | 2.1 | 2.5 |
| Digitalization of companies | 4.9 | 1.7 | 3.8 | 3.5 | 2.1 |
| Government spending on digitalization | 1.2 | 0.3 | 0.9 | 0.7 | 0.4 |
| ICT export | 1.3 | 5.7 | 2.4 | 0.2 | 0.4 |
| ICT import | -2.0 | -2.6 | -2.7 | -1.4 | -1.6 |

* Data for five countries of Western Europe – Great Britain, Germany, Italy, France and Sweden

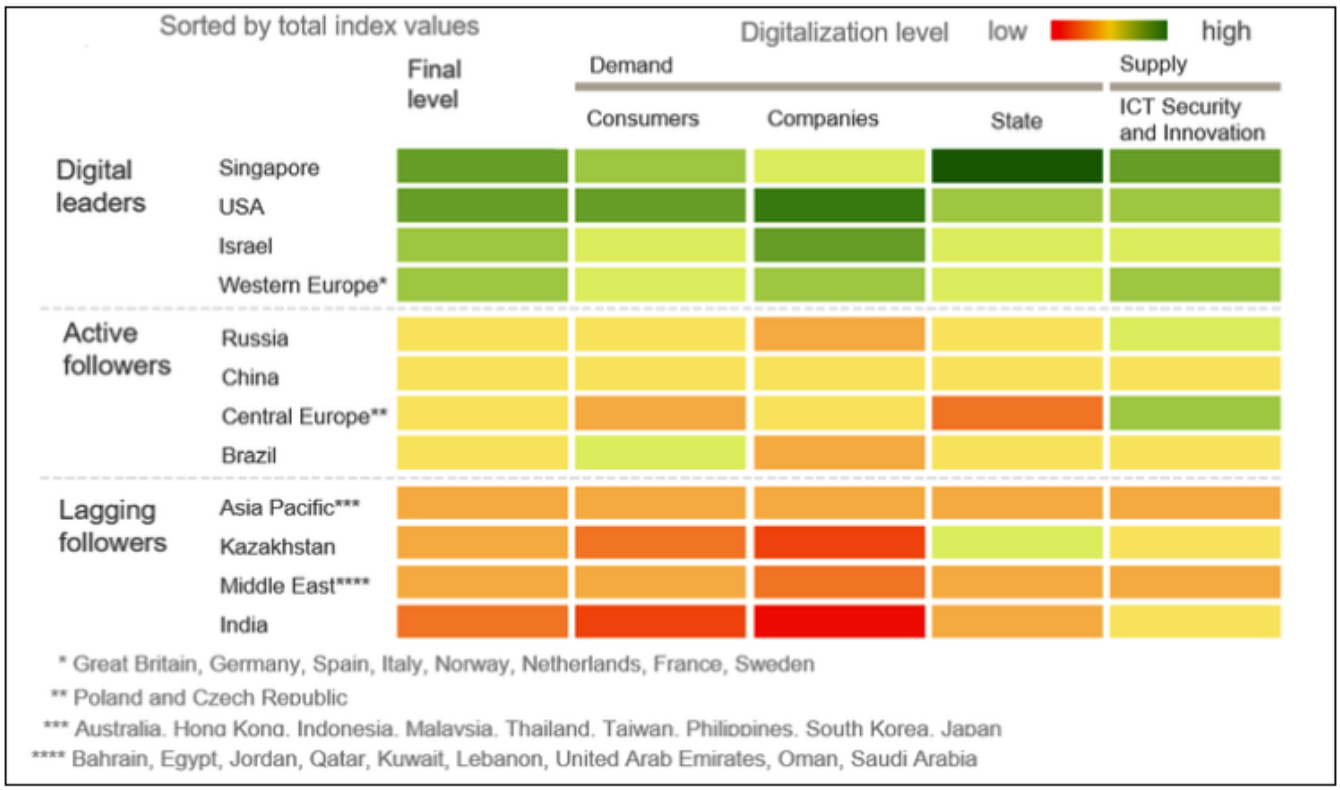
A complex but achievable goal is to triple the digital economy volume from 3.2 trillion rubles in 2015 to 9.6 trillion rubles in 2025, maintaining the prices of 2015, which will require maintaining the average annual digital economy's growth rate at 12%, which was observed in 2010-2015 (Figure 1). These results will be equivalent to an increase in the digital economy's share from the current 3.9% to 8-10% of GDP (depending on oil prices and other macroeconomic parameters), which on average corresponds to the current level of leading digital economy countries: USA, China and Western Europe. Prospects for the growth of the Russian digital economy above this level until 2025 seem unlikely. This is indicated by the experience of the above-mentioned countries, where in recent years, after reaching 8-10%, the digital economy growth rate has slowed significantly (Decree of the President of the Russian Federation, 2017; Bughin, Hazan, Labaye, Manyika, Dahlstrom, Ramaswamy, Cochin de Billy, 2016). By the information and computer technologies (ICT) development level, Russia is confidently evaluated as developed countries group representative, which are in the arrears of the group of leaders. The ICT sector gross value level estimation in the Russian Federation GDP for 2018 is 2.6%, a decrease of 1 percentage point to 2017 data.

**Figure 1**
The tripling of the digital economy in Russia by 2025




Analysis of the overall digitalization level (Figure 2) indicates that Russia has managed to achieve certain success in the digital economy development. Currently, the country is among the leaders of "active followers" group due to investments in expanding ICT infrastructure and implementing digital technologies in government, but it is significantly behind the leading countries, especially in terms of digitalization of companies (European Commission, 2019).

**Figure 2**
Comparison of Russia's digitalization
index with world economies




# 4. Analysis of the digital technology implementation by industries

The digital transformation of an enterprise can considered from two perspectives. The first is the business model digitalization; it means the customer interaction model transformation, changing traditional sales to the "smart" product model, complemented by a digital service for the client. The second is operational digitalization4 it means digital tools implementation in order to improve the enterprise's efficiency, within the existing business model. According to the KPMG global survey of 2018, 97% of industrial enterprises' CEOs see digital transformation as an opportunity to increase productivity and businesses development. An important aspect of technological transformation is the operational-calendar planning complex modernization, which should include the following components (Efimushkin, Ledovskikh, Scherbakova, 2017; PWC, 2019):

1. Resource Allocation and Status (RAS). Necessary tool for monitoring the general condition and procedures of resource allocation in real time. If it is assumed that this is a machine stock, employees as resources, in this case the system automatically monitors their condition, and an analysis is carried out taking into account available resources.

2. Operations/Detail Scheduling (ODS). Allows the system to implement operational and detailed planning in order to optimize the existing production schedule and organize parallel work at existing production facilities. These measures will significantly reduce the amount of time required to obtain the final product and reduce the downtime of the equipment.

3. ispatching Production Units (DPU). The procedure for organizing the system work in the field the production process supervisory control. It allows to gain information on the production process (at the workshop level) in the most efficient manner, i.e. provides the opportunity to make adjustments in real time, which contributes to the effective organization of the necessary range of work.

4. Document Control (DOC). The document management system realizes the necessary control over the content and passage of various documents for each manufactured product (for example, drawings, regulations, various technical documentation, etc.). It allows making out workshop documents: work orders, shift tasks, etc., and gives the opportunity to change document templates.

5. Data Collection/Acquisition (DCA). It is a collecting and storing data technology. It saves all the data necessary for the system operation, including those that can be downloaded from the outside.

The digital tools implementation in operational activities allows enterprises to improve the decisions' quality and get the first results within the first year. In particular, IoT solutions and big data analytics play an important role in the production processes efficiency improvement. They allow quickly collect information on physical indicators and translate it into digitized data for further processing, exchange information in electronic form along the entire value chain and process information using machine learning and artificial intelligence to obtain qualitatively new conclusions. In addition, they can be used for the production process and equipment physical parameters remote control based on decisions made taking into account the results of deep analytics. By combining various technologies, enterprises receive tools that make it possible increase the finished products output, reduce the level of rejects, reduce the materials consumption and increase equipment availability.

The high digitalization level in the modern world, as a rule, is the competitiveness' and companies' prospects', industries' and national economies' synonymous. The Digital Quotient, which contains companies' comparative assessment on four grounds, which are strategy, digital culture, competencies, organizational model, shows that enterprises that more actively implement digital solutions, usually demonstrate higher financial results. Mutual conditionality of these factors, however, is not mandatory.

In terms of private companies' digitalization, Russia is still lagging behind the leading countries. The private sector does not take advantage of the active digital technologies development usage by consumers; there are little invests in the technological achievements use, in increasing productivity and creating new products and services. The volume of investments by private companies in digitalization is only 2.2% of GDP, while in the USA it reaches 5%, in Western Europe it is 3.9%, in Brazil it is 3.6% (Decree of the President of the Russian Federation, 2016). As a result, the ability to support Russian companies' competitiveness is lower not only internationally (a small amount of high-tech exports), but also within the country (crowding out Russian players in electronic commerce, social networks, search engines by foreign companies). Moreover, the low investment level on the digital solutions' customers part limits the Russian companies' development opportunities, suppliers of digital solutions, since the domestic market is the first step for the future digital leaders growth.

The share of digital goods and services export in Russia's GDP structure remains extremely low: 0.5% of GDP versus 2.5% in Western Europe, 2.9% in India and 5.8% in China, which indicates the weak competitiveness of Russian ICT-products and services in world markets. Over the past few years, software exports have been growing rapidly in Russia: the average annual growth rate of this indicator in 2010–2015 was 15%. The situation was facilitated, first of all, by the global software market rapid development. According to IDC's assessment, in the period until 2020, this sector will grow by an average of 7% per year, which is twice as much as other world IT markets forecasted figures. As for the ICT equipment manufacturing industry, there are several successful niche manufacturers in Russia, for example, optical equipment, supercomputers, and high-performance computing services, but such goods' share in Russia's IT export structure is only 9% and is growing very slowly. At the same time, Russia's dependence on imports in certain market segments is becoming critical: the country imports from 80% to 100% of IT equipment in various categories and about 75% of software.

The new technologies development is transforming entire industries and individual businesses. Steps in the digital transformation field, taken by competitors, put pressure on management. At the same time, digitalization requires investment, therefore, companies embarking on this path need to determine the tactical and long-term transformation goals, a "road map" and a business case. According to a study conducted by leading experts, to date, six out of ten industrial enterprises in the world already have a developed digital transformation program. At the same time, a quarter of enterprises have a program horizon of less than 12 months, while the majority (61%) plan to implement the existing program in one to three years. However, these indicators, both in the world and in Russia, greatly reflect the largest enterprises' development level, means the industry leaders (Ilchenko, Babaev, 2004; EEC, 2017).

Within the framework of the pilot projects, enterprises set technology-testing task, showing a measurable economic effect, and starting cultural transformation process within the organization itself. Such pilot projects in most cases are implemented with the external expertise of necessary equipment suppliers' dedication, IT companies, consultants and technology startups. For market

non-leaders, new technologies are still just plans. Small and medium-sized businesses lag behind the largest enterprises not only in terms of digital technologies implementation, but often in terms of traditional robotics and production automation. The gap in the implementation speed is connected with the financial resources availability difference, emerging technologies implementation experience and the savings available to large enterprises.

# 5. Conclusion

New digital technologies generation creates a new consumer value level through previously unattainable combination of accessibility and customization, with the delivery of analytically customized goods and services at once by request and often at a much more attractive price compared to the traditional offer. Very often, under the extinction threat, traditional corporations have to rethink their activities completely. One of the survival ways is to find new partnerships, to promote the independent third-party organizations' ecosystem development and to delegate them fulfilling most of the product development tasks, production and delivery. Such an approach to the activities using platforms requires a rethinking and revision of the past managerial principles.

The digitalization of a high-tech enterprise is associated with the new technologies implementation that have become available for business in recent years: big data analytics and machine learning, artificial intelligence, robotics, augmented reality, Internet of things (IoT), 3D printing, cloud computing. The prerequisites for the digitalization development and penetration became the technology cost and computational power reduction, as well as high-speed data transmission availability increase. Leading experts presented the factors' analysis results of affecting the digital technologies implementation speed. The identified factors can be divided into two groups: the internal organization's capabilities and the digitalization incentives availability.

The internal organization's capabilities include the strategic solution availability and the possibility of its implementation, which is characterized by the company's management competencies and the management processes' quality. This also includes the employees' knowledge and skills necessary for digital transformation: not only IT professionals, but also the knowledge and skills of other professionals in the digital technologies field (at the same time the knowledge level of low-skilled employees also has a significant impact). Effective enterprise's personnel resources distribution, taking into account skills and knowledge, also belongs to internal capabilities. The digitalization implementation incentive is the competition level in the industry, which gives an impetus to the enterprises' management to increase labor productivity. In addition, the access to digital technologies, the open market, the financing availability for making digital technologies investments, the possibility of flexible entry and quitting the projects in the terms of risky investments in new technologies is important. The labor legislation flexibility in terms of the resources redistribution, additional tax and regulatory benefits presence are important. While working with these factors, the state can support enterprises and accelerate digital technologies implementation, because up to 60% of all available potential for enterprises' productivity increase is connected with them.

The presence of internal capabilities and additional incentives for digitalization gives enterprises the opportunity to start moving along the transformation path. However, even having the necessary resources, companies face internal resistance, business processes' change reluctance, and difficulties integrating with "traditional" solutions. It is important to remember that the enterprises' digital transformation is not a replacement of all employees with robots, but an expansion of managers' and employees' capabilities through new technologies. More than 70% of industrial enterprises' managers believe that digitalization will create additional jobs, rather than reduce their number.

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[Index]

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