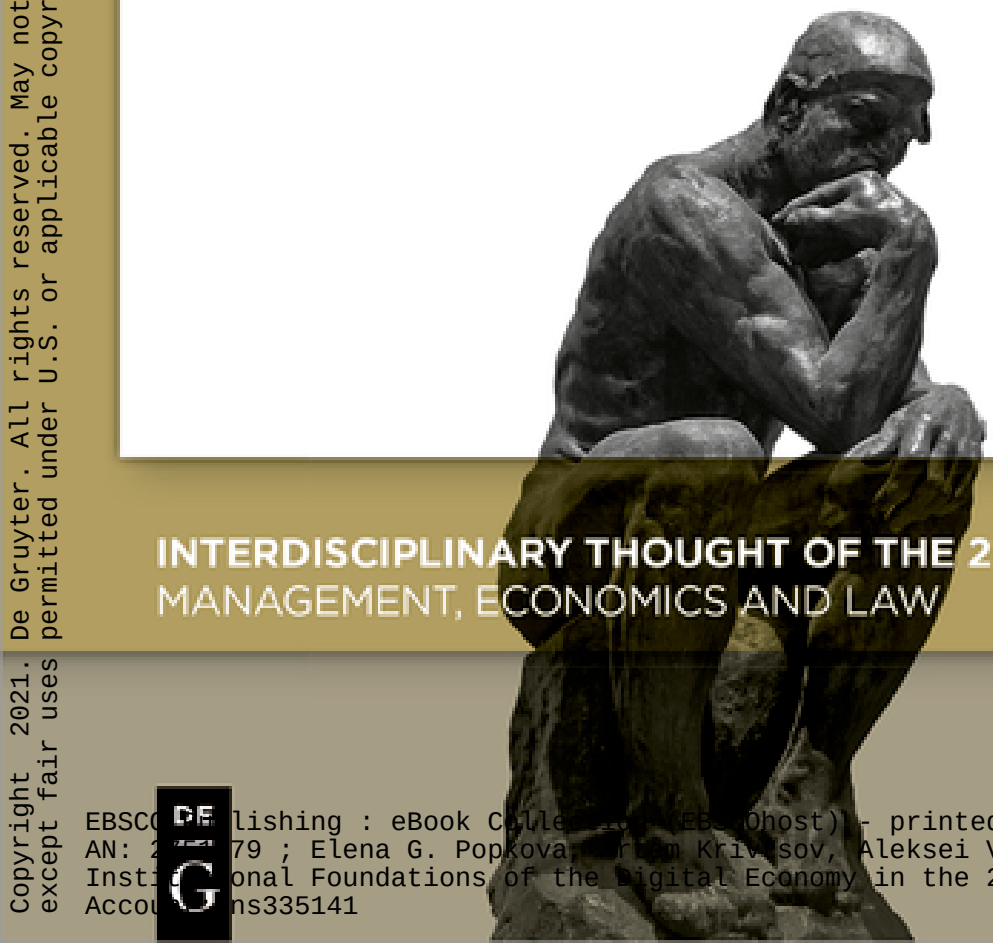
DE GRUYTER

# THE INSTITUTIONAL FOUNDATIONS OF THE DIGITAL ECONOMY IN THE 21ST CENTURY

*Edited by Elena G. Popkova, Artem I. Krivtsov and Aleksei V. Bogoviz*



INTERDISCIPLINARY THOUGHT OF THE 21ST CENTURY
MANAGEMENT, ECONOMICS AND LAW

# The Institutional Foundations of the Digital Economy in the 21st Century

# Interdisciplinary Thought of the 21st Century

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Elena G. Popkova and Artem Krivtsov

## Volume 3

# The Institutional Foundations of the Digital Economy in the 21st Century

Edited by
Elena G. Popkova, Artem I. Krivtsov
and Aleksei V. Bogoviz

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# Digital Economy in the 21st Century: An Introduction to the Institutional Approach

The 21st century is the age of prime of the digital economy. Each next decade of the 21st century starts a new wave of digitalization of economic systems, thus determining the internal specifics of their functioning and the conditions of their global competition. During the first decade (2000–2010), the telecommunication infrastructure was created – development and preparation for practical application of digital technologies and their pilot implementation into the economic practices of households and entrepreneurial structures. The initial experience of new technologies' application was accumulated, and sustainable practices of implementing digital economic processes formed. A motive for market players who used digital technologies was receipt of competitive advantages from higher speed, precision, and quality of the economic result.

This prepared a social environment for further technological progress. The information society was formed – its specifics include high level of media literacy, high demand for hi-tech and hi-tech products (goods and services), flexibility of behavior in market, striving for optimizing individual economic practices (at the level of households) based on the leading technologies, openness and acknowledgment of the value of new knowledge, information and technologies, positive treatment of globalization and readiness to use its capabilities, and susceptibility and inclination for support for innovations.

The second decade (2010–2020) stimulated further dissemination of digital technologies. Hi-tech entrepreneurship was formed based on the formed telecommunication infrastructure and as a response to the existing demand. In the course of its development, application of digital technologies turned from voluntary to mandatory – forced under the pressure of competition. As a result, high technological barriers of entrance formed in a lot of sectorial markets.

Governments around the world adopted national programs and strategies of economic systems' digitalization. The Fourth industrial revolution received official support and government financing. Digital competition passed from the corporate level (micro-economic) to the national (macro-economic). An international ranking of digital competitiveness appeared, and global competitiveness index received an addition "4.0".

This stage-by-stage character of the digital economy's development in the 21st century reflects its institutional nature – essence and perspectives of the digital economy's development are determined by successfulness of institutionalization of progressive economic practices. The basic social institutions of the digital economy of the 21st century are information society, telecommunication infrastructure, hi-tech entrepreneurship, and e-government.

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The uniqueness of the digital economy, as an evolutionary form of economic systems, consists in its formation in the conditions of ready market relations. That's why, unlike the previous forms of economic systems, the transition to which had been started by government, digital transformations took place under the pressure competition, not regulation – by own initiative of market players. The modern market nature of the digital economy, in which the elements of free competition and government regulation are combined, hinders its study from the positions of the neoclassical (based on the "pure market concept") and from the positions of neo-Keynesian (envisaging strong state regulation and limitation of market liberties) economic theories.

The mixed economy of the 21st century, with progressive market relations and moderate de-regulation, in which the digital economy formed and is developing now, has no place in the traditional fundamental concepts and "ideal" models. That's why its research from the positions of the existing approach to studying economic systems, which is based on the positions of the neoclassical and neo-Keynesian theories, causes multiple gaps and contradictions, hindering the formation of a comprehensive concept of the digital economy.

For solving this problem, the authors of this book develop and use a new – institutional – approach to studying the digital economy, which allows overcoming the gaps and solving the contradictions in its research and forming a systemic view of its essence and prospects of development. The book consists of eight parts, each of which describes the institutional view of the 21st century digital economy.

Part I develops and substantiates a scientific concept of 21st century digital economy. The digital economy is defined as a modern type of economic system, and the principles of functioning and the priorities of its development are determined. Classification of breakthrough digital technologies is performed, and the prospects of their application in economy are given.

Part II is devoted to the process of the digital economy's institutionalization in the 21st century. It defines the essence and logic of the process of digital transformation of sectorial markets and outlines the current tendencies of economy's digitalization in developed and developing countries. The main stages of economy's digital modernization are distinguished.

Part III determines the meso-level institutions of the 21st century digital economy; outlines the problems and perspectives of regional economy's digitalization; develops the institutional model of the digital economy formation in a modern region. Management of a modern region based on digital technologies is studied.

Part IV distinguishes the macro-level institutions of the digital economy in the 21st century; considers state institutional regulation of the process of economy's digital modernization; determines the role of financial institutions in support for the digital economy; presents a view of the 21st century digital economy from the positions of developed and developing countries.

Part V dwells on the global institutions of the digital economy in the 21st century. It determines the barriers and opportunities for development of international trade in the digital sphere; considers the existing and perspective international institutions of support for economy's digital modernization; offers and tests a scientific and methodological approach to provision and evaluation of global competitiveness of the digital economy.

Part VI contains the overview and analysis of case studies of institutions of the digital economy in the 21st century. It dwells on the problems and prospects of economic cooperation between Russia and Mexico; substantiates the innovative critical success factors for public-private partnerships in infrastructure projects of developing countries by the example of Zambia; presents a prediction mechanism of the territorial socio-economic processes in formation of the information systems; outlines the specific economic security regulations in the context of pathological crises of digital transformation of agricultural organizations.

Elena G. Popkova, Artem I. Krivtsov and Aleksei V. Bogoviz

# Part I: **The Scientific Concept of the Digital Economy in the 21st Century**

Aleksei V. Bogoviz, Svetlana V. Lobova, Alexander N. Alekseev
and Lubinda Haabazoka

# 1 Digital Economy as a Modern Type of Economic System

## 1 Introduction

The 21st century is the age of the digital economy. New digital technologies led to formation of the digital segments of sectorial markets – these segments actively used the possibilities of digitalization and featured electronic economic operations (non-cash payments, electronic communications). In this period, the digital economy was treated as a vector of growth and development (i.e., a part) of the post-industrial economy.

After this, digital technologies became very popular and were adapted to all economic processes. This led to the systemic digital transformation of economy and the transition to a completely new type of economic system – digital economy. Thus, deep changes were observed in all economic spheres. The social sphere transformed into the information society and the knowledge society, in which knowledge is the highest value, and economic subjects are susceptible to new information and technologies.

The business environment performed a transition to electronic (digital) business, which actively uses the leading technologies for full automatization of business processes and the global product sale via the Internet. The regulatory environment became electronic as well – it reached a high level of automatization of state monitoring, control, regulation, and provision of state services.

The described process of digitalization acquired a global scale and determined the new foundations of functioning and development of economy. However, scientific study of this process is behind the economic practice – which causes a set of problems. Firstly, there is no clear scientific idea of the essence of the current changes, which does not allow for their qualitative (positive or negative) treatment.

Secondly, the factors of formation and development of the digital economy are not clear – which reduces the effectiveness of its state management and creates barriers on the path of forecasting the future perspectives of development of the modern economic systems. Thirdly, uncertainty of the causal connections of

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formation and development of the digital economy hinders the start of the process of digitalization and involvement of developing countries in the global digital competition (e.g., the least progressive countries of Africa) and formation of the global digital economy, slowing down the growth and development of the global economy.

The working hypothesis of this research is that the above problems are caused by imperfection of the existing scientific and methodological approach to studying the digital economy. Thus, it is necessary to develop a new, better approach, which would allow for systemic solution of these problems. The purpose of this chapter is to develop a scientific and methodological approach to studying the digital economy as a modern type of economic system, which would allow for its systemic research and for completion of the existing gaps in its scientific concept.

## 2 Materials and Method

Digital economy – as a modern type of economic system – was studied in the works Alpidovskaya and Popkova (2019), Andronova et al. (2019), Fedotova et al. (2020), Glazova (2015), Inshakova and Bogoviz (2020),Litvinova (2015), Natsubidze (2015), Pankova (2015), Popkova (2019), Popkova (2017), Popkova et al. (2020), Popkova and Gulzat (2020a), Popkova and Gulzat (2020b), Popkova et al. (2018), Popkova and Sergi (2018), Popkova and Sergi (2019), Ragulina (2019), Ragulina et al. (2019), Sergi (2019), Shulus et al. (2020), and Stolyarov et al. (2020).

The content analysis of the above publications shows that the existing scientific and methodological approach to studying the digital economy is based on the neoclassical and Neo-Keynesian economic theories. Though these theories are different by all basic provisions and develop separately, the essence of the both approaches – during the study of the digital economy – is brought down to studying the roles of state and the specifics of the digital economy regulation.

The neo-classical economic theory points out the necessity for reducing state regulation and creating favorable and effective “rules of the game” and conditions for the digital economy development under the influence of the market mechanism. Contrary to it, Neo-Keynesian theory requires the increase of state regulation. A completely new alternative is the neo-institutional theory, which allows presenting the digital economy as a social institution, and thus moving attention from state regulation to the natural market processes.

It is offered to create a new scientific and methodological approach to studying the digital economy based on the neo-institutional theory. The comparative analysis of the existing and the offered new approaches is shown in Table 1.1.

**Table 1.1:** Comparative analysis of the existing and new scientific and methodological approaches to studying the digital economy.

| Criterion of comparison | The existing approach, based on the neoclassical and Neo-Keynesian economic theories | The offered new approach, based on the neo-institutional economic theory |
|---|---|---|
| Scientific treatment of the digital economy | macro-economic object of state management | macro-economic social institution |
| Studied aspects of the digital economy | goals, factors, and consequences of state management of the digital economy | Social processes (connections, relations, practices, and experience), which stimulate the formation and development of the digital economy |
| Stages of the digital economy, which are to be studied | formed digital economy, at the stage of its development | all stages, from formation of the digital economy to its further development, which allows determining its genesis |
| Determined processes | external processes, only result is visible | external and internal processes, causal connections are visible |
| Assumption on the initiation of transition to the digital economy | only the state initiative on formation of the digital economy through modernization is allowed | state and private initiatives are allowed which allows studying the market mechanism of formation of the digital economy |
| Possibility of critical analysis | absent – the digital economy is considered as an evolutional (more prefer a priori) type of economic system | present – critical analysis of the digital economy from the positions of effectiveness is stimulates, and its assignment to “institutional traps” (false branch of evolution of economic systems) is possible |

Source: developed and compiled by the authors.

As is shown in Table 1.1, the existing approach, which is based on the neoclassical and Neo-Keynesian economic theories, offers a scientific treatment of the digital economy as a macro-economic object of state management. The studied aspects of the digital economy include goals, factors, and consequences of state management of the digital economy. The digital economy, which is already formed, could be studied at the stage of its development. Only external processes are determines, and only the result of digitalization is visible. Only state initiative on formation of the digital economy through modernization is allowed. The possibility of critical analysis is absent – the digital economy is studied as an evolutionary (more perfect a priori) type of economic system.

The offered new approach, which is based on the neo-institutional economic theory, treats the digital economy as a macro-economic social institution. It studied social processes (connections, relations, practices, and experience), which stimulate the formation and development of the digital economy. The new approach allows covering all stages – from formation of the digital economy to its further development – for determining its genesis, in particular. It takes into account external and internal processes, which shows causal connections. The new approach allows for state and private initiatives, which allows studying the market mechanism of the digital economy formation. Critical analysis of the digital economy from the positions of effectiveness is stimulates, and it could be assigned to the "institutional trap" (false branch of economic systems' evolution).

# 3 Results

The place of the digital economy in the system of evolutionary types of economic systems is shown in Table 1.2.

**Table 1.2:** Evolution of the types of economic systems before the digital economy.

| Characteristics | Type of economic system | | | |
|---|---|---|---|---|
| | **Agrarian (pre-industrial) economy** | **Industrial economy** | **Post-industrial (service) economy** | **Digital (neo-industrial) economy** |
| State of economy's evolution | 1st stage | 2nd stage | 3rd stage | 4th stage |
| Conventional timeframe of the stage | before 18th century | 18th – 1st half of 20th century | 2nd half of 20th century | since early 21st century |
| Sectorial specialization of economy | agriculture (agrarian sector) | industry (extracting and processing) | service sphere | hi-tech and hi-tech products |
| Dominating technologies | Pre-digital technologies: manual labor | conveyor | telegraph, telephone | Digital technologies: mobile communications, Internet |

**Table 1.2** (continued)

| Characteristics | Type of economic system | | | |
|---|---|---|---|---|
| | **Agrarian (pre-industrial) economy** | **Industrial economy** | **Post-industrial (service) economy** | **Digital (neo-industrial) economy** |
| | | Fragmentary automatization: | | |
| Level of automatization | automatization is absent | automatization of production | automatization of production and distribution | full automatization, including management |
| Social environment | agrarian society | industrial society | consumer society | knowledge society, information society |
| Business environment | geographically concentrated business | transnational corporations (network business) | | global electronic business (no boundaries) |
| Approach to state regulation | Pre-digital state management: subjective, with incomplete coverage, with reduced accessibility of state services | | | e-government |
| End of the stage, which stimulates the transition to the next stage | 1st industrial revolution, formation of Industry 1.0 | 2nd industrial revolution, formation of Industry 4.0 | 3rd industrial revolution, formation of Industry 3.0 | 4th industrial revolution, formation of Industry 4.0 |

Source: developed and compiled by the authors based on McKinsey & Company (2020).

As shown in Figure 1.2, the pre-digital (neo-industrial) economy is the fourth stage of economy's evolution, which started in the 21st century. The digital economy envisages sectorial specialization in hi-tech and hi-tech products. Digital technologies dominate: mobile communications and Internet. This ensures full authomatization, including production, distribution, and management. Social environment, in which the digital economy forms and develops, is the knowledge society and information society. Business environment is a global electronic business (without boundaries), the approach to state regulation – e-government. The end of the stage, which stimulates the transition to the next stage: 4th industrial revolution, formation of Industry 4.0.

The algorithm of the digital economy formation as a modern type of economic system from the positions of the existing scientific and methodological approach (neoclassical and Neo-Keynesian economic theories) is shown in Figure 1.1.

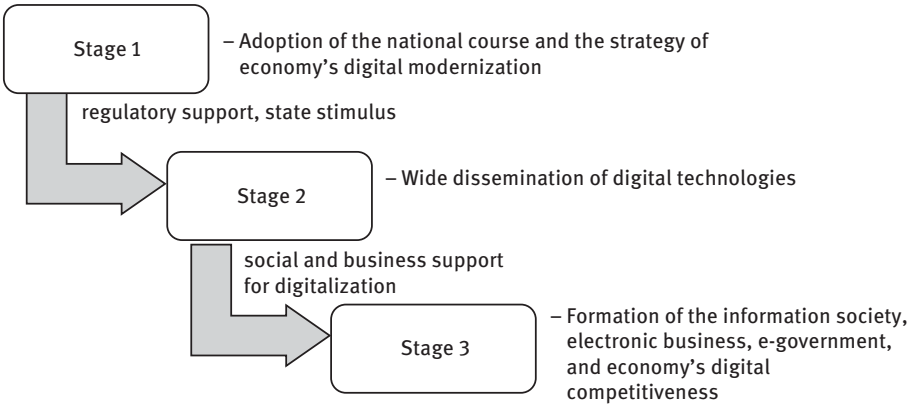


**Figure 1.1:** The algorithm of the digital economy formation as a modern type of economic system from the positions of the existing scientific and methodological approach (neoclassical and Neo-Keynesian economic theories).
Source: developed and compiled by the authors.

As shown in Figure 1.1, the existing approach, which is based on the neoclassical and Neo-Keynesian economic theories, envisages the adoption of the national course and the strategy of economy's digital modernization at the first stage. This forms the regulatory support and state stimulus for transition to the digital economy. The second stage envisages wide dissemination of digital technologies, which ensures social and business support for digitalization. The third stage envisages formation of the information society, electronic business, e-government, and digital competitiveness of the economy.

The process of institutionalization of the digital economy (alternative algorithm of the digital economy formation) as a modern type of economic system from the positions of a new – institutional – approach is shown in Figure 1.2.

As shown in Figure 1.2, a precondition for starting the process of the digital economy institutionalization is systemic influence of globalization and technological progress on the economic system. At the first stage, as a result of synergy, this leads to emergence of digital technologies in the economic system and to appearance of the need to apply them. At the second stage, the experience of their application by business and society is accumulated, and spontaneous social norms and rules appear; at the third stage, the state joins this process – it starts the pilot implementation with the following legitimization of the official regulated norms, standards, and plans of the digital economy development.

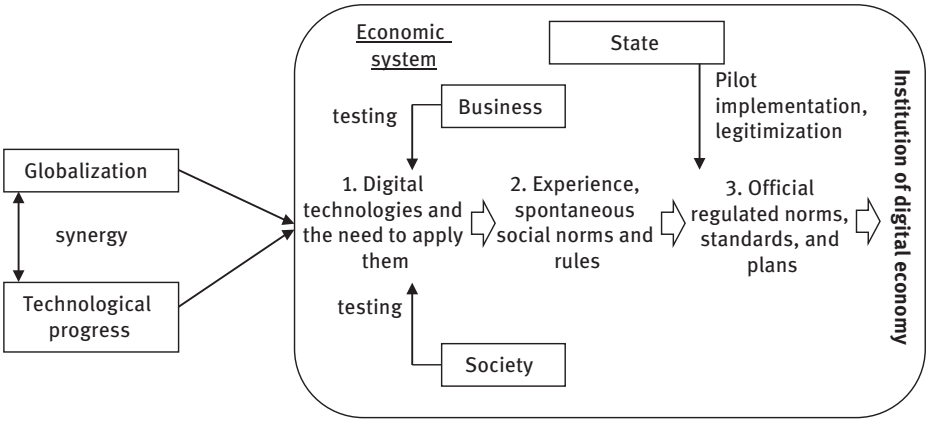


**Figure 1.2:** The process of institutionalization of the digital economy as a modern type of economic system.
Source: developed and compiled by the authors.

# 4 Conclusion

Thus, a new approach to studying the digital economy has been offered; it is based on the neo-institutional economic theory. The institutional approach has two advantages as compared to the existing approach, which is based on neoclassical and Neo-Keynesian economic theories. Firstly, the institutional approach allows for a more complex and detailed analysis of the digital economy.

Secondly, the new approach describes formation and development of the digital economy as a continuous, consistent process. Thirdly, the institutional approach expands the boundaries of the digital economy formation and eliminates the necessity for initiation of the process by the state. Erasing the limits of regulation, the new approach allows involving all countries of the world in the process of digital transformation of the global economy, allowing them to use the natural market mechanism for this.

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Marina L. Alpidovskaya

# 2 "Digitalization"- Overcoming Institutional Barriers

## 1 Introduction

The polysemantic word "digitalization" has firmly entered the lexicon of the Russian economic elite. Almost no one doubts that without high-quality digital renewal, robotization and structural changes, the Russian economy will not be able to overtake, or even catch up with the Western economy in the near future.

The digitalization is supposed to result in accelerated pace of technological renewal and a complete rejection of the dependence of the Russian economy on external factors that stimulate its raw materials orientation. At the same time, improving living standards is not only a goal, but also a determining factor and condition for both the digitalization of the domestic economy and intensive economic growth.

## 2 Methodology

To resolve the problem of overcoming the border of modernization (based on the advanced digital-development technologies), as well as the problem of the role of man and his dialectical hypostasis of the Creator and implementer of new ideas in the new digital society, it is suggested using political and economic analysis of socio-economic relations in the process of production, distribution, exchange and consumption of material goods and services, economic categories and laws.

## 3 Results

In terms of its costs and duration, the digitalization program should represent a huge investment project that cannot be implemented without economic intervention and the power of the state.

But this is in a perfect world . . . Unfortunately, the aforementioned has not been observed yet. Let us start with the etymology. The true meaning of the word "digitalization" is the transferring an economy to a "flexible" state from the current. That is, modification, modernization, reorganization, internal degeneration according to the

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only true, from the point of view of digital-reformers, pattern of "digital". Internal degeneration of socio-economic systems has never been without serious consequences, i.e. without cultural trauma and crises.

Back in the 1990 during the post-Soviet reforms, reformers turned Russia from a dead end, as it has been and still is, the development path to the mainstream market that the whole world is following. Of all the scientific movements that serve as the ideological source of economic policy, the Russian government has chosen monetarism, the main policy tool of the IMF and industrialized countries. Yet other methods of regulating the economy were unjustly discarded by reformers.

The foundations of modern economic science and practice are not at all those ideas about the free market that existed in the middle of the 19$^{th}$ century, in one way and another adopted by our reformers. They are based on state regulation of processes in the economy, including the market sector, which existed in our country in the XX century.

In addition, the reformers were not so kind to take into account that not a single country in the world following the course of monetarist reforms has managed to get impressive achievements in the national economy and has turned into a modern civilizational periphery. Why should Russia be an exception?

In the conditions of a peripheral economy, monetarism forces the country to take a peculiar place in the international division. The competitiveness of the country in these conditions is doubtful, and global leadership cannot be even discussed!

Moreover, Russia is an originally industrialized country, and, unlike others, has something to lose. Over the last time, Russia has been rapidly deindustrializing. And in the course of reforms carried out to this day, no changes have occurred. The "mimicry" of Western institutions, the Westernization, is going on.

If we consider the Russian economy as an element of the world system, we can state that, given the large supply of natural and labor resources and vast territories, and taking into account the level of scientific and technological potential that has been preserved from the past, Russian economy is a serious potential competitor for developed countries.

The state policy of the developed Western states is based on the principles according to which their governments strive to maintain and increase the high social level of their population, and try to fix high standards. Due to which, as in any competition, it is natural for them to pursue a foreign economic policy that promotes the existence of competitive relations, to put it mildly, that impede and prevent the revival of Russia's production potential. And the lack of competition from the real sector of the Russian economy allows Western countries to receive monopolistically high profits. Russia, day after day, year after year, is losing its life base, which is production and highly skilled labor.

In the absence of the development of domestic production in Russia, the technological lag behind developed countries will become more significant. Hence the extreme need for the urgent development of the national production sector, based

on its own resources and productive forces. Russia needs fundamental institutional and structural changes. If specific measures are not taken by the state, the lag in economic development will become catastrophic.

Today there is an obvious technological, technical-economic, structural degradation of the national economy, degradation of the potential of the Russian industry, primarily engineering, conservation of technological backwardness. As a result, Russia suffered the most from the global crisis. The rate of decline in industrial production and investment in Russia is fairly greater than in any of the G20 countries. During the acute crisis, Russia has the worst indicators: approximately 8% of GDP and 40% in engineering. These and similar deplorable results are expressed in the technical and economic noncompetitiveness.

So, the modernization based on digital potentials, as well as the transfer of Russia to the trajectory of scientific and technological development, the development of advanced technologies, should come primarily by the country’s leadership. The national interests and specifics of Russia, by which we mean its cultural and moral traditions, are to be priority goals.

The model of catch-up modernization imposed on the Russian economy dooms home-grown reform-imitators to lag behind. Blind imitation of foreign technology makes it impossible to extract innovative rents. That is, that superprofit, which is formed due to the temporary monopoly on the use of advanced scientific and technical solutions, for the development of which competitors require time and money. This rent is the main source to finance the accelerated development, which allows leaders to build up their competitive advantages by investing in basic research and education. Actually, the ability of expanded reproduction of scientific and technological superiority also forms the possibility of a new “economic miracle”.

However, a new technological order cannot arise for no reason. With the emergence of a new technological order, the preceding order does not disappear and does not turn into an “old junk”. What is changed is only its function: from the resulting it turns into the providing one. Of course, one can agree with the existing opinion that “ . . . in 200–250 years, the industrial sector will be phased out as unnecessary like the agricultural sector is declining throughout the world” But . . . Will the role of the real sector of the economy be really reduced? Perhaps in 250 years it will be. But we are now interested in a near future. And in this regard, investments in infrastructure become particularly important: energy, transport, communications, utilities, modernizing them in accordance with the needs of the new technological structure.

Consequently, modernization should take place everywhere simultaneously, combining the restoration of previously destroyed industrial zones with the formation of “high technology centers”, while relying solely on its own resources.

And in this context, the key community, a skilled workforce, is very important. It is no secret that over the past 20 years, the technical and technological skills of employees of the engineering, and scientific level have gradually fallen. The

technical intelligentsia is being replaced by a new cultural type with a predominantly humanitarian education. Such specialists are adapted exclusively to the functions of an office worker without a rigid professional framework.

We must add that the systemic crisis of the currently prevailing socio-economic system in the growing difficulties of selling goods leads to an increasing distribution costs and a tremendous expansion of the nonproductive sphere. Increasing masses of the population are distracted from productive labor and are focusing on trade, banking, marketing, advertising, etc. More labor is now involved in these areas than in the productive sector and in those sectors where material and cultural goods are created. There is evidence that the share of advertising in the price of goods increased from 5% at the beginning of the twentieth century to 25% in the 1990s, and today for some products its share is at least 50%.

The growing "parasitism" of modern society is manifested in the fact that more and more people are engaged in nonproductive and far from useful work, and, on the contrary, a relatively decreasing mass of social labor is being spent on the production of material and spiritual values.

The already built "post-industrial society" has been discussed for several years. It is the myth of the existence of such a socio-economic system that haunts some of the strata of our society engaged exclusively in "intellectual" labor. Let us make a small note . . . The main purpose of myths was to establish harmony between the world and man, nature and society, society and the individual, and thus ensure the internal harmony of human life. Modern society in its daydreaming already sees the appearance of a new digital "fairy-tale world" that differs from the modern one, how medieval cities differed from industrial centers of the 19th century.

Anyway, what is actually going on? What is the difference between socio-economic systems of the sample of the 1970s and the beginning of the XXI century? In fact, we see the same overpopulated cities with the same conveyor enterprises . . .

Those who believe in the existence of a post-industrial society may argue that in Europe these same enterprises have become much smaller,[1] the population is engaged in other labor (if engaged at all), production is reduced, special workers are hardly in demand . . . Nevertheless . . . The reduction in the number of industrial enterprises does not indicate that society has "overstepped" this stage. The population of the "post-industrial" world consumes goods manufactured at the enterprises of the "industrial" world. And goods are produced in seconds only in myths, people

**1** At the same time, highly developed "postindustrial" economies temporarily manage to slip away from the trap of cost increases in financial costs and move on to stimulate their consumer demand. They outsource the production process to scientifically backward countries with low-paid labor, providing financial mechanisms to return goods produced in these countries to their consumer markets.

just control the machines, and the burden of overworked physical labor is borne by robots that replaced human workers.

Labor and capital have not lost their significance in modern socio-economic systems. Is production capital really no longer a “decisive” factor? Nothing has changed in the world, the “struggle” for resources necessary for the functioning of not decreasing, but developing industrial enterprises goes on. But this happens in the countries of the “third world”.

Russian “digital-reformers” understand the digitalization by literally interpreting one of the signs of a new post-industrial society: a replacement by the services industry of industrial production (by means of its rapid and irrevocable collapse). It is believed that Russian economy is heading in the right direction only if factories and plans are replaced everywhere by office and shopping centers, that are completely robotic.

## 4 Conclusion

The de-industrialization of the Russian economy that has taken place is explained by the above-mentioned concept of “post-industrial society” in its modern sense, which clarifies, justifies and whitens a lot. This concept is closely linked with the doctrine of globalization. Those countries that have embarked on the path of post-industrial development, indeed being at a higher stage of development, declare their monopoly right to control the future. Such management is carried out by methods far from the latest technologies: neither economic, nor commercial, nor military expansion is excluded, as in the “good old days”. The modern globalization of the world economy is nothing but its strengthening according to the world-system theory of Immanuel Wallerstein.

The economy of the province will never act in the image and likeness of the center. It will have some enclaves of modern production and life, provided with resources due to the archaization of production and life of the vast majority of the population. In such a situation, maintaining even the appearance of a democracy will become unprofitable and not necessary. “This will be a world of contrasts: next to the ultra-modern enclaves of the region-economies there will be de-modernizing, archaic and even asocial zones.” That is why the myth of post-industrialism is needed . . . After all, the myth is born and dominates in culture at the stage of archaic consciousness.

In this situation, the question arises: what position will Russia face in the new world? An objective and unbiased analysis of the current situation states that if the liberal line does not undergo changes, then we can only dream of economic recovery. And the digital modernization itself in Russian will gradually turn into a detrimental logical sequence for society as a whole, the final point of which will be archaization . . .

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Andrejs Limanskis

# 3 Development of the Information Technologies Sector in Latvia under Globalization

## 1 Introduction

The Information Technology (IT) industry is one of the fastest growing sectors of the economy globally as well as in Latvia, the EU member state. In the global agenda 2030, the IT plays one of the central roles.

Development of the IT sector can be measured by the number of IT companies and their financial indicators. Criteria of belonging of a company to the IT sector proposed by author is registration in the State register of enterprises under two corresponding NACE codes, namely NACE 62 (Computer Programming, Consulting and Related Activities) and NACE 63 (Information Services). Thus the research gets its focus and can be measured.

The aim of this research is to disclose the trends in the development of IT companies in Latvia and their prospects under globalization.

The tasks to be solved are to review literature on IT sector development in Latvia, define research methodology, investigate the IT sector companies by number, structure and dynamics both in non-financial and financial indicators as well as their employment and taxation indicators.

The object of research is the set of IT enterprises in Latvia.

The subject of research is the trends in the development the IT industry in Latvia in 2013–2018. Research methodology includes both qualitative (literature review, personal observations by the author, expert interviews) and quantitative (time series and structural analysis) methods.

Secondary data comes from official statistics by the Register of enterprises represented by Lursoft, as well as by the State Revenue Authority of Latvia. The data demand organisation in time series and sets for structural analysis.

Primary data stem from personal observations by the author and expert interviews.

Hypothesis1: over the observation period, the number of IT enterprises and their net sales in Latvia increased with the rate above the GDP growth rate.

Hypothesis2: over the observation period, the Return on Sales of IT enterprises in Latvia proved above that of all enterprises.

Novelty consists of disclosing recent trends and introducing of new data in the scientific circulation. The hypotheses are proven. However a number of unfavourable

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phenomena acts as a brake for IT sector. Further research of the IT companies development is proposed in conjunction with broader agenda 2030 concept.

## 2 Materials and Methods

Growth of the IT sector is considered as a component part of the scientific-technological revolution and the digitisation of the economy. Publications in English language form the mainstream in the IT sector development literature in Latvia. McKinsey (2018) regarded Baltic states as challengers.

Some research starts in the state language. For example, Latvian Association of Information and Communication Technologies (in Latvian LIKTA) disclosed (2019), that only 8% of professional leaders consider that in the IT sector the enterprises have already done the digital transformation. Experts (Paurs M, 2017) use to discuss introduction of IT as a challenge for Latvian economy drivers. A number of organisations, like Latvian Internet Association, Association of Computer Technologies of Latvia, Business Software Alliance, Latvian IT Cluster, etc., publish interesting points of view.

Researchers are increasingly attracted by discussing position of Latvia in the Digital Economy and Society Index (DESI) as a composite index that summarises relevant indicators on Europe's digital performance and tracks the evolution of EU Member States in digital competitiveness.

Some attempts are done in researching cases of IT sector hurdles.

In Latvia, however, no published generalised research in the economic tendencies of the development of the IT sector can be found yet. A number of data is brought to attention of those interested, but no complex research was published on economic basis of IT sector development. Time has come to bridge the gap.

The diversity of research methods can be subdivided in the qualitative and quantittative ones.

The qualitative research methods include literature review, personal observations by the author, expert interviews.

The quantitative research methods include time series and structural analysis.

Special role is played by plotting of charts.The time span of five years is relevant because it is necesary and sufficient to demonstraate dynamics of the process under investigation.

Major financial indicators are the industry's turnover and profit. Turnover, or Sales is cleared of the Value added tax (VAT). In Latvia, the enterprises in the IT industry are paying 21% VAT. The profit for this research is Net Profit, i.e. profit after taxes. It can be called yield and is measured in absolute expression in Euro and in per cent as Return on Sales ROS.

Figure of taxes paid is an ever gaining in importance indicator for analysis. It should be taken into account, the growth of profit since 2018 is partly due to reform

in the corporate income tax (CIT) application procedure. Since 2018, the company's profits are not subject to CIT until distribution of net profit. It stimulates re-investment of profit as opposed to paying dividends.

Case study as research method is also to be implemented in the research, namely cases of the Top five of the IT enterprises. Due to significant share in profit the Top five case study gives representative new knowledge. Number of employees as well as financial indicators are to be singled out and investigated by each of the Top five. Interviews by experts provide for interpretation and generalisation of the data included in the article.

Research limitations are, first, certain time lag between event and possibility of financial analysis of it. Big data flow in the Register of enterprises takes certain time to collect and publish the annual reports of companies in Latvia. Thus the financial results of 2018 are taken as the basis with those for 2019 are applied to a selected number of enterprises in conjunction with interviews. The second limitation is exclusion of NACE 61 enterprises. the telecommunication ones. There are some very close to IT, for example wireless communications. In the future the author intends to take them in the focus. Figures from big databases are researched with permission of lursoft and plotted by author in this manuscript however are to be attributed to the author.

# 3 Results

The starting figure for the number of enterprises in the IT sector (NACE 62 (Computer Programming, Consulting and Related Activities), NACE 63 (Information Services)) was 5,098 in 2014. Since then new entries were made in the Register of enterprises by years (see Figure 3.1).

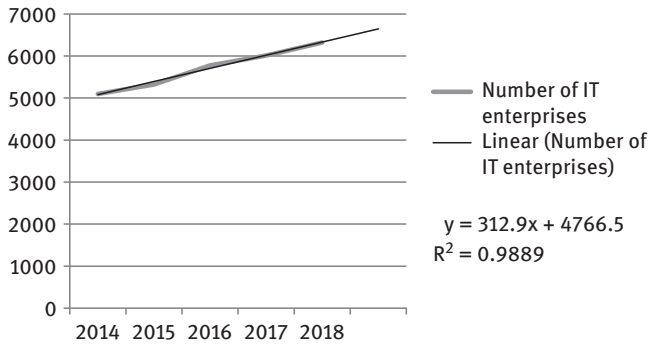


**Figure 3.1:** The number of enterprises in the IT sector in Latvia, 2014–2018.

To be precise, 6,317 IT companies are currently registered in Latvia according to Lursoft (2019). Over the last five years, the number of companies has increased by 23.91%, i.e. 4,7823% annually. Linear trend function applied to the time series discloses a well pronounced trend with very high R2.

The time span is too short to conclude if the process develops with acceleration which would be a very positive observation. However there are no grounds to notice acceleration.

The annual average rate of growth of GDP on Latvia in 2014–2018, by Worldbank (2020) is 3.0716%. It means, the number of IT enterprises is growing 1,5569 times faster.

Of the total, 1033 enterprises, i.e. 16.35% are those with foreign direct investment (FDI). The share seems low and may indicate on certain underdevelopment of internationalisation of entrepreneurship in the IT area in Latvia. However, study of the tendency of FDI in the IT sector makes an area of further research and is not disclosed in this rearch.

Most of IT companies – 66.30% of the total number of companies working in the sector – were registered in Riga and 18.01% in the Riga region. It makes 84.31% of the total. Details of the regional distribution of IT enterprises can be seen lower (see Figure 3.2).

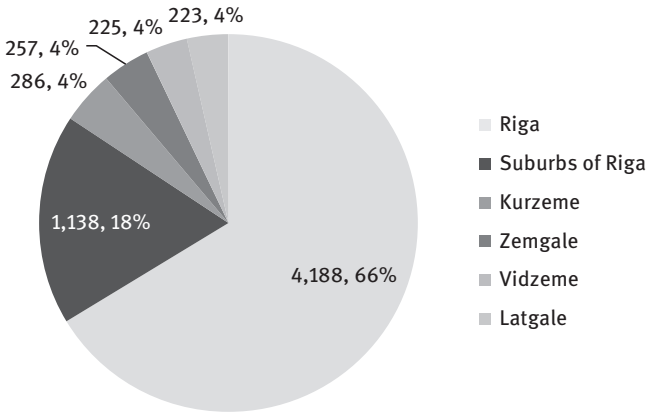


**Figure 3.2:** IT enterprises in Latvia by regions.

It can be observed in the chart, that the concentration of the IT enterprises in the capital metropolis leaves less than 34% for its suburbs and the four administrative regions out of the capital city. Riga suburbs attracted 18.01% of the IT enterprises. The remote regions host approximately the same small numbers and shares (around 4%) of the IT enterprises total, namely from 3.53% in Latgale to 4.43% in Kurzeme.

Statistically, the most rapid increase in the number of IT companies by 400% in the last five years is documented in Rezekne county – if only 2 IT companies were

registered in the county five years ago, now they are already 10 companies. To continue, the number of IT companies registered in Burtnieki county has increased by 116% in five years, in Talsi county – by 106%, and in Dobele county – by 90% (19 IT companies are now opposed to 10 companies five years ago), in Ozolnieki county – by 78%, and in Cesis county – by 69%.

Meanwhile, among the cities of republican importance, the number of IT companies increased most in Liepaja – 65 IT companies were registered in the city five years ago, but today they are already 109 companies, which is an increase of 68%.

The corresponding financial indicators grew faster. For example, the turnover of IT companies registered in Liepaja over the last five years has doubled to EUR 2.28 million, while the amount of taxes paid has increased more than 3 times.

Nevertheless, the most important IT enterprises are in Riga and in the suburbs of Riga.There is every reason to speak about IT cluster embracing Riga and its suburbs, which is quite natural for Latvia with the dominating capital city.

The industry's trend towards growth is reflected in the industry's turnover and profit. The total turnover of the IT industry grows on average by 15% annually. If in 2014 the sector turnover was EUR 599.36 million, then in 2017 it was already EUR 939.65 million. The figures for 2018 are incomplete at the moment of this research because the annual reporting period is still ongoing and several industry leaders have not submitted reports yet. Nevertheless, experts interviewed by author call the accelerating figures, namely above 15% growth.

The total turnover in the IT is 2.24% of the total turnover of companies registered in Latvia. In 2018, the sector had 11 companies with a turnover of over EUR 10 million and 15 companies with a profit of over EUR 1 million.

With the increase in total turnover, the profit of IT companies has also increased, rising from EUR 44.94 million in 2014 to EUR 106.26 million in 2018 (see figure 3.3).

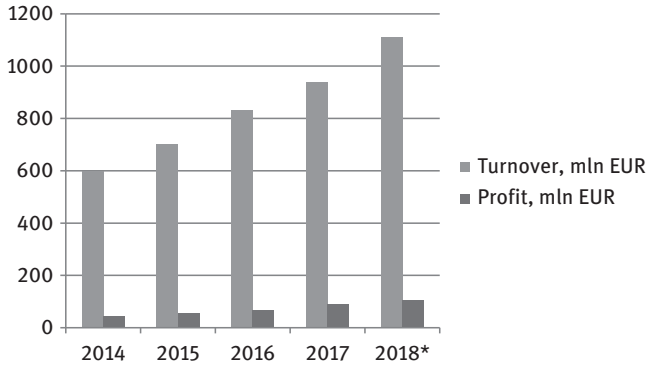


**Figure 3.3:** Turnover and profit of IT enterprises in Latvia, 2014–2018, mln EUR.
Note: *financial indicators for 2018 are published as of 23.05.2019

The growth is evident. Compared to the previous year, in 2018 the sector's profit increased by 57.94%.

The rapid growth of profit in 2018 is partly due to reform in the corporate income tax (CIT) application procedure. Following the Estonia experience, Latvia since 2018 made the company's profits not subject to CIT until distribution. It stimulates re-investment of profit as opposed to paying dividends. This aspect should become a special research subject in the future as the business would accomodate to the tax reform of 2018.

The rate of profit of the IT enterprises in Latvia is shown in the following time series Return on Sales (ROS) (see Figure 3.4)

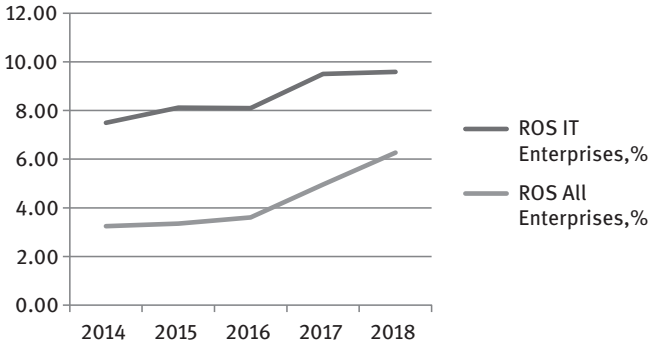


**Figure 3.4:** Return on sales of IT and all enterprises in Latvia, 2014–2018, %.

One can see that the ROS in IT industry is approaching the 10% annual level. Author plotted ROS of all reporting enterprises in Latvia for the same period as the benchmark. It is disclosed, that in average in the period ROS of IT enterprises was 8,56% against 4,29% for all enterprises, i.e. two times higher.

No wonder, foreign multinationals start acquisitions of IT companies in Latvia. Company AirDog was recently (2019) purchased by one of the largest developers of US smart home security solutions, Alarm.com. According to interview, the Nasdaq-listed company, with its acquisition of AirDog, intends to promote research and development of robotics for "Alarm.com" smart homes and business technologies and promote the company's international growth, including in the Baltic States. Other cases emerge. Unfortunately, is goes out of the scope of this research.

The amount of taxes paid is an ever gaining in importance indicator that reflects the industry's contribution to the economy. In Latvia as a whole, the amount of taxes paid by IT companies has doubled in five years. According to the State Revenue Service VID (2019) tax payments by IT companies in the general government budget reached 266.42 million EUR or 4% of total tax revenue in the general government budget in the taxes administered by the state income authority VID in 2018. Details can be seen in the Table 3.1.

**Table 3.1:** Leading IT companies' characteristics in Latvia in 2019: taxes paid, employees, taxex per employee.

| Name | Taxes Paid, EUR | Employees | Taxes per Employee, EUR |
|---|---|---|---|
| 1. SIA "Evolution Latvia" | 24 410 000 | 3 435 | 7 106,26 |
| 2. Accenture Latvia Affiliate | 22 530 000 | 1 496 | 15 060,16 |
| 3. SIA "Tieto Latvia" | 10 290 000 | 710 | 14 492,96 |
| 4. SIA "C.T.CO" | 9 370 000 | 447 | 20 961,97 |
| 5. "Euro Live Technologies" Ltd. | 6 460 000 | 915 | 7 060,11 |
| Total and average | 73 060 000 | 7 003 | 10 432,67 |

The leader of the IT industry in the amount of taxes paid in the general government budget last year was SIA "Evolution Latvia", which paid EUR 24.41 million to the taxes administered by the SRS, of which 17.08 mln. in the form of the State Social Insurance Obligatory Contributions (SSIOC) and 8.64 million as the personal income tax.

Over the last five years, the amount of taxes paid by Evolution Latvia has increased more than three times. The company is not only the largest taxpayer, but also the largest IT company in terms of number of employees, turnover and profits.

In terms of the number of people employed in the IT sector, it can be disclosed that in recent years the number of employees in the IT sector has exceeded 20,000, which in 2018 accounts for 5% of the total number of employees registered in Latvia.

The growth of the sector is most marked by analyzing the increase in the number of employees – since 2014 it has increased by 55.68%.

Based on the SRS data on the number of employees in enterprises, it can be seen that last year there were two IT companies employing more than 1000 employees. The leader is the already mentioned SIA "Evolution Latvia" with 3435 employees. The number of employees in the company has increased by 60.5% over the last three years, while Accenture's Latvian affiliate, which employed 917 people in 2016 and 1 496 last year, also had the same rapid growth.

The ICT sector, which also includes the IT sector, is constantly gaining leadership in sectors with the highest average wages, competing with the financial and insurance business, the energy sector.

Data published by the Central Statistical Bureau show that as long as the average gross wage in the country in 2018 was EUR 1004, the average one in the ICT sector was 58.57% higher, i.e. EUR 1,592.

The salary level is also reflected in the data on the personal income tax (PIT) paid per employee. According to Lursoft data, the average amount of PIT paid per employee in the IT industry in 2018 reached EUR 3,120, while the amount of PIT paid for one employee among all companies registered in Latvia was almost by half lower. Meanwhile, the amount of State Social Insurance Obligatory Contributions paid (in Latvian abbreviation VSAOI sounds grim for entrepreneurs) per person employed in the IT sector was EUR 5,310 in 2018, while in the country on average it was EUR 3,100.

One of the largest PIT payers per employee last year was SIA Estoty, which was founded with the intention of developing applications (games) for smartphones. The information published by the SRS shows that the company employed 9 employees last year and paid PIT 232.61 thousand, which is EUR 25,850 per employee per year. At the top of the list are Microsoft Latvia with EUR 21,630 large PIT payments per employee in 2018 and SIA Forticom with one employee in 2018 paid EUR 18,000.

SIA Forticom is a Mail.ru group company that provides development and IT administration services to Mail.ru Group companies in Russia and manages the mail.ru and ok.ru sites. Last year the company's turnover was EUR 7.17 million but the profit was EUR 589,870.

In the past year, there were three companies among IT companies, the amount of SSIAC per employee exceeded EUR 30,000, namely "Microsoft Latvia" with EUR 38,810, "SAP Latvia" with EUR 33,430 and "Forticom" with EUR 31,780. Compared to 2014, the amount of SSIAC performed by these companies per employee has doubled, while the amount of SSIAC performed by the industry has increased by 143.18%.

According to the information provided by the SRS, "Microsoft Latvia"employed 12 employees in 2019 and paid EUR 592,830 in taxes, including EUR59,550 of PIT and EUR 465,370 in compulsory state social insurance contributions. After the total amount of taxes paid in 2018, "Microsoft Latvia" ranked 84th.

Following are the leading 5 in social responsible IT business (see Table 3.2).

**Table 3.2:** IT companies characteristics in Latvia in 2019: SSIOC per employee and PIT per employee.

| Nr | IT Enterprise | SSIOC per employee, EUR | PIT per employee, EUR |
|---|---|---|---|
| 1 | SIA "Microsoft Latvia" | 38810 | 21630 |
| 2 | SIA "SAP Latvia" | 33430 | 18510 |
| 3 | SIA "Forticom" | 31780 | 18000 |
| 4 | AS "Baltic Magazine" | 25360 | 15040 |
| 5 | SIA "The Payment House" | 24850 | 14440 |

Major taxpayers among IT companies do not coincide with payers of SSIOC and PIT. According to some interviewees, the last list includes those that pay highest salaries.

To summarise, the IT companies do represent locomotives of the growth of the economy. In addition one should notice that the socially responsible economic growth in Latvia is also pushed by the IT companies.

# 4 Conclusions

Both hypotheses are proven. Over the last five years, the number of companies in the IT sector (NACE 62 (Computer Programming, Consulting and Related Activities), NACE 63 (Information Services)) in Latvia has increased by 23.91% and sales by 85.03% while the GDP has grown by 15.4%. ROS of IT enterprises in average in the period was 8.56% against 4.29% for all enterprises, i.e. two times higher.

The most important trends are a significant increase in the number of IT enterprises; concentration of them in the metropolis Riga; overcoming by them of the average profitability of entrepreneurship in the country, export orientation and emerging interest in their acquisition by international leaders.

The position of Latvia in the DESI is determined to great extent by IT sector development.

However, a number of processes in the economy limit the progress. The share of foreign direct investments in IT (16.35% are enterprises with FDI) is too low. It indicates certain underdevelopment of internationalisation of entrepreneurship in the IT area in Latvia. The recent FDI flow in the IT sector in Latvia demands special research.

Further research of the IT companies development is proposed in conjunction with broader DESI concept and experience accumulated in IT sector under Coronavirus crisis of 2020.

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# 4 The Principles of Functioning and Priorities of Development of the Digital Economy

## 1 Introduction

Digital economy is an achievement and factual reality of the recent years. This is shown by the fact that most of developed and developing countries in 2012–2017 adopted national strategies of digital modernization of economic systems. The IMD Digital Competitiveness Ranking has been calculated since 2013 – therefore, in 2013 the results of digitalization were achieved in a lot of (to be specific, 63) countries. All this proves that the process of the digital economy institutionalization has been completed.

However, there is still a scientific discussion in the goals of economy's digitalization, which was spontaneous in the business and social environments at first, and then was supported by national governments for supporting economy's competitiveness economy in a new – digital – environment and for entering the global markets of hi-tech and hi-tech products, which have stable demand, large profitability, and large commercial attractiveness.

According to one approach, the digital economy is to accelerate growth and development of economic systems. In this case, digitalization is considered primarily as a commercial tool for development of business and satisfaction of the society's material needs. This approach is based on the fundamental idea that economic advantages are most important and thus they justify the potential costs for society.

Another approach sets before the digital economy a socially-oriented goal – stimulation of sustainable development. This approach is opposite to the previous approach and is based on the fundamental idea that technological progress should be conducted with full responsibility before the society and should envisage systemic advantages, avoiding costs in any sphere of economic activities. Here digitalization is viewed as a non-profit tool, aimed at satisfaction of non-material needs of the society – stimulating social progress (quality of life, social justice) and environment protection.

The fundamental contradiction of the digital economy and uncertainty of its goal cause multidirectionality of its development and hinders its strategic management –

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which is an important scientific and practical problem. For solving this problem, the chapter aims at determining the principles of functioning and priorities of development of the digital economy for specifying its fundamental principle as a social institution.

## 2 Materials and Method

The approach that sets primarily economic goals before the digital economy is presented in the works Belokurova et al. (2020), Popkova (2019), Popkova and Sergi (2018), Popkova and Sergi (2019), Ragulina (2019), Ragulina et al. (2019), Sergi (2019), Shulus et al. (2020), and Stolyarov et al. (2020). The approach that aims the digital economy at stimulating the social and economic interests is studied in the works Andronova etal. (2019), Glazova (2015), Litvinova (2015), Natsubidze (2015), Pankova (2015), Plotnikov et al. (2020), Popkova and Sergi (2020), Popkova and Gulzat (2020a), Popkova and Gulzat (2020b), and Zavyalova et al. (2018), Alpidovskaya and Popkova (2019), Inshakova and Bogoviz (2020), Popkova (2017), Popkova et al. (2020).

The performed overview of the research literature and its critical analysis allow concluding that the existing approaches are not alternative – they do not contradict but supplement each other. Digitalization is a goal in itself – a logical response of humankind to the achievements of technological progress, a logical progressive movement of economy. However, two priorities should be taken into account on the path of achievement of this goal – stimulating economic growth and development and stimulating sustainable development. Both of these priorities are equal. According to the offered new – systemic – approach to goal setting of digitalization, the following principles of functioning and priorities of development digital economy are determined (Table 4.1).

As shown in Table 4.1, the priority of stimulating economic growth and development is achieved with the help of the principles of accelerating economic growth, supporting economy's innovative development of economy, increasing the effectiveness of economic activities, and supporting the provision of economy's competitiveness. The priority of stimulating sustainable development is achieved with the help of the principles of supporting the implementation of sustainable development goals, supporting the growth of population's quality of life, stimulation of social progress, and supporting public well-being. For each principle, a criterion of evaluating the level of its observation is offered.

**Table 4.1:** Principles of functioning and priorities of development digital economy.

| Priorities of the digital economy | Principles of the digital economy | Criteria of evaluating the observation of principles |
|---|---|---|
| Stimulating economic growth and development | acceleration of economic growth | increase of growth rate of GDP due to digitalization |
| | supporting economy's innovative development | accelerating innovative development of economy by means of digitalization |
| | increasing the effectiveness of economic activities | growth of labor efficiency due to digitalization |
| | supporting the provision of economy's competitiveness economy | growth of global competitiveness due to digitalization |
| Stimulating sustainable development | supporting the implementation of sustainable development goals | contribution of digitalization to implementation of sustainable development goals |
| | supporting the growth of population's quality of life | contribution of digitalization to increase of population's quality of life |
| | stimulating social progress | contribution of digitalization to development of human potential |
| | supporting public well-being | contribution of digitalization to increase of the happiness level in society |

Source: developed and compiled by the authors.

For empirical purposes of the research, let us determine the level of observation of the principles and priorities in the modern developed (by the example of Major Advanced Economies – G7) and developing (by the example of BRICS) countries in 2020 with the help of correlation analysis based on the data as of late 2019 (Table 4.2).

**Table 4.2:** Statistics of the digital economy, economic growth, and sustainable development in countries of G7 and BRICS in 2020.

| Category of countries | Country | Digital competitive ness ranking, points 1–100 | Indicators of economic growth and development | | | | Indicators of sustainable development | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Rate of economic growth, % | Innovation index, points 1–100 | Labor efficiency (GDP per hour worked), USD | Global competitive ness index, points 1–100 | Sustainable development index, points 1–100 | Quality of life index, points 1–200 | Human development index, shares of 1 | Happiness index, points 1–10 |
| G7 (developed) | Canada | 90.836 | 1.843 | 53.88 | 52.17 | 79.6 | 77.9 | 169.42 | 0.922 | 7.278 |
| | France | 82.522 | 1.749 | 54.25 | 67.66 | 78.8 | 81.5 | 156.10 | 0.891 | 6.592 |
| | Germany | 86.216 | 1.415 | 58.19 | 66.42 | 81.8 | 81.1 | 184.30 | 0.939 | 6.985 |
| | Italy | 67.903 | 0.800 | 46.30 | 53.28 | 71.5 | 75.8 | 143.81 | 0.883 | 6.223 |
| | Japan | 82.775 | 0.846 | 54.68 | 45.90 | 82.3 | 78.9 | 176.46 | 0.915 | 5.886 |
| | UK | 88.691 | 1.606 | 61.30 | 58.39 | 81.2 | 79.4 | 166.73 | 0.920 | 7.054 |
| | USA | 100.000 | 2.121 | 61.73 | 70.78 | 83.7 | 74.5 | 176.77 | 0.920 | 6.892 |
| BRICS (developing) | Brazil | 57.346 | 1.954 | 33.82 | n/a | 60.9 | 70.6 | 103.87 | 0.761 | 6.300 |
| | China | 84.292 | 6.000 | 54.82 | n/a | 73.9 | 73.2 | 99.87 | 0.758 | 5.191 |
| | India | 64.952 | 7.791 | 36.58 | n/a | 61.4 | 61.1 | 115.41 | 0.647 | 4.015 |
| | Russia | 70.406 | 1.500 | 37.62 | 25.68 | 66.7 | 70.9 | 104.05 | 0.824 | 5.648 |
| | South Africa | 60.865 | 2.198 | 34.04 | 20.82 | 62.4 | 61.5 | 135.75 | 0.705 | 4.722 |

n/a – data are absent in the source.

Source: compiled by the authors based on Institute of Scientific Communications (2020), OECD (2020).

# 3 Results

For determining the level of observation of the principles and priorities of the digital economy in 2020 in countries of G7, let us use Figure 4.1, and in countries of BRICS – Figure 4.2.

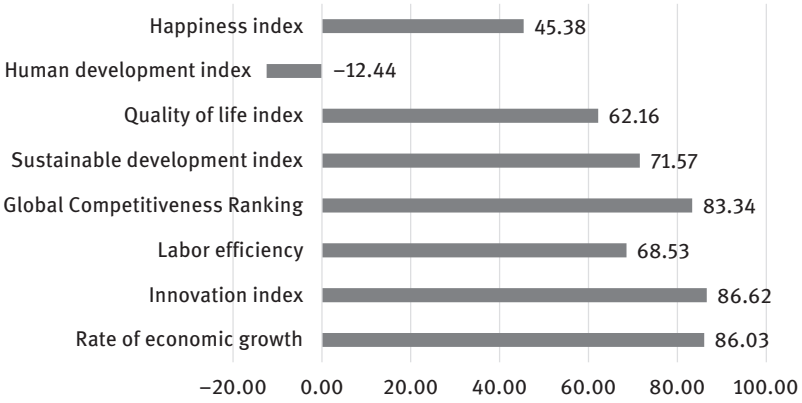


**Figure 4.1:** Correlation between Digital Competitiveness Ranking and the indicators of economic growth and sustainable development in countries of G7 in 2020, %.
Source: developed and compiled by the authors.

As shown in Figure 4.1, correlation between the digital economy and the rate of economic growth is very high – 86.03% – in countries of G7 in 2020; therefore, the principles of acceleration of economic growth is observed. Correlation with the innovation index is also high (86.62%) – therefore, the principle of supporting economy's innovative development is observed. Correlation with the Global competitiveness ranking constitutes 83.34% – therefore, the principle of provision of economy's competitiveness is observed. Correlation with the sustainable development index constitutes 71.57% – therefore, the principles of supporting the implementation of sustainable development goals is observed.

Correlation with labor efficiency is moderate (68.53%) – therefore, the principle of increasing the effectiveness of economic activities is observed, but to a lesser extent, as well as the principle of supporting the growth of population's quality of life (correlation with quality of life index – 62.16%). Correlation with happiness index is small (45.38%) – therefore, the principle of supporting public well-being is observed partially. Correlation with human development index is negative (–12.44%) – therefore, the principle of social progress stimulation is not observed.

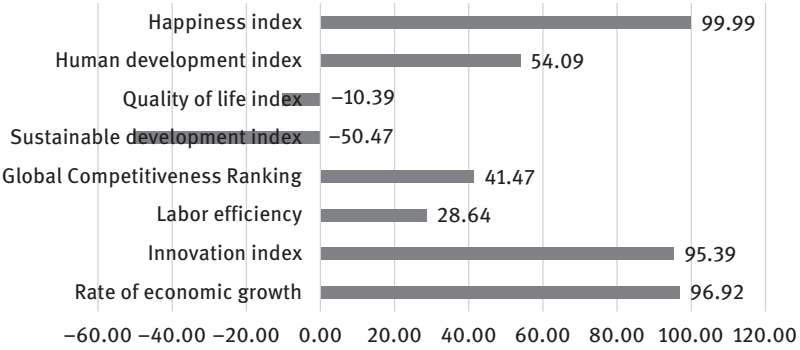


**Figure 4.2:** Correlation between the Digital Competitiveness Ranking and the indicators of economic growth and sustainable development in countries of BRICS in 2020, %.
Source: developed and compiled by the authors.

As shown in Figure 4.2, correlation between the digital economy and the rate of economic growth is very high – 96.92% – in countries of BRICS in 2020; therefore, the principle of acceleration of economic growth is observed. Correlation with the innovation index is also high (95.39%) – therefore, the principle of supporting economy's innovative development is observed. Correlation with happiness index is very high (99.99%), but this is due to insufficiency of data – thus, it is impossible to have a precise idea of observation of the principle of supporting public well-being. Correlation with human development index is moderate (54.09%) – therefore, the principle of social progress stimulation is observed, but to a lesser extent.

Correlation with Global competitiveness ranking constitutes 41.47% – therefore, the principle of supporting the provision of economy's competitiveness is observed partially – as well as the principle of increasing the effectiveness of economic activities (correlation with labor efficiency – 28.64%). Correlation with sustainable development index is negative (–50.47%) – therefore, the principle of supporting the implementation of sustainable development goals is not observed – neither is the principle of supporting the growth of population's quality of life (correlation with quality of life index –10.39%).

The generalized results of correlation analysis in countries of G7 and countries of BRICS in 2020 are presented in Figure 4.3.

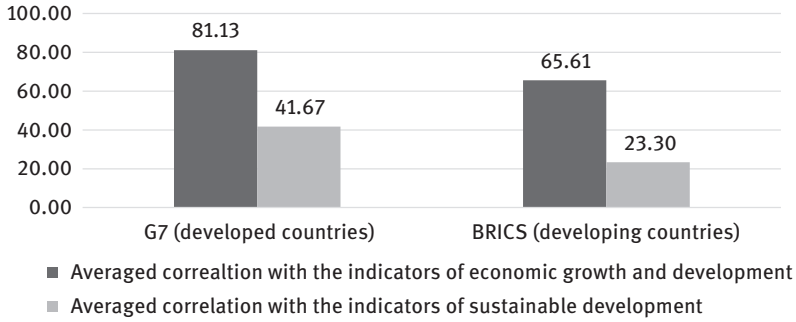


**Figure 4.3:** The generalized results of correlation analysis in countries of G7 and countries of BRICS in 2020.
Source: developed and compiled by the authors.

As shown in Figure 4.3, the digitalization priorities are observed on the whole in countries of G7 and BRICS – but to a different extent, which is a vivid disproportion of the global digital economy.

# 4 Conclusion

Thus, a systemic conceptual approach to determining the priorities of the digital economy has been offered; it unifies the priority of stimulating economic growth and development and the priority of stimulating sustainable development. According to each priority, the principles of the digital economy have been formulated, and the criteria of evaluating the level of observation of these principles have been offered.

The empirical study by the example of G7 and BRICS countries in 2020 showed that developed countries fully observe the priority of stimulating digitalization of economic growth and development (correlation – 81.13%), as well as the priority of stimulating sustainable development – which is observed, however, to a lesser extent (correlation – 65.61%). In developing countries, both priorities are observed only partially (correlation – 41.67% and 23.30%, accordingly).

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# 5 Classification of Breakthrough Digital Technologies and the Perspectives of Their Application in Economy

## 1 Introduction

Digital technologies are a totality of different technologies, and the only thing that unites them is relation to the digital technological mode. From the positions of the existing scientific & methodological approach to studying the digital economy, they are generalized – for it is most convenient from the positions of state management and simplifies international comparisons. At the same time, the existing approach hinders the practical implementation of digital technologies.

Firstly, generalization of digital technologies does not envisage and does not stimulate their implementation in the practice of an economic system. It is to improve a country's position in the global digital ranking, but does not envisage their internal use. In this case, dissemination of digital technologies is a goal in itself. For increasing the global digital competitiveness, the state develops primarily digital technologies of wide access (mobile communications, Internet), which are cheaper and simpler in mastering. Domination of massive digital technologies leads to unequal development of the digital economy, as it contains not the technologies that are in the highest demand but the technologies that are most accessible and quickly improve the country's position in the global ranking.

Secondly, refusal from differentiation of digital technologies does not allow taking into account the sectorial specifics of the need for them. Evaluation of effectiveness of digital technologies application in each specific sphere of economy is also complicated, which causes a deficit of technologies in certain spheres and their excess – with the absence of the need for them (overspending of resources) – in other spheres. The result is sectorial disproportions of the digital economy and its inability to fully use the absolute and relative competitive advantages.

Thus, in order to increase the activity and effectiveness of practical application of digital technologies, it is necessary to differentiate them in view of the spheres and technologies, which could be done with the help of the developed institutional

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scientific & methodological approach to studying the digital economy. The purpose of this chapter is to perform a classification of breakthrough digital technologies and determine the perspectives and practical experience of their application in the modern economy from the positions of the institutional scientific & methodological approach to studying the digital economy.

## 2 Materials and Method

In a generalized form, digital technologies are studied in the works Belik et al. (2020), Kovazhenkov et al. (2019), Popkova (2019), Popkova and Sergi (2020), Popkova and Sergi (2019), Ragulina (2019), Ragulina et al. (2019), Sergi (2019), Sergi et al. (2019), Shulus et al. (2020), Alpidovskaya and Popkova (2019), Inshakova and Bogoviz (2020), Popkova (2017), Popkova et al. (2020). Digital technologies are differentiated in the works Andronova et al. (2019), Glazova (2015), Litvinova (2015), Natsubidze (2015), Pankova (2015), Popkova et al. (2019), Popkova and Gulzat (2020a), Popkova and Gulzat (2020b), Popkova et al. (2018), Popkova and Parakhina (2019), and Popkova and Zmiyak (2019).

The performed literature overview shows that a comprehensive and universal classification of digital technologies has not yet been formed in the research literature. Certain sources take into account separate digital technologies, selected by certain criteria, but this does not allow compiling a unified classification of digital technologies. This requires further research, for which the institutional scientific & methodological approach is used in this chapter.

For classification of breakthrough digital technologies based on IMD Digital Competitiveness Ranking 2019, which is actual as of early 2020, let us determine the most perspective technologies in each sphere of the digital economy. For this, correlation analysis is used for determining the contribution of digital technologies in development of the spheres of economy science and education, society and trade, business and state management. Let us perform the research by the example of countries of G7 and BRICS, for determining the differences between developed and developing countries. Statistical data are shown in Tables 5.1 and 5.2.

**Table 5.1:** Digital technologies and results of their application in science and education, society and trade in countries of G7 and BRICS in 2020, positions 1–63.

| Category of countries | Country | Digital technologies in science and education | | | | Digital technologies in society and trade | | | |
|---|---|---|---|---|---|---|---|---|---|
| - | - | Robots in Education and R&D | Employee training | R&D productivity by publication | High-tech patent grants | Mobile Broadband subscribers | Internet users | E-Partici-pation | Internet retailing |
| | | technologies | results | | | technologies | | results | |
| G7 (developed countries) | Canada | 9 | 22 | 13 | 11 | 38 | 17 | 26 | 12 |
| | France | 5 | 35 | 14 | 19 | 50 | 24 | 13 | 14 |
| | Germany | 2 | 3 | 11 | 24 | 54 | 18 | 23 | 13 |
| | Italy | 12 | 50 | 6 | 47 | 46 | 25 | 15 | 27 |
| | Japan | 4 | 15 | 15 | 4 | 1 | 5 | 5 | 16 |
| | UK | 6 | 37 | 4 | 21 | 23 | 15 | 5 | 3 |
| | USA | 3 | 38 | 3 | 5 | 26 | 3 | 5 | 2 |
| BRICS (developing countries) | Brazil | 14 | 53 | 8 | 46 | 27 | 46 | 12 | 42 |
| | China | 1 | 13 | 1 | 14 | 35 | 56 | 28 | 21 |
| | India | 17 | 39 | 2 | 26 | 62 | 63 | 15 | 55 |
| | Russia | 8 | 45 | 5 | 33 | 33 | 45 | 23 | 41 |
| | South Africa | 38 | 30 | 26 | 53 | 48 | 59 | 36 | 56 |

Source: compiled by the authors based on IMD (2020).

**Table 5.2:** Digital technologies and the results of their application in business and state management in countries of G7 and BRICS in 2020, positions 1–63.

| Category of countries | Country | Digital technologies in business | | | | Digital technologies in state management | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | World robots distribution | Use of big data and analytics | Agility of companies | High-tech exports (%) | Cyber security | Software piracy | E-Government | Public-private partnerships |
| | | technologies | | results | | technologies | | results | |
| G7 (developed countries) | Canada | 14 | 13 | 21 | 27 | 18 | 13 | 23 | 8 |
| | France | 8 | 53 | 55 | 7 | 22 | 20 | 9 | 19 |
| | Germany | 5 | 46 | 36 | 24 | 26 | 8 | 12 | 40 |
| | Italy | 6 | 51 | 46 | 50 | 45 | 33 | 24 | 51 |
| | Japan | 2 | 63 | 63 | 21 | 41 | 2 | 10 | 37 |
| | UK | 12 | 25 | 42 | 11 | 29 | 10 | 4 | 34 |
| | USA | 4 | 6 | 18 | 20 | 34 | 1 | 11 | 12 |
| BRICS (developing countries) | Brazil | 19 | 60 | 57 | 30 | 58 | 36 | 37 | 58 |
| | China | 1 | 12 | 25 | 6 | 16 | 56 | 50 | 15 |
| | India | 13 | 30 | 32 | 49 | 37 | 48 | 58 | 27 |
| | Russia | 34 | 31 | 60 | 34 | 44 | 53 | 28 | 46 |
| | South Africa | 32 | 20 | 37 | 58 | 47 | 20 | 52 | 54 |

Source: compiled by the authors based on IMD (2020).

# 3 Results

The specifics of applying different digital technologies in various spheres of economy in countries of G7 and BRICS in 2020 are shown from the positions of the correlation analysis results in Figures 5.1–5.4.

As shown in Figure 5.1, robotization, as the main digital technology in education, is much more effective in countries of BRICS, showing a very high correlation with R&D productivity (by publication) (91.28%) and hi-tech patent grants (80.05%). In countries of G7, robotization of education stimulates the increase of employee training (59.92%) and hi-tech patent grants (62.80%).

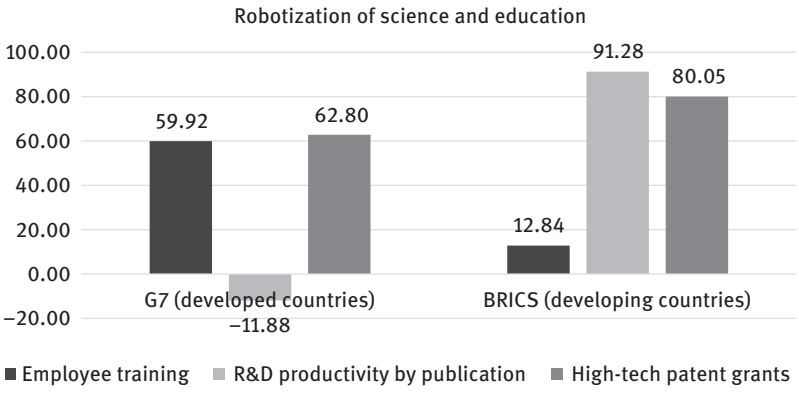


**Figure 5.1:** Correlation between application of digital technologies and development of science and education, %.
Source: calculated and built by the authors.

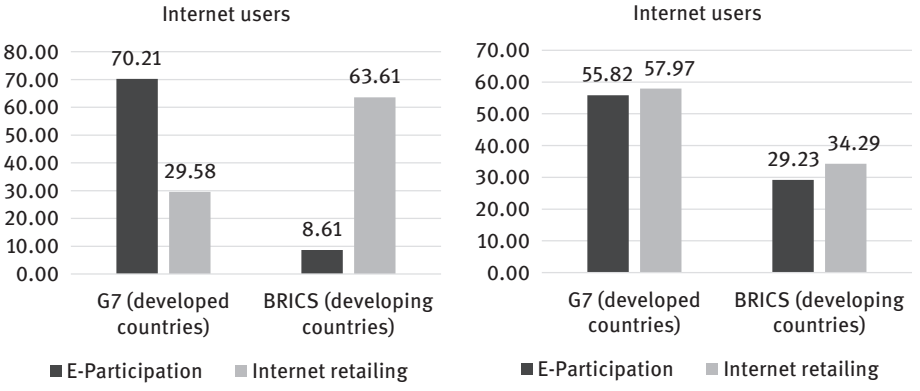


**Figure 5.2:** Correlation between application of digital technologies and development of society and trade, %.
Source: calculated and built by the authors.

As shown in Figure 5.2, mobile communications in countries of G7 ensure the development of the digital civil society (70.21%), and in countries of BRICS – development of Internet retailing (63.61%). Internet is used more effectively in countries of G7, where it stimulates the development of the civil society (55.82%), and Internet retailing (57.97%).

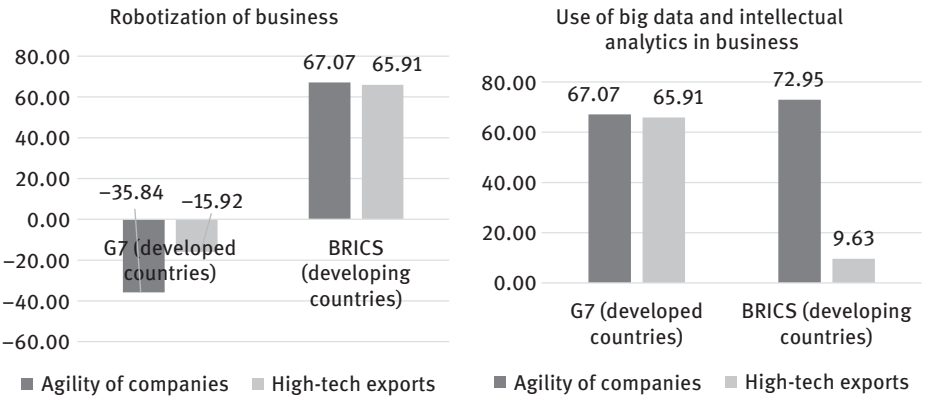


**Figure 5.3:** Correlation between application of digital technologies and development of business, %.
Source: calculated and built by the authors.

As shown in Figure 5.3, robotization of business ensures advantages only in countries of BRICS, leading to increase of agility of companies (67.07%) and increase of hi-tech exports (65.91%). Big data and intellectual analytics in countries of BRICS ensure only increase of agility of companies (72.95%), and in countries of G7 – increase of agility of companies (67.07%) and development of hi-tech exports (65.91%).

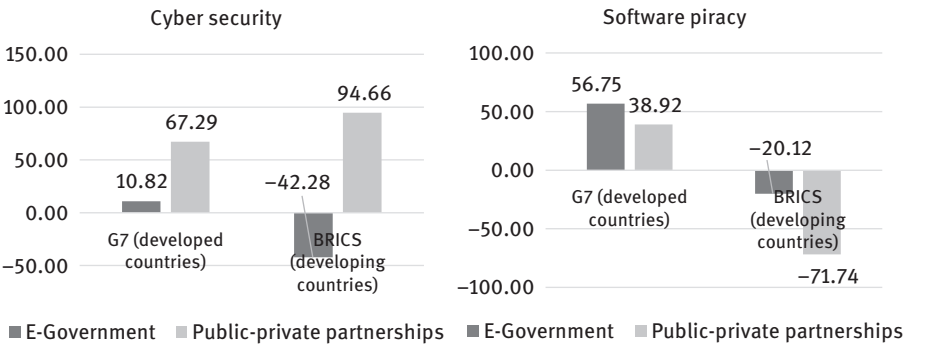


**Figure 5.4:** Correlation between application of digital technologies and improvement of state management, %.
Source: calculated and built by the authors.

As shown in Figure 5.4, in countries of G7 and countries of BRICS, cyber security leads to development of e-government (correlation – 67.29% and 94.66%, accordingly). Personal information protection is effective only in countries of G7, ensuring development of e-government (56.75%) and increase of the level of development of public-private partnership (38.92%).

## 4 Conclusion

Thus, breakthrough digital technologies have been classified by the criterion of effectiveness and the perspectives of their application in various spheres of economy. It has been determined that the system of science and education uses robotization, which is in the highest demand in developing countries. Society and trade have a need for mobile communications and Internet, which are used most effectively in developed countries. Business in developed countries effectively uses Big data and intellectual analytics, and in developing countries – robotization.

State management in developing countries widely uses cyber security, and in developed countries – protection of personal information. The offered classification opens opportunities for flexible management of the digital economy as a social institution for its smooth sectorial development and maximization of effectiveness of digital technologies' practical application.

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# Part II: **The Process of Digital Economy Institutionalization in the 21st Century**

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# 6 The Essence and Logic of the Process of Sectorial Markets' Digital Transformation

## 1 Introduction

Transition to the digital economy ensures a range of universal advantages for economic activities, which include improvement of transport logistics due to the intellectual support for managing the added values chains, reduction of resource intensity and production waste due to implementation of "smart" technologies into production, increase of economic processes' integration, and increase of accessibility of goods and services due to Internet and the Internet of Things.

Though the above advantages of digitalization are observed in the economy on the whole and are equally accessible in all spheres, they have different demand and ensure differentiated profits for business, depending on its sectorial specialization. From the positions of the institutional approach, which treats the digital economy as a social institute, studying the essence and logic of the process of sectorial markets' digital transformation is very interesting and topical in the aspect of science and practice. It is expedient to use three generalized criteria for the objective and correct comparison of sectorial markets.

1st criterion: share in GDP. This criterion is to determine to which extent digitalization stimulates the increase of added value and business activity in the sphere and the change of its value in the economy. 2nd criterion: share in employment. It shows the consequences of digitalization and the connected authomatization for the sectorial labor market. 3rd criterion: labor efficiency. It is formed from the two previous criteria and shows the influence of digitalization on effectiveness of the production activities in the spheres.

The purpose of this chapter is to determine the essence and logic of the process of sectorial markets' digital transformation – agriculture, industry, and service sphere – by the criteria of share in GDP, share in employment and labor efficiency.

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## 2 Materials and Method

The overview and analysis of the existing publications on the topic of the digital economy shows that they consider the consequences of the digital transformation of the economic spheres separately. The issues of digitalization of state management are studies in Boyazitov (2015), Dubova (2015), Fedotova et al. (2020), and Shulus et al. (2020). The specific features of digital modernization of service sphere are studied in Baranova (2015), Ragulina et al. (2019a), Ragulina et al. (2019b), and Stolyarov et al. (2020), Alpidovskaya and Popkova (2019), Inshakova and Bogoviz (2020), Popkova (2017), Popkova et al. (2020).

The consequences of transition to the digital economy for agriculture are considered in Andronova et al. (2019a) and Andronova et al. (2019b). The influence of digitalization on the financial sphere is studied in Popkova (2019), Popkova et al. (2019), Popkova and Gulzat (2020a), Popkova and Gulzat (2020b), Popkova et al. (2018), Popkova and Parakhina (2019), Popkova and Zmiyak (2019), Sergi et al. (2019a), and Sergi et al. (2019b). The contribution of the digital economy in development of industry is reflected in Badzim et al. (2015), Popkova and Sergi (2020), Popkova and Sergi (2018), Popkova and Sergi (2019), Sergi (2003), and Sergi (2019).

The large number of the relevant publications shows a high level of elaboration of the set problem; however, it remains unsolved, as the fragmentary studies by the example of sectorial markets (separately) with application of different criteria do not allow compiling a systemic vision of the essence and logic of the process of sectorial markets' digital transformation.

Thus, trend analysis is here used for determining the growth of the share in GDP, share in employment and labor efficiency (as ratio of added value to number of the employed) in agriculture, industry, and service sphere in 2020, as compared to 2010. Also, correlation analysis is used for determining the connection between digitalization and the achieved growth. The research objects are top 3 developed and top 3 developing countries by the level of digital competitiveness, according to the 2019 IMD ranking. Statistical data for these countries are shown in Table 6.1.

**Table 6.1:** Statistics of the sectorial service markets in top 3 developed and top 3 developing countries by the level of digitalization in 2010 and 2020.

| Category of countries | Country | GDP, USD million | Employed population, million | Agriculture | | | Industry | | | Service sphere | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Share in GDP, % | Share in employment, % | Labor efficiency, USD per capita | Share in GDP, % | Share in employment, % | Labor efficiency, USD per capita | Share in GDP, % | Share in employment, % | Labor efficiency, USD per capita |
| 2010 – in the process of the digital economy institutionalization | | | | | | | | | | | | |
| Top 3 developed countries | USA | 14,964.4 | 156.9 | 1.0 | 2.0 | 4,721.6 | 22.8 | 20.0 | 10,867.5 | 76.2 | 77.9 | 9,333.0 |
| | Singapore | 236.4 | 3.0 | 0.0 | 1.2 | 0.0 | 32.2 | 29.9 | 8,470.5 | 67.8 | 68.9 | 7,727.8 |
| | Sweden | 488.4 | 4.9 | 2.0 | 3.1 | 6,337.3 | 35.2 | 27.6 | 12,597.5 | 62.8 | 69.3 | 8,964.6 |
| Top 3 developing countries | China | 6,066.4 | 775.4 | 9.0 | 39.2 | 179.5 | 46.8 | 22.7 | 1,613.1 | 44.2 | 38.1 | 908.1 |
| | Russia | 1,638.5 | 75.9 | 3.0 | 9.9 | 657.6 | 43.9 | 27.5 | 3,448.5 | 53.1 | 62.7 | 1,829.4 |
| | Saudi Arabia | 526.8 | 9.9 | 3.0 | 4.8 | 3,360.6 | 57.8 | 21.8 | 14,108.3 | 39.2 | 73.4 | 2,847.9 |
| Average | | – | – | 3.0 | 10.0 | 2,542.8 | 39.8 | 24.9 | 8,517.5 | 57.2 | 65.0 | 5,268.5 |
| 2020 – in the condition of the completed process of the digital economy institutionalization | | | | | | | | | | | | |
| Top 3 developed countries | USA | 22,063.0 | 166.1 | 1.0 | 0.7 | 18,978.0 | 21.6 | 20.3 | 14,135.3 | 77.4 | 79.0 | 13,015.5 |
| | Singapore | 320.0 | 3.5 | 0.0 | 0.1 | 0.0 | 30.6 | 30.2 | 9,185.0 | 69.4 | 69.7 | 9,025.9 |
| | Sweden | 578.4 | 5.5 | 1.0 | 1.1 | 9,648.3 | 34.3 | 28.2 | 12,908.9 | 64.7 | 70.7 | 9,712.4 |

(continued)

**Table 6.1** (continued)

| Category of countries | Country | GDP, USD million | Employed population, million | Agriculture | | | Industry | | | Service sphere | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Share in GDP, % | Share in employment, % | Labor efficiency, USD per capita | Share in GDP, % | Share in employment, % | Labor efficiency, USD per capita | Share in GDP, % | Share in employment, % | Labor efficiency, USD per capita |
| Top 3 developing countries | China | 15,066.7 | 780.8 | 7.0 | 26.1 | 517.5 | 37.8 | 27.6 | 2,642.6 | 55.2 | 46.3 | 2,300.5 |
| | Russia | 1,712.0 | 73.0 | 3.0 | 9.8 | 717.7 | 42.9 | 27.5 | 3,657.6 | 54.1 | 62.7 | 2,023.0 |
| | Saudi Arabia | 785.9 | 14.4 | 2.0 | 6.7 | 1,630.4 | 49.6 | 21.4 | 12,658.9 | 48.4 | 71.9 | 3,676.6 |
| Average | | – | – | 2.3 | 7.4 | 5,248.6 | 36.1 | 25.9 | 9,198.0 | 61.5 | 66.7 | 6,625.7 |

Source: calculated and compiled by the authors based on CIA World Factbook (2020), IMD (2020), International Monetary Fund (2020), World Bank (2020).

# 3 Results

For determining the growth of sectorial indicators in 2020 (in the conditions of the completed process of the digital economy institutionalization), as compared to 2010 (in the process of the digital economy institutionalization) in developed and developing countries, in which the influence of digitalization is most vivid, let us use the results of trend analysis (Figure 6.1).

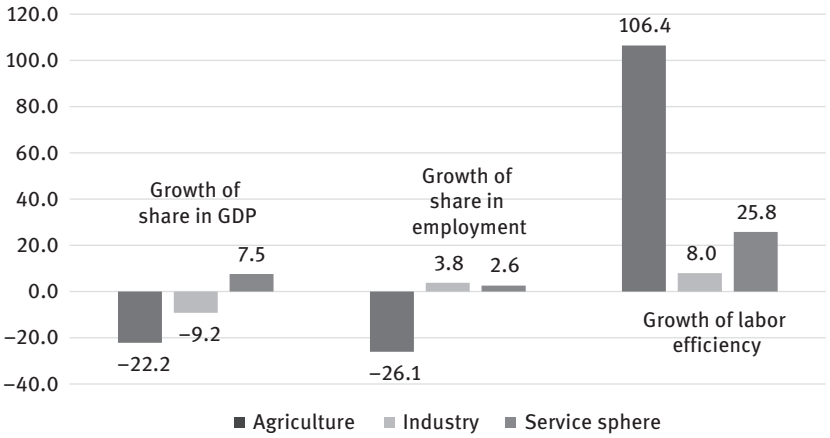


**Figure 6.1:** Growth (trend) of share in GDP, share of employment and labor efficiency in agriculture, industry, and service sphere in top 3 developed and top 3 developing countries by the level of digitalization in 2020, as compared to 2010, %.
Source: calculated and compiled by the authors.

As shown in Figure 6.1, digitalization in agriculture ensured the increase of labor efficiency by 106.4%, in industry – growth of employment by 3.8% and growth of labor efficiency by 8%, and in service sphere – growth of the share in GDP by 7.5%, growth of employment by 2.6%, and growth of labor efficiency by 25.8%. For a more thorough study, let us use the statistics of digital competitiveness and growth of sectorial indicators in top 3 developed and top 3 developing countries by the level of digitalization in 2020, as compared to 2010.

Based on the data from Table 6.2, correlation between digital competitiveness ranking and growth of sectorial indicators in 2020, as compared to 2010, is calculated (Figure 6.2).

As shown in Figure 6.2, digitalization in agriculture determines the growth of share in GDP (correlation – 10.35%) and labor efficiency (51.30%). In industry, digitalization determines growth of share in GDP (34.08%) and growth of share in employment (6.56%) and growth of labor efficiency (25.30%). In service sphere, digitalization determines only growth of share of employment (6.56%).

**Table 6.2:** Statistics of digital competitiveness and growth of sectorial indicators in top 3 developed and top 3 developing countries by the level of digitalization in 2020 as compared to 2010.

| Category of countries | Country | Digital competitiveness ranking, points 1–100 | Agriculture | | | Industry | | | Service sphere | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Share in GDP, % | Share in employment, % | Labor efficiency, USD per capita | Share in GDP, % | Share in employment, % | Labor efficiency, USD per capita | Share in GDP, % | Share in employment, % | Labor efficiency, USD per capita |
| Top 3 developed countries | USA | 100.000 | 0.0 | –65.3 | 301.9 | –5.3 | 1.5 | 30.1 | 1.6 | 1.5 | 39.5 |
| | Singapore | 99.373 | 0.0 | –91.9 | 0.0 | –5.0 | 1.1 | 8.4 | 2.4 | 1.1 | 16.8 |
| | Sweden | 96.070 | –50.0 | –64.7 | 52.2 | –2.6 | 2.1 | 2.5 | 3.0 | 2.1 | 8.3 |
| Top 3 developing countries | China | 84.292 | –22.2 | –33.5 | 188.2 | –19.2 | 21.6 | 63.8 | 24.9 | 21.6 | 153.3 |
| | Russia | 70.406 | 0.0 | –0.5 | 9.2 | –2.3 | 0.1 | 6.1 | 1.9 | 0.1 | 10.6 |
| | Saudi Arabia | 69.036 | –33.3 | 40.8 | –51.5 | –14.2 | –2.0 | –10.3 | 23.5 | –2.0 | 29.1 |

Source: calculated and compiled by the authors.

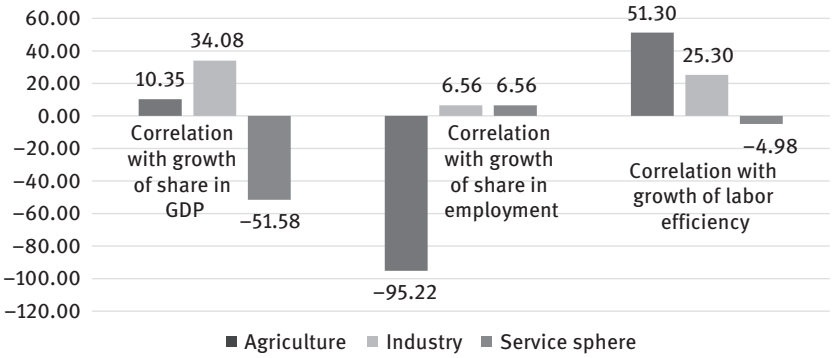


**Figure 6.2:** Correlation between digital competitiveness ranking and growth of sectorial indicators in 2020 as compared to 2010, %.
Source: developed and compiles by the authors.

## 4 Conclusion

It should be noted that the essence and logic of the process of digital transformation are different in sectorial markets. In agriculture, digitalization determines the growth of labor efficiency, which in top 3 developed and top 3 developing countries by the level of digitalization in 2020, as compared to 2010, constitutes 106.4% (correlation – 51.30%). In industry, digitalization determines growth of share in employment, which constitutes 3.8% (correlation – 6.56%) and growth of labor efficiency, which equals 8% (correlation – 25.30%).

In service sphere, digitalization stimulates only the growth of population's employment, which equals 2.6% (correlation – 6.56%). Therefore, advantages for business are most vivid in the sphere of agriculture, where it is recommended to pay more attention to the issues of digitalization and conduct more active digital transformation of entrepreneurship.

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# 7 The Current Tendencies of Economy Digitalization in Developed and Developing Countries

## 1 Introduction

The differences between developed and developing countries form the paradigm foundations of the modern world order. These differences are manifested almost in all aspects of economic activities, including digitalization. The existing scientific and methodological approach to studying the digital economy offers criteria for comparing digital competitiveness of developed and developing countries. A lot of studies were performed within this approach, which explain the extent of differences between these categories of countries in detail. This forms the basis for international comparisons, but preserves an uncertainty regarding the perspectives of reducing the gap between developed and developing countries.

The new, institutional, scientific and methodological approach is to overcome this uncertainty and determine the internal causal connections of digital transformations in the economy of developed and developing countries. Firstly, consideration of the institutional component of the processes of the digital economy development will allow developing detailed strategies of state regulation, which allow influencing – with high precision and effectiveness – the key factors of digital competitiveness, which are specific for developed and developing countries.

Secondly, the institutional view of digitalization of economy of developed and developing countries will open perspectives for reduction and potential full overcoming of the disproportions in the global digital economy. Due to this, digital transformation could become a mechanism of provision of well-balanced development of the global economic system. Based on the above, this chapter aims at determining the modern tendencies of economy digitalization in developed

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and developing countries, the key factors of this process, and the perspectives of accelerating it for reducing the differentiation of these countries and leveling the disproportions in the global digital economy.

## 2 Materials and Method

The specific features of economy digitalization in developed and developing countries are studied in the works Andronova et al. (2019), Badzim et al. (2015), Baranova (2015), Belokurova et al. (2020), Boyazitov (2015), Dubova (2015), Fedotova et al. (2020), Ivanov et al. (2019), Petrenko and Shevyakova (2019), Popkova (2019), Popkova and Sergi (2020), Popkova and Gulzat (2020a), Popkova and Gulzat (2020b), Popkova and Zmiyak (2019), Popkova and Sergi (2018), Popkova and Sergi (2019), Ragulina (2019), Ragulina et al. (2019), Sergi (2003), Sergi (2019), Sergi et al. (2019a), Sergi et al. (2019b), Sergi et al. (2019c), and Shulus et al. (2020), Alpidovskaya and Popkova (2019), Inshakova and Bogoviz (2020), Popkova (2017), Popkova et al. (2020).

However, despite the large number of publications on the considered topic, the problem is still unsolved. The tendencies of economy digitalization in developed and developing countries are studied insufficiently from the institutional point of view, which provides limited opportunities for determining the perspectives of reducing the disproportions in the global digital economy.

For this, the authors use a complex of methods of economic statistics (econometrics), including calculation of averages for determining the generalized tendencies of economy digitalization of developed and developing countries, trend analysis for determining the growth of average indicators of economy digitalization in developed and developing countries, and regression analysis and for optimization modeling for determining the factors of digital competitiveness and their targeted growth, which allows reducing the disproportions in the global digital economy.

The research is performed by the example of countries of G7 (Major Advanced Economies), which represent developed countries, and countries of BRICS, which represent developing countries. For determining the tendencies, the data of IMD Digital Competitiveness Ranking for 2017 and 2020 are used (Table 7.1). The result of digitalization is digital competitiveness ranking, and the factors are education and digital society, accessibility of technologies and infrastructure, and implementation of digital technologies.

**Table 7.1:** The results and factors of economy digitalization in developed and developing countries in 2017 and 2020, points 1–100.

| Category of countries | Country | 2017 | | | | 2020 (as a result of 2019) | | | |
|---|---|---|---|---|---|---|---|---|---|
| – | – | Digital competitiveness ranking | Knowledge | Technology | Future Readiness | Digital competitiveness ranking | Knowledge | Technology | Future Readiness |
| G7 (developed countries) | Canada | 91.671 | 86.792 | 82.209 | 88.553 | 90.836 | 87.849 | 80.633 | 82.816 |
| | France | 78.810 | 73.114 | 75.180 | 70.676 | 82.522 | 76.024 | 80.265 | 70.066 |
| | Germany | 84.108 | 78.683 | 75.507 | 80.675 | 86.216 | 83.072 | 71.088 | 83.358 |
| | Italy | 65.467 | 58.121 | 54.186 | 66.636 | 67.903 | 59.979 | 56.784 | 65.736 |
| | Japan | 78.094 | 68.787 | 75.176 | 72.861 | 82.775 | 74.687 | 75.080 | 77.347 |
| | UK | 88.943 | 82.976 | 78.979 | 87.414 | 88.691 | 81.686 | 77.907 | 85.270 |
| | USA | 95.410 | 85.878 | 88.884 | 94.009 | 100.000 | 90.988 | 89.364 | 98.427 |
| BRICS (developing countries) | Brazil | 52.290 | 46.364 | 42.827 | 50.220 | 57.346 | 45.742 | 49.166 | 55.919 |
| | China | 71.452 | 71.177 | 63.624 | 62.097 | 84.292 | 78.067 | 72.856 | 80.743 |
| | India | 54.367 | 60.982 | 38.084 | 46.577 | 64.952 | 63.721 | 54.978 | 54.946 |
| | Russia | 62.854 | 70.344 | 54.333 | 46.427 | 70.406 | 75.017 | 58.451 | 56.539 |
| | South Africa | 55.709 | 52.772 | 45.035 | 51.861 | 60.865 | 52.148 | 53.647 | 55.588 |

Source: compiled by the authors based on IMD (2020).

# 3 Results

For a general idea of the dynamics of economy digitalization in developed and developing countries, let us consider the calculated direct average values of the selected indicators (Figure 7.1).

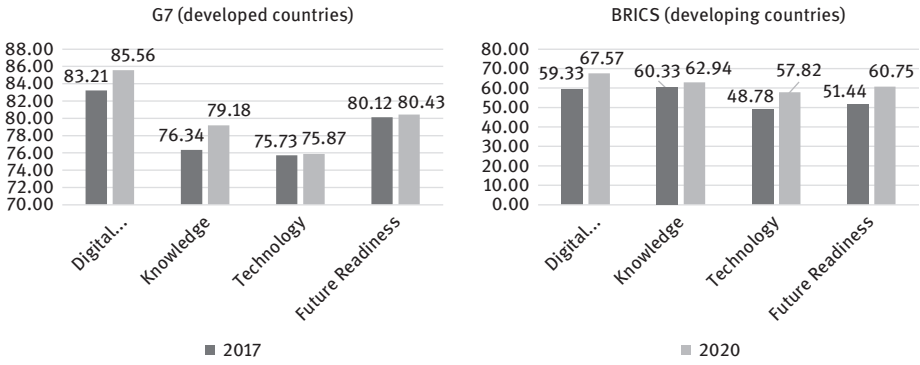


**Figure 7.1:** Direct average values of the indicators of economy digitalization in developed and developing countries in 2017 and 2020.
Source: calculated and built by the authors.

Based on the calculated direct average value, growth (trend) of average value indicators of economy digitalization in developed and developing countries in 2020, as compared to 2017, is determined (Figure 7.2).

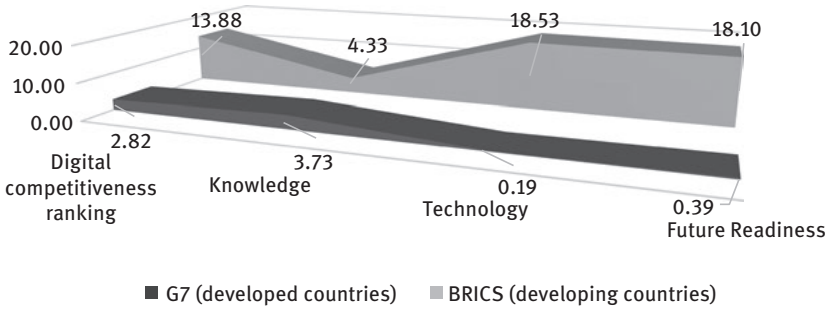


**Figure 7.2:** Growth (trend) of average indicators of economy digitalization in developed and developing countries in 2020, as compared to 2017, %.
Source: calculated and built by the authors.

As shown in Figure 7.2, the tendency of digitalization in developing countries is more vivid – growth of digital competitiveness ranking in 2020, as compared to 2017, constituted 13.88%. The highest growth is peculiar for accessibility of technologies and

infrastructure (18.53%) and implementation of leading technologies (18.10%), while growth of education and the digital society is poor (4.33%).

In developed countries, growth of digital competitiveness ranking constitutes 2.82%. The highest growth is peculiar for education and the digital society (3.73%), while for accessibility of technologies and infrastructure (0.19%), and implementation of leading technologies (0.39%) it is very low. Growth of the indicators of economy digitalization in view of the distinguished developed and developing countries in 2020, as compared to 2017, is shown in Table 7.2.

**Table 7.2:** Growth of the indicators of economy digitalization in developed and developing countries in 2020, as compared to 2017, %.

| Category of countries | Country | Digital competitiveness ranking | Knowledge | Technology | Future Readiness |
|---|---|---|---|---|---|
| – | – | y | $x_1$ | $x_2$ | $x_3$ |
| G7 (developed countries) | Canada | −0.91 | 1.22 | −1.92 | −6.48 |
| | France | 4.71 | 3.98 | 6.76 | −0.86 |
| | Germany | 2.51 | 5.58 | −5.85 | 3.33 |
| | Italy | 3.72 | 3.20 | 4.79 | −1.35 |
| | Japan | 5.99 | 8.58 | −0.13 | 6.16 |
| | UK | −0.28 | −1.55 | −1.36 | −2.45 |
| | USA | 4.81 | 5.95 | 0.54 | 4.70 |
| BRICS (developing countries) | Brazil | 9.67 | −1.34 | 14.80 | 11.35 |
| | China | 17.97 | 9.68 | 14.51 | 30.03 |
| | India | 19.47 | 4.49 | 44.36 | 17.97 |
| | Russia | 12.02 | 6.64 | 7.58 | 21.78 |
| | South Africa | 9.26 | −1.18 | 19.12 | 7.19 |

Source: calculated and compiled by the authors.

Based on the data from Table 7.2, regression analysis and optimization modeling of managing the digital competitiveness factors in developed and developing countries for the period until 2024 are performed. The target setting of optimization is doubling of the growth rate of digital competitiveness ranking as compared to 2020 (Table 7.3).

The established (Table 7.3) target growth of the factors of digital competitiveness for its double acceleration in developed and developing countries in 2024 is shown in Figure 7.3.

**Table 7.3:** Results of the regression analysis and optimization modeling of managing the factors of digital competitiveness in developed and developing countries for the period until 2024.

| Variable | Symbol | G7 (developed countries) $y = 1.43 + 0.32 * x1 + 0.33 * x2 + 0.1 * x3$ | | | BRICS (developing countries) $y = 0.84 - 0.08 * x1 + 0{+}24 * x2 + 0.47 * x3$ | | |
|---|---|---|---|---|---|---|---|
| | | Initial value in 2020 | Target value in 2024 | Growth in 2024 as compared to 2020, % | Initial value in 2020 | Target value in 2024 | Growth in 2024 as compared to 2020, % |
| Factor of education and the digital society | $x_1$ | 3.85 | 6.92 | 79.89 | 3.66 | 3.66 | 0.00 |
| Factor of accessibility of technologies and infrastructure | $x_2$ | 0.41 | 3.55 | 773.84 | 20.07 | 31.89 | 58.87 |
| Factor of implementation of leading technologies | $x_3$ | 0.43 | 3.40 | 684.49 | 17.66 | 40.72 | 130.53 |
| Digital competitiveness ranking (result) | y | 2.94 | 5.87 | 99.97 | 13.68 | 27.35 | 99.99 |

Source: calculated and compiled by the authors.

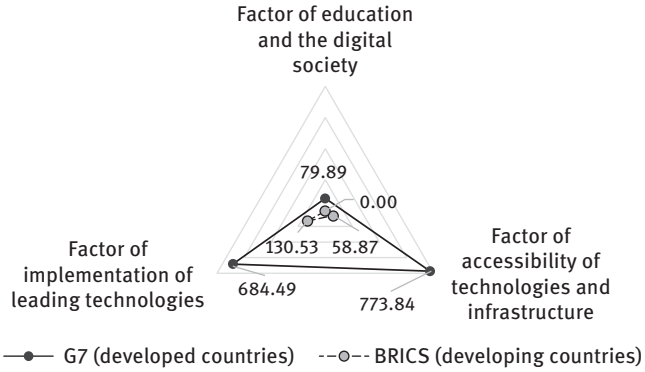


**Figure 7.3:** Target growth of the factors of digital competitiveness for its double acceleration in developed and developing countries in 2024.
Source: calculated and built by the authors.

As shown in Figure 7.3, for doubling the growth rate of digital competitiveness ranking as compared to 2020 in developed countries, accessibility of technologies and infrastructure should be increased (until 2024) by 773.84%, and in developing countries – by 58.87%. Implementation of leading technologies should grow in developed countries by 684.49%, and in developing countries – by 130.53%. Education and digital society in developing countries may remain unchanged, and in developed countries should grow by 79.89%.

# 4 Conclusion

It should be concluded that a modern tendency of digitalization of economy in developed countries is growth of education and development of the digital society, and in developing countries – increase of accessibility of digital technologies and infrastructure and the level of their practical application. On the whole, the tendency of growth of digital competitiveness in developing countries is more vivid than in developed countries.

Due to rather accessible and highly probably doubling of the growth rate of digital competitiveness in 2024, as compared to 2020, in developed countries – up to 5.87%, and in developing countries – up to 27.35%, digital competitiveness ranking in developed countries will be increased up to 90.58 points (85.56 points*1.0587), and in developing countries – up to 86.05 points (67.57*1.2735).

As a result, the gap in the level of digital competitiveness between developed and developing countries will reduce from 17.99 points (85.56–67.57) in 2020 to 4.53 points (90.58–86.05) in 2024 – i.e., by 74.82%, which will allow balancing the

global digital economy in the mid-term. Applied recommendations for managing the factors of digital competitiveness for developed and developing countries are offered.

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# 8 The Main Stages of the Digital Modernization of Economy

## 1 Introduction

Digital modernization is a long process, which started in the global economy more than two decades ago. The existing scientific and methodological approach to studying the digital economy treats the process of its establishment as a homogeneous one, without a clear internal structure. This leads to evaluation of economic systems' digitalization with the help of a lot of non-systematized indicators. This allows outlining and tracking the leadership of developed countries by most of these indicators, but it not good for studying other – developing and underdeveloped – countries and does not allow evaluating the process of digital modernization of the global economy on the whole.

The offered alternative – institutional – approach to studying the digital economy treats digital modernization as a complex process and allows distinguishing the main stages of this process. Thus it becomes possible to determine the consistency of the process of the digital modernization of different countries' economies separately or within the categories of countries in the global economy. In this case, it is possible to distinguish various models of digital modernization from the positions of observing the consistency of its logical stages.

Also, the scientific methodology for determining a country's or group of countries' stage of digital modernization of economy is provided. It becomes possible to forecast future perspectives of digitalization and to compile scenarios of its implementation. The institutional approach is especially useful for studying the digital economy of developing and underdeveloped countries, in order to determine the specifics of the process of their digital modernization and choose the path of this process contrary to catching-up development according to the experience of developed countries.

Structuring of the criteria of digital modernization in view of its stages allows determining developing countries that implement digital modernization economies quicker than developed countries and are at the later stages or at the final stage. Thus, this chapter aims to determine the logic and the main stages of the digital

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modernization of economy, the criteria of their completion (terms of transition to the next stage, and current the stage of developed, developing, and underdeveloped countries, as well as the level of succession and specifics of the digital modernization of their economies.

## 2 Materials and Method

Various attempts at structuring of the process of the digital modernization of economy are made in the works Andronova et al. (2019), Badzim et al. (2015), Baranova (2015), Belik et al. (2020), Boyazitov (2015), Dubova (2015), Fedotova et al. (2019), Petrenko and Shevyakova (2019), Popkova (2019), Popkova and Sergi (2020), Popkova et al. (2019), Popkova and Gulzat (2020a), Popkova and Gulzat (2020b), Popkova et al. (2018), Popkova and Parakhina (2019), Popkova and Zmiyak (2019), Popkova and Sergi (2018), Popkova and Sergi (2019), Ragulina (2019), Ragulina et al. (2019), Sergi (2003), Sergi (2019), Sergi et al. (2019), and Shulus et al. (2020), Alpidovskaya and Popkova (2019), Inshakova and Bogoviz (2020), Popkova (2017), Popkova et al. (2020).

The above publications have formed a scientific justification of heterogeneity of the process of economy's digital modernization. However, the logic and the main stages of this process have not been clearly determines and require further research. Here the process of economy's digital modernization is structures with the help of the following main stages (Figure 8.1).

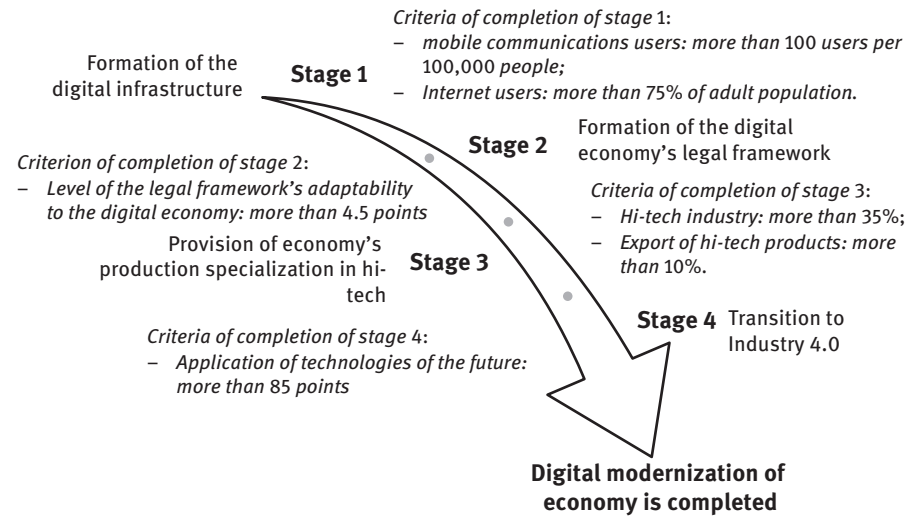


**Figure 8.1:** The main stages of economy's digital modernization.
Source: developed and compiled by the authors.

As shown in Figure 8.1, the digital infrastructure is formed at the first stage. The criteria of completion of stage 1 are as follows: more than 100 mobile communications users per 100,000 people, and Internet users – more than 75% of adult population. Stage 2 envisages the formation of the digital economy's legal framework. The criterion of completion of stage 2: the level of the legal framework's adaptability to the digital economy: more than 4.5 points.

Stage 3 is provision of economy's production specialization in hi-tech. For transition to the next stage, hi-tech industry should constitute more than 35%, and export of hi-tech products – more than 10%. At stage 4, transition to Industry 4.0 takes place. The criterion of completion of stage 4: activity of application of technologies of the future is more than 85 points. After this, digital modernization of economy could be deemed completed.

For practical application of the offered structure of digital modernization, let us use the statistics of developed (top 3 developed countries of IMD ranking), developing (top 3 developing countries of IMD ranking), and underdeveloped (3 lowest countries of IMD ranking) countries in 2020 (Table 8.1).

Based on the existing statistics, we calculate direct average for each distinguished category of countries and compare the value with the determined quantitative limits of determining the limits of digital modernization's stages.

## 3 Results

For determining the current stage of each distinguished category of countries, let us use the calculated direct average values and compare them with the limits (Figures 8.1–8.4).

As shown in Figure 8.2, countries of all distinguished categories exceed the set limit by mobile-cellular telephone subscriptions per 100,000 population. However, by the criterion of Internet users, % of adult population, underdeveloped countries (49.40%) have not yet reached the limit (75%), and thus as of now (2020) they are at stage 1 of digital modernization, while other countries have already completed it.

As shown in Figure 8.3, developed (5.47 points) and developing (4.47 points) countries have reached the limit (4.5 points) of legal framework's adaptability to digital business models and, therefore, have completed stage 2 of the economy's digital modernization.

**Table 8.1:** Statistics of the digital modernization of economy of developed, developing, and underdeveloped countries in 2020.

| Category of countries | Country | Mobile-cellular telephone subscriptions per 100,000 population | Internet users, % of adult population | Legal framework's adaptability to digital business models, value 1–7 | Medium and high-tech Industry (including construction), % manufacturing value added | High-technology exports, % of manufactured exports | Future readiness |
|---|---|---|---|---|---|---|---|
| Top 3 developed countries (top) | USA | 123.7 | 87.3 | 5.7 | 47.0 | 19.0 | 98.427 |
| | Singapore | 145.7 | 88.2 | 5.6 | 78.0 | 52.0 | 86.407 |
| | Sweden | 125.1 | 92.1 | 5.1 | 52.0 | 14.0 | 89.034 |
| Top 3 developing countries (middle) | China | 115.0 | 54.3 | 4.6 | 41.0 | 31.0 | 80.743 |
| | Russia | 157.4 | 80.9 | 3.9 | 30.0 | 11.0 | 56.539 |
| | Saudi Arabia | 122.6 | 93.3 | 4.9 | 39.0 | 1.0 | 61.950 |
| Lowest 3 underdeveloped countries (low) | Peru | 123.8 | 52.5 | 3.0 | 15.0 | 5.0 | 46.993 |
| | Mongolia | 133.2 | 23.7 | 3.0 | 5.0 | 5.0 | 42.936 |
| | Venezuela | 71.8 | 72.0 | 1.9 | 34.0 | n/a | 25.061 |

*n.a. – no data in the source.

Source: calculated and compiled by the authors based on IMD (2020), World Bank (2020a), World Bank (2020b), World Economic Forum (2020).

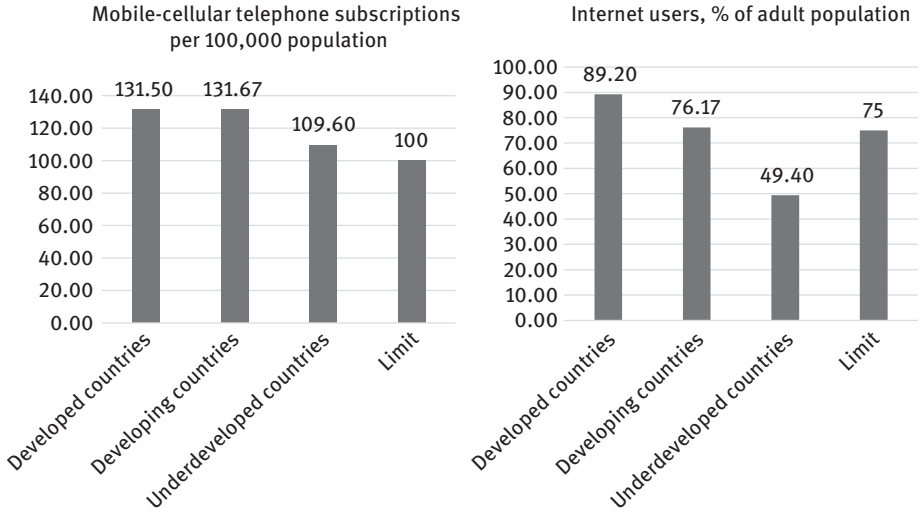


**Figure 8.2:** Average indicators of digital modernization of the distinguished categories of countries at stage 1 of digital modernization.
Source: developed and compiled by the authors.

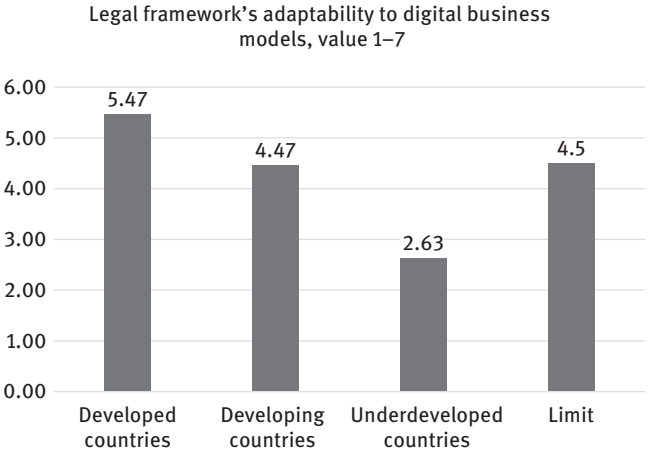


**Figure 8.3:** Average indicators of digital modernization of the distinguished categories of countries at stage 2 of digital modernization.
Source: developed and compiled by the authors.

As is shown in Figure 8.4, developed and developing countries have reached the limit (35%) of medium and high-tech industry (59% and 34.67%, accordingly) and the limit (10%) of hi-tech products export (28.33% and 14.33%. accordingly), and, therefore, have completed stage 3 of the economy's digital modernization.

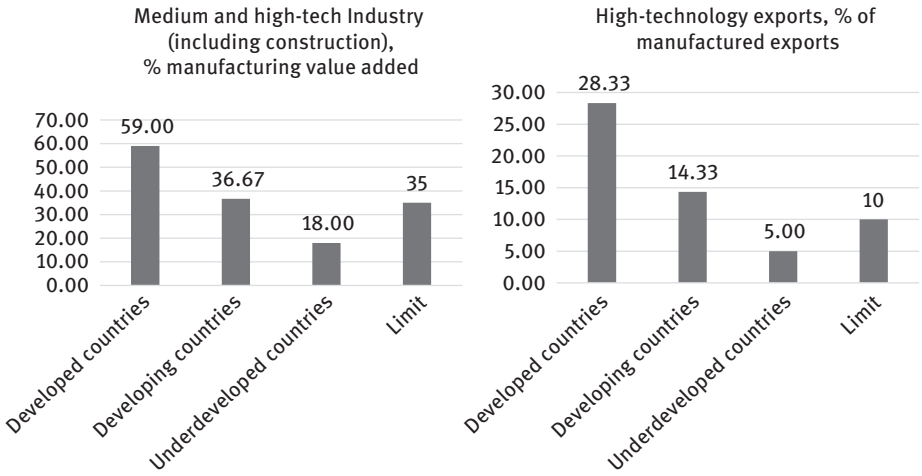


**Figure 8.4:** Average indicators of digital modernization of the distinguished categories of countries at stage 3 of digital modernization.
Source: developed and compiled by the authors.

As shown in Figure 8.5, developed countries (91.29 points) have exceeded the limit (85 points) of activity of application of technologies of the future and have completed the process of the economy's digital modernization. Developing countries (66.41%) are at stage 4 – final stage – of this process and will probably complete in in the near future.

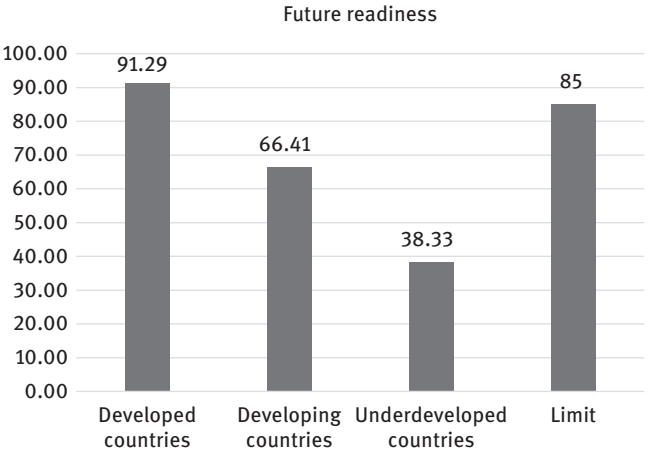


**Figure 8.5:** Average indicators of digital modernization of the distinguished categories of countries at stage 4 of digital modernization.
Source: developed and compiled by the authors.

## 4 Conclusion

Thus, the main stages of digital modernization of economy have been determined: 1) formation of the digital infrastructure, 2) formation of the legal framework of the digital economy, 3) provision of production specialization of economy in hi-tech, and 4) transition to Industry 4.0. Also, quantitative criteria (lower limits of values of the official statistics indicators) have been offered for precise determination of completion of each stage by countries of the world.

Underdeveloped countries just started the process of the digital modernization of economy and are currently at its first stage. Developing countries are at the last stage, and developed countries have already completed this process. As developed countries were the first to start the process of the digital modernization of economy, it took place with strict accordance to the set succession.

In developing and underdeveloped countries, the succession is different, which shows the existence of their special models of the digital modernization of economy. For example, underdeveloped countries, despite their current position at the first stage, have high values of the indicators from the next stages, and, obviously, the process of digital modernization will be quicker in underdeveloped countries than in developed countries.

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# 9 Implementation of Cluster Initiatives in the Digital Sphere as a Tool of Digital Entrepreneurship's Institutionalization

## 1 Introduction

Cluster processes in entrepreneurship are a highly-efficient mechanism of accelerating its innovative development, for, on the one hand, they allow reducing the costs and distributing the risks, and, on the other hand, they provide access to a more developed infrastructure and the improved results of R&D, marketing, and sales due to cooperation between the cluster participants. As implementation of digital technologies is a direction of business's innovative development, clustering could accelerate and simplify the implementation of this direction and ensure its better commercial profit.

The existing scientific and methodological approach to studying the digital economy envisages consideration of digital entrepreneurship from the positions of its activities' results. However, there is no unambiguous scientific view of these results; there are no statistics for their precise measuring either. The key manifestation of the activities of digital entrepreneurship at the current level of the digital economy's development is the volume of hi-tech exports. Though this indicator reflects the results of digital entrepreneurship's activities, it characterizes them only indirectly.

Hi-tech exports are largely determined by the government foreign trade policy. In case of its stimulating influence (e.g., favorable currency exchange rate, cheap manpower), hi-tech exports could be high even with a low level of digital business's development. On the contrary, in case of the restraining influence of the government foreign trade policy (unfavorable currency exchange rate, negative foreign economic situation), hi-tech exports will be low – despite the high

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level of digital business's development. That why using this indicator only could lead to a distorted treatment of the level of digital entrepreneurship's development.

The described contradiction of the existing approach hinders the determination of the positive effect from clustering for development of digital entrepreneurship. Thus, studying digital entrepreneurship from the positions of the institutional approach is very important. Instead of results, the new approach considers the factors (conditions) of development of digital entrepreneurship, of which the most important are the digital capabilities of entrepreneurship. The purpose of this chapter is to determine the perspectives of using the implementation of cluster initiatives in the digital sphere as a tool of institutionalization of digital entrepreneurship.

## 2 Materials and Method

The scientific foundations and practical experience of implementing cluster initiatives in entrepreneurship are studied in the works Abramova and Pozdnyakova (2015), Chan (2015), Divina (2015), Mitrofanova and Dudchenko (2015), Popkova et al. (2015), Popkova et al. (2017), Pozdnyakova et al. (2017), and Zorin et al. (2016), Alpidovskaya and Popkova (2019), Inshakova and Bogoviz (2020), Popkova (2017), Popkova et al. (2020).

Certain aspects of the influence of clustering on digital entrepreneurship's development during creation of hi-tech clusters in the spheres of economy are studied in the works Andronova et al. (2019), Belik et al. (2020), Belokurova et al. (2020), Fedotova et al. (2019), Popkova and Sergi (2020), Popkova and Sergi (2018), Popkova and Sergi (2019), Ragulina (2019), Ragulina et al. (2019), Sergi (2003), Sergi (2019), Shulus et al. (2020), Zavyalova et al. (2018).

However, the existing publications do not reflect the causal connections of cluster initiatives implementation in the digital sphere and institutionalization of digital entrepreneurship, which leads to the necessity for continuing scientific research. In this chapter, a complex of economic statistics is used.

The influence of the level of entrepreneurship's cluster development on its digital capabilities is determined with the help of regression analysis. The potential of digital entrepreneurship's institutionalization based on clustering is determined with the help of economic and mathematical modeling. The required level of clustering for institutionalization of digital entrepreneurship is determined with the help of simplex method.

The research objects are top 5 developed and top 5 developing countries with the highest digital competitiveness, according to the IMD Ranking 2019. The level of

clustering and digital capabilities of entrepreneurship in these countries are shown in Table 9.1.

**Table 9.1:** The level of cluster development and digital capabilities of entrepreneurship in developed and developing countries with the highest digital competitiveness in 2020.

| Position of countries in Digital Competitiveness Ranking | Country | State of cluster development, points 1–7 | Digital capabilities of entrepreneurship, points 1–5 | | | |
|---|---|---|---|---|---|---|
| | | | E-commerce | Digital media | Sharing economy | Online freelance |
| – | – | x | $y_1$ | $y_2$ | $y_3$ | $y_4$ |
| Top 5 developed countries | USA | 5.5 | 3.62 | 3.62 | 3.79 | 3.40 |
| | Singapore | 5.1 | 3.31 | 2.84 | 3.26 | 3.31 |
| | Sweden | 4.9 | 3.44 | 2.89 | 3.24 | 3.17 |
| | Denmark | 5.0 | 3.44 | 2.91 | 3.36 | 3.19 |
| | Switzerland | 5.3 | 3.40 | 3.08 | 3.14 | 3.08 |
| Top 5 developing countries | China | 4.6 | 2.04 | 2.24 | 2.51 | 2.06 |
| | Russia | 3.4 | 1.70 | 2.05 | 2.22 | 2.22 |
| | Thailand | 4.1 | 2.29 | 2.40 | 2.13 | 2.43 |
| | India | 4.3 | 1.87 | 2.32 | 2.24 | 2.48 |
| | Chile | 3.7 | 2.47 | 2.79 | 2.83 | 2.75 |

Source: compiled by the authors based on The Fletcher School, Tufts University (2020), World Economic Forum (2020).

# 3 Results

Based on the data from Table 9.1, the regression curves of the influence of the level of entrepreneurship's cluster development on its digital capabilities are built (Figure 9.1).

The obtained regression curves (Figure 9.1) show that implementation of cluster initiatives in entrepreneurship contributes positively to increase of all digital capabilities of entrepreneurship. Based on the obtained regression curves, let us perform the modeling of digital entrepreneurship's institutionalization based on clustering until 2024.

Firstly, we determine whether the digital capabilities reach their maximum in case of the maximum value of the level of entrepreneurship's clustering (x=max).

Secondly, we determine the value of clustering (x) that is required for all digital capabilities to take sufficient institutionalization (all y ≥ 3.5). The obtained results of the modeling are shown in Table 9.2.

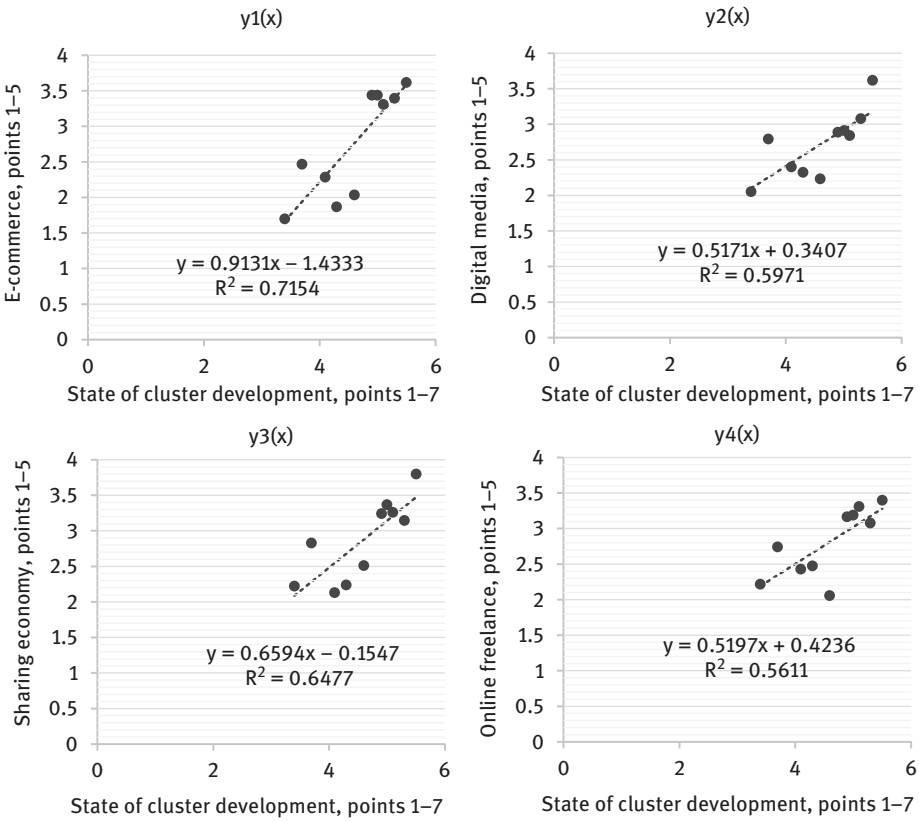


**Figure 9.1:** Regression curves of the influence of the level of entrepreneurship's cluster development on its digital capabilities.
Source: calculated and compiled by the authors.

As shown in Table 9.2, in case of the maximum level of clustering (x=7 points), digital capabilities of entrepreneurship do not reach their maximum (5 points), but grow substantially: e-commerce by 79.78%, up to 4.96 points; digital media by 45.92%, up to 3.96 points; sharing economy by 55.33%, up to 4.46 points; and online freelance by 44.59%, up to 4.06 points. Sufficient institutionalization (achieving 3.5 points) of all digital capabilities of entrepreneurship could be achieved on the basis of clustering. For this, the level of clustering has to reach 6.11 points – i.e., grow by 33.12%.

**Table 9.2:** Results of the modeling of digital entrepreneurship's institutionalization based on clustering for the period until 2024.

| Indicator | Symbol | Initial value in 2020 (average) | If x=max | | For all y≥3.5 | |
|---|---|---|---|---|---|---|
| | | | Target value in 2024 | Growth 2024/ 2020, % | Target value in 2024 | Growth 2024/ 2020, % |
| State of cluster development, points 1–7 | x | 4.59 | 7.00 | 52.51 | 6.11 | 33.12 |
| E-commerce | $y_1$ | 2.76 | 4.96 | 79.78 | 4.15 | 50.32 |
| Digital media | $y_2$ | 2.71 | 3.96 | 45.92 | 3.50 | 28.97 |
| Sharing economy | $y_3$ | 2.87 | 4.46 | 55.33 | 3.87 | 34.90 |
| Online freelance | $y_4$ | 2.81 | 4.06 | 44.59 | 3.60 | 28.12 |

Source: calculated and compiled by the authors.

# 4 Conclusion

Thus, implementation of cluster initiatives in the digital sphere is a highly-efficient tool of digital entrepreneurship's institutionalization. The potential of clustering in stimulating the increase of the modern entrepreneurship's digital capabilities is very high, though it cannot be used as the only source of increasing these capabilities.

At the same time, the exclusive use of clustering (without additional mechanisms) allows for institutionalization of digital entrepreneurship; full application of the potential of clustering is not mandatory. The received results show the necessity for more active use of the cluster policy in the interests of digital entrepreneurship's development.

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# 10 Institutions of Support for Digital Entrepreneurship: Special Economic Zones, Innovative Networks and Technological Parks

## 1 Introduction

Digital form is rather complex for the entrepreneurial activities, as it requires large flexibility of business processes and high innovative activity – for continuous development and constant mastering of the leading technologies. Thus, the hypothesis of this chapter is that digital entrepreneurship requires special institutions of support. Direct support from government leads to large burden on the state budget and is unavailable in the conditions of economic crises, in particular the 2020 global crisis; however, it also envisages the distortion of the effect of the competition mechanism due to state interference with the market processes.

Therefore, the search for support institutions for digital entrepreneurship, which work by the terms of de-regulation, is very important. A perspective direction of these institutions' activities is integration of entrepreneurship. Also, it is expedient to consider the institutions of infrastructural support for digital entrepreneurship.

One of them is special economic zones – areas in a country that are subject to unique economic regulations that differ from other regions of the same country. They allow digital companies enter new markets through investments and development of their networks on a certain territory with a favorable business environment. Special economic zones are good for industrial companies that are interested in creating "smart" departments in different countries.

Other institutions of infrastructural support for digital entrepreneurship are innovative networks and technological parks. They are good for companies of the service sphere and allow for international commercial (by the terms of buy-sell) exchange of knowledge, information, and technologies within the integration associations of

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companies with research institutes, which are not fixed to any certain territory. Innovative networks and technological parks for digital companies allow raising the accessibility of human and technological infrastructure – i.e., intellectual resources.

This chapter aims at determining the current contribution of support institutions – special economic zones, innovative networks, and technological parks – to development of digital entrepreneurship, as well as perspectives of increasing this contribution in the mid-term (by 2024).

## 2 Materials and Method

The integration processes in entrepreneurship – special economic zones, innovative networks, and technological parks – are studied in detail in the works Andronova et al. (2019), Belik et al. (2020), Belokurova et al. (2020), Fedotova et al. (2020), Andronova et al. (2019), Popkova (2019), Popkova et al. (2019), Popkova and Gulzat (2020a), Popkova and Gulzat (2020b), Popkova and Zmiyak (2019), Popkova and Sergi (2018), Popkova and Sergi (2019), Sergi (2003), Sergi (2019), Sergi et al. (2019), and Shulus et al. (2020), Alpidovskaya and Popkova (2019), Inshakova and Bogoviz (2020), Popkova (2017), Popkova et al. (2020).

The role of integration processes in the form of special economic zones, innovative networks, and technological parks for the purpose of formation and development of digital entrepreneurship is studies in the works Abramova and Pozdnyakova (2015), Chan (2015), Divina (2015), Ivanov et al. (2019), Mitrofanova and Dudchenko (2015), Popkova and Sergi (2020), Ragulina (2019), Ragulina et al. (2019), Sergi et al. (2019), and Sergi et al. (2019).

At the same time, the essence of infrastructural support for digital entrepreneurship in special economic zones, innovative networks, and technological parks has not been studied sufficiently from the institutional point of view and thus requires further elaboration. For obtaining the most precise results, we shall use the data of the official statistics, which shall be processes with the help of mathematical tools.

By the example of top 5 developed and developing countries – the leaders of Digital Competitiveness Ranking 2019 – we determine dependence of the entrepreneurship's digital capabilities on the institutions of its infrastructural support, using the method of regression analysis. As the direct statistical accounting of special economic zones, innovative networks, and technological parks is not available, we shall use statistical data which indirectly characterize these institutions of infrastructural support for entrepreneurship: level of market competition, international innovations, and multistakeholder collaboration. The selection of data for 2020 is shown in Table 10.1.

**Table 10.1:** The level of cluster development and the digital capabilities of entrepreneurship in developed and developing countries with the highest digital competitiveness in 2020.

| Positions of countries in the Digital Competitiveness Ranking | Country | Institutions of infrastructural support for entrepreneurship, points 1–100 | | | Digital capabilities of entrepreneurship, points 1–5 | | | |
|---|---|---|---|---|---|---|---|---|
| | | Extent of market dominance | International co-inventions | Multi-stakeholder collaboration | E-commerce | Digital media | Sharing economy | Online freelance |
| – | – | $x_1$ | $x_2$ | $x_3$ | $y_1$ | $y_2$ | $y_3$ | $y_4$ |
| Top 5 developed countries | USA | 70.6 | 79.63 | 73.9 | 3.62 | 3.62 | 3.79 | 3.40 |
| | Singapore | 63.8 | 100.00 | 66.0 | 3.31 | 2.84 | 3.26 | 3.31 |
| | Sweden | 63.7 | 100.00 | 72.0 | 3.44 | 2.89 | 3.24 | 3.17 |
| | Denmark | 72.7 | 98.40 | 69.5 | 3.44 | 2.91 | 3.36 | 3.19 |
| | Switzerland | 80.1 | 100.00 | 72.1 | 3.40 | 3.08 | 3.14 | 3.08 |
| Top 5 developing countries | China | 58.9 | 19.70 | 57.3 | 2.04 | 2.24 | 2.51 | 2.06 |
| | Russia | 44.4 | 15.91 | 49.5 | 1.70 | 2.05 | 2.22 | 2.22 |
| | Thailand | 43.8 | 9.59 | 52.1 | 2.29 | 2.40 | 2.13 | 2.43 |
| | India | 53.8 | 10.13 | 53.3 | 1.87 | 2.32 | 2.24 | 2.48 |
| | Chile | 38.9 | 7.46 | 44.8 | 2.47 | 2.79 | 2.83 | 2.75 |

Source: compiled by the authors based on The Fletcher School, Tufts University (2020), World Economic Forum (2020).

Based on the models of multiple linear regression with the help of simplex method, we determine the target values of the infrastructural support institutions for bringing entrepreneurship's digital capabilities to the necessary level, for achieving the institutionalization of the practices of their application (3.5 points).

# 3 Results

Based on the data from Table 10.1, the following models of multiple linear regression of the type $y=a+b_1*x_1+b_2*x_2+b_3*x_3+b_4*x_4$ are obtained (Table 10.2).

**Table 10.2:** Results of regression analysis of dependence of the digital capabilities on institutions of infrastructural support for business.

| Regression statistics | | Regression model | | | | Qualitative treatment of the regression analysis results |
|---|---|---|---|---|---|---|
| | | y1 | y2 | y3 | y4 | |
| Multiple R (correlation) | | 0.9333 | 0.7585 | 0.8559 | 0.8822 | high correlation in all models |
| Constant (a) | | 0.94 | 0.78 | 1.33 | 2.36 | – |
| Coefficient (b) with | $x_1$ | –0.02 | –0.01 | –0.01 | –0.02 | factor variable does not influence or restrain (negative regression) the development of digital business |
| | $x_2$ | 0.01 | 0.00 | 0.01 | 0.01 | variable has weak influence on development of digital business |
| | $x_3$ | 0.04 | 0.04 | 0.03 | 0.02 | variable has vivid influence (the key institution of infrastructural support for digital entrepreneurship) |

Source: calculated and compiled by the authors.

As shown in Table 10.2, all regression models are peculiar for high correlation, which shows their applicability to further research. The key (with the highest coefficients of regression) institutional factor of infrastructural support for digital entrepreneurship is multistakeholder collaboration ($x_3$). Based on the data from Table 10.2, optimization of the infrastructural support for institutionalization of digital entrepreneurship by 2024 is performed (Table 10.3).

**Table 10.3:** Optimization of the infrastructural support for institutionalization of digital entrepreneurship by 2024.

| Indicator | Symbol | Initial value in 2020 (average) | Isolated optimization | | | | Systemic optimization (maxx) | |
|---|---|---|---|---|---|---|---|---|
| | | | $y_1 \geq 3.5$ | $y_2 \geq 3.5$ | $y_3 \geq 3.5$ | $y_4 \geq 3.5$ | all $y \geq 3.5$ | growth, % |
| Extent of market dominance | $x_1$ | 59.07 | 59.07 | 59.07 | 59.07 | 59.07 | 59.07 | 0.00 |
| International co-inventions | $x_2$ | 54.08 | 58.50 | 54.44 | 57.74 | 71.89 | 71.89 | 32.93 |
| Multistakeholder collaboration | $x_3$ | 61.05 | 78.75 | 79.43 | 80.89 | 93.47 | 93.47 | 53.10 |
| E-commerce | $y_1$ | 2.76 | 3.5 | – | – | – | 4.24 | 53.62 |
| Digital media | $y_2$ | 2.71 | – | 3.5 | – | – | 4.12 | 51.77 |
| Sharing economy | $y_3$ | 2.87 | – | – | 3.5 | – | 3.98 | 38.66 |
| Online freelance | $y_4$ | 2.81 | – | – | – | 3.5 | 3.50 | 24.60 |

Source: calculated and compiled by the authors.

According to the results of systemic optimization (Table 10.3), the key growth of the support institutions and the results in the form of growth of the indicators of digital entrepreneurship's development are shown in Figure 10.1.

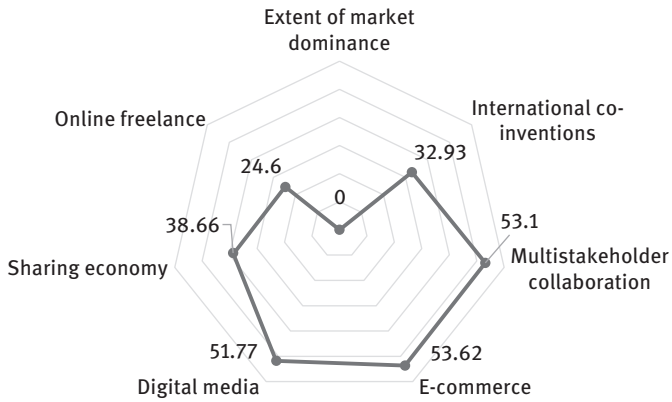


**Figure 10.1:** Target growth of the support institutions and the results in the form of growth of the indicator of digital entrepreneurship's development, %.
Source: calculated and compiled by the authors.

As shown in Figure 10.1, institutions of infrastructural support for digital entrepreneurship could allow online freelance to grow by 24.6% by 2024, sharing economy – by 38.66%, digital media – by 51.77%, and e-commerce – by 53.62%. For this, multistakeholder collaboration should be increased by 53.1%, and international innovations – by 32.93%.

## 4 Conclusion

Thus, it has been substantiated that the institutions of infrastructural support – special economic zones, innovative networks, and technological parks = have a large potential of stimulating the digital entrepreneurship's development. The level of market competition does not necessarily have to be high; it might be also decreased for a better effect of the above institutions. The key role in institutionalization of infrastructural support for digital entrepreneurship belongs to international cooperation during creation and implementation of innovations, as well as multistakeholder collaboration.

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# Part III: **Meso-Level Institutions of the Digital Economy in the 21st Century**

Inna A. Koryagina, Alfira M. Kumratova, Petr N. Afonin and Ivan V. Grekov

# 11 Digitalization of Regional Economy: Problems and Perspectives

## 1 Introduction

The level of economy at which digitalization takes place determines the specifics of this process management. At the national level, the key factor of economy digitalization is international competition – thus, the most important priority of management is provision of the global digital competitiveness of the national economy. At the regional level, two factors are very important at the same time. 1st factor: national strategy of economy's digital development. Regions are to implement the national course of the economic system's development. Global competitiveness of the national economy is ensured by means of digitalization of the regions. That's why the priority of management at the regional level is acceleration of the rate of economy's digital development.

2nd factor: disproportions of regional economy. The level and potential of socioeconomic development are usually differentiated among a country's regions. Thus, according to the first priority, the leading region is the first to achieve the high level of digitalization, which ensures the necessary competitiveness at the national level. Other regions lag behind and have a lower level of digital development, which causes the imbalance of regional economy. Thus, another priority of management is provision of the balance of regional economy through overcoming the differences in the level of regions' digitalization.

The existing approach to studying the digital economy focuses on the national results of digital modernization and thus does not take into account the specifics of managing the digitalization at the regional level of economic system, which is poorly studied. This gap is to be filled by the developed institutional approach to studying the digital economy, which ensures thorough study of the process of economic systems' digitalization through the prism of institutions.

The research object is modern Russia. It has a high level of digital competitiveness (38th position in the world) and a high level of economy's regionalization (a lot of regions with different potential, level, and rate of development). Here we

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offer a hypothesis that modern Russia's regional economy has a vivid influence of the both factors, which makes its experience demonstrative and useful for other countries. The purpose of this chapter is to determine the current (as of 2020) problems of digitalization of Russia's regional economy and the perspectives of solving them by 2024, at which the program "Digital economy of the Russian Federation" is oriented, being the national landmark of digital modernization of the Russian economic system.

## 2 Materials and Method

The essence and managerial aspect of digitalization of the economy and the regional level of economy are studied in the works Popkova (2019), Popkova et al. (2019), Popkova and Gulzat (2020a), Popkova and Gulzat (2020b), Popkova et al. (2018), Popkova and Parakhina (2019), Popkova and Zmiyak (2019), Popkova and Sergi (2019), Ragulina (2019), Ragulina et al. (2019), Sergi (2003), Sergi et al. (2019), Shulus et al. (2020), Zavyalova et al. (2018).

The experience of the regional economy's digitalization in modern Russia is reflected in the works Andronova et al. (2019), Baranova (2015), Borzenko (2015), Belokurova et al. (2020), Dubova (2015), Fedotova et al. (2020), Litvinova (2015), Popkova and Sergi (2020), Popkova and Sergi (2018), Sergi (2019), Sergi et al. (2019a), and Sergi et al. (2019b), Alpidovskaya and Popkova (2019), Inshakova and Bogoviz (2020), Popkova (2017), Popkova et al. (2020). The above publications define the theoretical and methodological platform of this research, but do not fully describe the set problem of Russia's regional economy's digitalization, which is not studied sufficiently from the institutional point of view.

As Russia has 85 territorial subjects, they cannot all be studied in detail here. This research is performed on the basis of eight federal districts. The main statistics for Russia's regional economy could be obtained from Federal State Statistics Service (Rosstat) – the data for 2016–2017 are available as of 2020. The statistics of the Russian economy's digitalization are collected by Skolkovo analytical center; the data for 2019 are available.

In order to determine the current state of affairs and use the compatible (the same time period) data, we use the materials of the forecast of the Institute of Scientific Communications from the data set "Interactive Statistics and Intelligent Analytics of the Balanced State of the Regional Economy of Russia in Terms of Big Data And Blockchain – 2020". These data reflect the factual data in view of the moderate growth rate "other conditions being equal", based on the dynamics of past year.

The selected data include the resulting indicator – level of economy's digitalization and its potential factors: financial factors – private investments in fixed

capital, regional budget surplus (possibilities of state financing of digitalization), and balanced financial result of companies (own capabilities for financing of business's digitalization) – and the non-financial factor – the share of innovations-active organizations (flexibility of business). The described data are shown in Table 11.1.

**Table 11.1:** The level and factors of digitalization of Russia's regional economy in 2020 (by the example of federal districts).

| Federal district | Level of economy's digitalization, points 1–100 | Share of innovations-active organizations, % | Investments in fixed capital per capita, RUB | Regional budget surplus, RUB million | Balanced financial result of companies' activities, RUB million |
|---|---|---|---|---|---|
| | y | $x_1$ | $x_2$ | $x_3$ | $x_4$ |
| Central | 47.70 | 8.77 | 141,030.41 | −582,368.93 | 872,305.21 |
| Far Eastern | 44.66 | 6.40 | 277,016.68 | −44,255.90 | 37,093.91 |
| North Caucasian | 33.80 | 4.27 | 56,245.07 | 26,172.15 | 12,559.31 |
| Northwestern | 49.66 | 9.64 | 164,767.83 | −142,812.18 | 1,610,539.77 |
| Siberian | 42.14 | 8.68 | 91,495.58 | 125,973.03 | 1,310,938.84 |
| Southern | 45.23 | 13.84 | 150,537.69 | 152,547.64 | 213,120.78 |
| Ural | 57.69 | 8.20 | 283,508.69 | 64,429.09 | 1,031,931.63 |
| Volga | 47.48 | 8.29 | 79,226.23 | 106,381.85 | 6,185.50 |

Source: compiled by the authors based on Institute of Scientific Communications (2020).

In this research, regression analysis is used for determining multiple linear dependence of the digitalization level on the selected factors. Variation analysis is used for determining the level of equality of digitalization of the Russian regions' economy.

# 3 Results

Variation analysis is performed for determining the balance of Russia's regional economy in 2020 from the positions of digitalization based on the data from Table 11.1. It shows that the level of digitalization in federal districts of Russia in 2020 diverts from the average level (46.05 points) by 14.71% (6.77 points). This is a

moderate, but rather vivid level of differentiation of the economy's digitalization level. The histogram of normal distribution of the digitalization level of Russia's federal districts economy in 2020 is built in Figure 11.1.

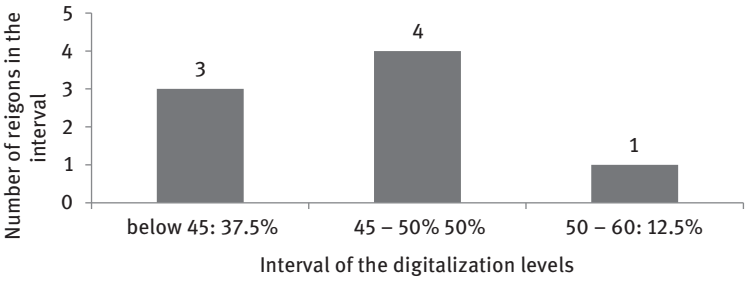


**Figure 11.1:** Histogram of normal distribution of the Russian federal districts economy's digitalization level in 2020.
Source: calculated and compiled by the authors.

As shown in Figure 11.1 by the example of federal districts, 37.5% of Russian regions have a level of digitalization below 45 points, 50% of regions – 45–50 points, and 12.5% of regions – 50–60 points. Even the Ural Federal District, which has 57.69 points is characterized by a lower value than the average Russian value (70.406 points, according to IMD Digital Competitiveness Ranking 2019).

It is determined based on the data from Table 11.1 that regression dependence of the digitalization level on the financial factors strives to zero (is negligibly small). That's why instead of multiple regression we shall build a regression curve of dependence of the level of digitalization of Russia's regional economy on one (non-financial) factor – share of innovations-active organizations (Figure 11.2).

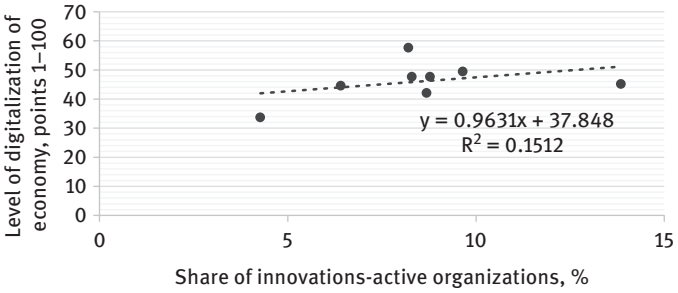


**Figure 11.2:** The regression curve of dependence of the digitalization level of regional economy on the share of innovations-active organizations in Russia in 2020 (by the example of federal districts).
Source: calculated and compiled by the authors.

As shown in Figure 11.2, increase of the share of innovations-active organizations by 1% leads to growth of the digitalization level by 0.9631 points, though the connection between the indicator is small (correlation – 15.12%). Putting the data in the regression equation in Figure 11.2, we determine that the level of digitalization of the federal districts' economy will reach the all-Russian level (77.406 points) if the share of innovations-active organizations constitutes 33.81%, which could be achieved by 2024. The target growth of the share of innovations-active organizations for acceleration and balance of digitalization of Russia's regional economy by 2024 is shown in Figure 11.3.

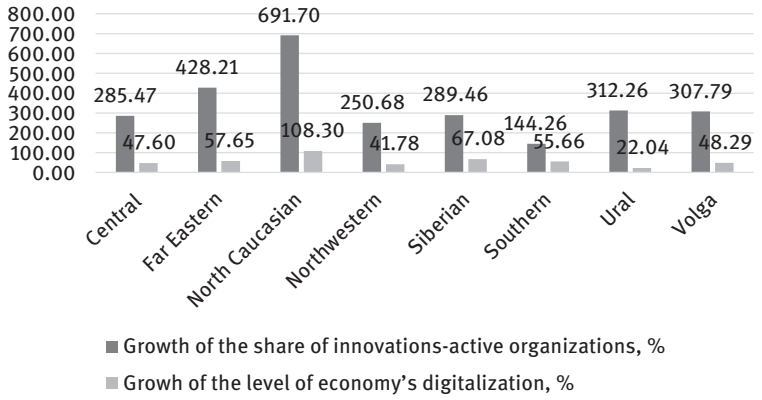


**Figure 11.3:** Target growth of the share of innovations-active organizations for accelerating and balancing the digitalization of Russia's regional economy by 2024.
Source: calculated and compiled by the authors.

As shown in Figure 11.3, the highest growth of the share of innovations-active organizations is required in the North Caucasian Federal District (691.70%), and the lowest – in the Southern Federal District (144.26%). The highest growth of the level of digital competitiveness is requires and will be achieved in the Far Eastern Federal District (57.65%), and the lowest – in the Ural Federal District (22.04%).

# 4 Conclusion

Thus, it has been determined that the most important problems of digitalization of Russia's regional economy in 2020 are non-achievement of the national strategic landmarks and imbalance of regional economy by the level of digitalization (variation – 14.71%).

The perspectives of solving the above problems are connected to stimulation of entrepreneurship's innovative activity. If the share of innovations-active organizations

reaches 33.81% in all federal districts by 2024, the all-Russian level of digitalization (70.406 points) will be achieved. The detailed data on federal districts have not only scientific and theoretical but also practical significance, as they could be the basis for developing a "road map" of digitalization of Russia's regional economy and the strategies of digitalization of economy for Russia's federal districts until 2024.

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# 12 The Institutional Model of the Digital Economy Creation in a Modern Region

## 1 Introduction

At the regional level, the process of the digital economy creation is described with a larger number of indicators than at the national level. This is dues to the fact that for comparing countries in the world economy the universal indicators of expert analytics are used – which are similar for all countries and of which the most well-known and frequently used is IMD Digital Competitiveness Ranking (2020). The large number of absolute indicators is inaccessible due to differences in the national systems of statistical accounting.

At the level of regions, generalized indices (relative indicators) provide surface data, and absolute indicators of basic statistics are used instead of them. As regions belong to the same country, their statistical accounting is conducted according to the same standards – which ensures data compatibility. This opens wide opportunities for a detailed study of the causal connections of the digital economy creation in a modern region.

The existing scientific and methodological approach to studying the digital economy does not allow using the described opportunities, because it aims at determining the current level, progress in dynamics, and competitiveness of the region's digital economy. The indicators' values are studied, but their contribution to the general process of the region's economy's digitalization is not determined. This contribution could be determines by the developed institutional approach to studying the digital economy.

The new approach considers statistical indicators not as set ones (obtained spontaneously, uncontrolled) but as ones that formed as a result of functioning and development of institutions that are subject to state management. In this

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case, the level of region's economy's digitalization is a function of the corresponding institutions, which is available for precise study with application of the mathematical tools. Based on the above, the purpose of this chapter is to develop an institutional model of the digital economy creation in a modern region by the example of Russia – as a country with a vivid regionalization of the economy.

## 2 Materials and Method

Literature overview and analysis shows that different sources note different factors of the digital economy creation in a modern region.

The works Popkova (2019), Popkova and Sergi (2020), Popkova and Gulzat (2020a), Popkova and Gulzat (2020b), Popkova et al. (2018), Popkova and Zmiyak (2019), Popkova and Sergi (2018), Popkova and Sergi (2019), Sergi et al. (2019) draw attention to the information society as a factor of digitalization of region's economy. Dissemination of digital technologies (primarily, Internet) in society and their active use determine the opportunities for development of e-commerce, digital communications, online labor market, and other processes of the digital economy, which envisage participation of wide groups of population (consumers).

Other researchers – Andronova et al. (2019), Baranova (2015), Belik (2020), Borzenko (2015), Dubova (2015), Litvinova (2015), and Shulus et al. (2020), Alpidovskaya and Popkova (2019), Inshakova and Bogoviz (2020), Popkova (2017), Popkova et al. (2020) – note such factor of creating the digital economy in a region as digitalization of business. Progress of entrepreneurship defines the accessibility of hi-tech products in a region, the level of competition in the markets of digital goods and services, and activity of international digital cooperation.

Another factor of the digital modernization of region's economy – which is substantiated in Fedotova et al. (2020), Popkova et al. (2019), Popkova and Parakhina (2019), Ragulina (2019), Ragulina et al. (2019), Sergi (2003), Sergi (2019), and Zavyalova et al. (2018) – is e-government. It determines activity of applying the authomatization means for state management (e.g., tax administration) and accessibility of online state services.

In this chapter, all the above factors, which are considered as institutions of the digital economy creation in a region, are studied from the positions of the institutional approach: from the aspect of demand, offer, and markets' regulation. In order to cover the whole regional economy of Russia, the research is performed on the basis of federal districts, which statistics (as of 2020) are shown in Table 12.1.

**Table 12.1:** The level and institutions of the digital economy creation in regions of Russia in 2020 (by the example of federal districts).

| Federal district | Institutions of the digital economy creation | | | |
|---|---|---|---|---|
| | Level of economy's digitalization, points 1–100 | Share of Internet users among population aged 15–74, % | Share of organizations using broadband Internet, %: | Share of citizens using the mechanism of public and municipal services in the online form, % |
| | y | $x_1$ | $x_2$ | $x_3$ |
| Central | 47.70 | 87.3 | 87.4 | 80.0 |
| Far Eastern | 44.66 | 85.9 | 78.6 | n/a |
| North Caucasian | 33.80 | 86.9 | 80.3 | 71.4 |
| Northwestern | 49.66 | 88.0 | 88.6 | 67.8 |
| Siberian | 42.14 | 84.0 | 77.8 | n/a |
| Southern | 45.23 | 89.1 | 80.8 | 77.8 |
| Ural | 57.69 | 86.8 | 82.9 | 65.6 |
| Volga | 47.48 | 86.1 | 83.5 | 77.3 |

Source: compiled by the authors based on D-Russia (2020), Institute of Scientific Communications (2020), National Research Institute "Higher School of Economics" (2020).
Note: (n/a) – due to changes in the structure of the Siberian and Far Eastern Federal Districts, the data for them are unavailable.

Regression analysis is used for studying the causal connections of the digital economy creation in regions of Russia. A model of multiple linear regression of the form $y = a + b1^*x1 + b2^*x2 + b3^*x3$ is built. Structural analysis is used for the quantitative and qualitative study of the balance of development of the digital economy's institutions in Russia's regions in 2020. Simplex method is used for determining the necessary progress in development of the institutions to achieve the all-Russian level of digitalization in all federal districts – 70.406 points, according to IMD (2020) in 2019 – for the period until 2024.

# 3 Results

Based on the data from Table 12.1, the following regression model is obtained: $y = -60.123 + 0.23797x1 + 1.0769^*x2 - 0.0509^*x3$. The model shows inequality of development of the digital economy institutions in Russia's regions. The largest contribution to the digital economy is made by the institution of digital

business – increase of the share of organizations using broadband Internet (average value in 2020: 82.49%) by 1% leads to growth of the level of digitalization of region's economy by 1.0769 points.

A less vivid, but still significant, contribution to formation of the digital economy is made by digital society – increase of the share of Internet users among population aged 15–74 (average value in 2020: 86.76%), by 1% leads to growth of the level of digitalization of region's economy by 0.23797 points. The institution of e-government is least developed (average share of citizens using online public and municipal services in 2020: 54.99%) and does not contribute to formation of the digital economy in Russia's regions (regression coefficient is negative and small: 0.0509 points).

Based on the obtained regression equation, the target growth of the institutions of the digital society and the institution of digital business in each federal district of Russia that is required for achieving the nationwide level of digitalization (70.406 points) by 2024 is determined (Figure 12.1).

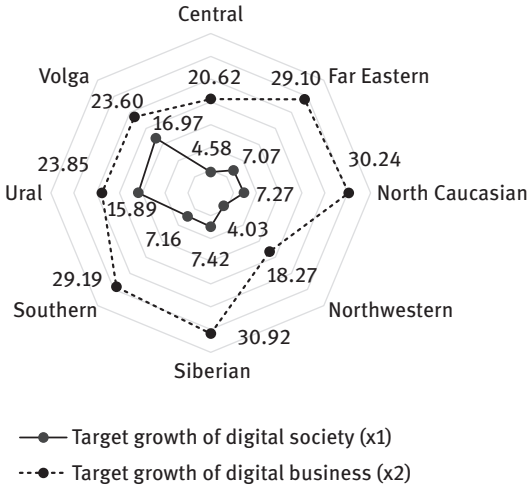


**Figure 12.1:** The target growth of the institutions for achieving the all-Russian level of economy's digitalization (70.406 points) in all federal districts of Russia by 2024.
Source: calculated and compiled by the authors.

As shown in Figure 12.1, the largest development of digital society by 2024 is required in the Volga (16.97%) and Ural (15.89%) federal districts, and the largest development of digital business – in the Siberian (30.92%) and North Caucasian (30.24%) federal districts. However, in all federal districts, the shares of organizations organizations that use broadband Internet and of Internet users among population aged 15–74 that exceed 100% are required – however, this cannot be achieved in practice.

The potential (maximum progress) of increase of the level of digitalization of the Russian federal districts' economy based on development of the institutions of digital society and digital business by 2024 is shown in Figure 12.2.

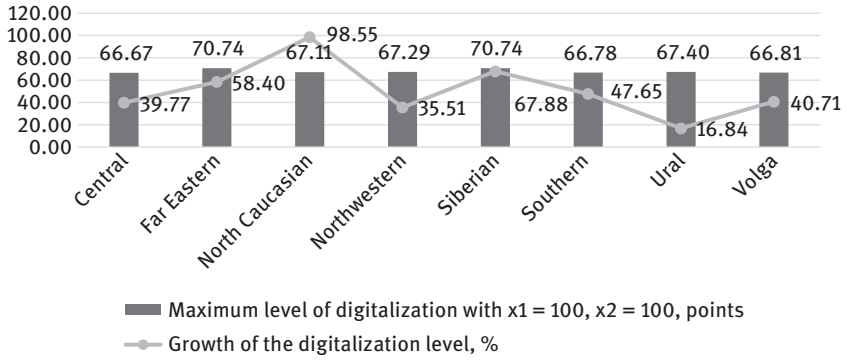


**Figure 12.2:** Potential of increasing the level of digitalization of Russia's federal districts' economy based on development of the institutions of digital society and digital business for the period until 2024.
Source: calculated and compiled by the authors.

As shown in Figure 12.2, the largest progress in development of the digital economy based on development of institutions of digital society and digital business by 2024 could be achieved in the Far Eastern and Siberian (70.74 points in both cases) federal districts, and the largest growth of the digitalization level – in the North Caucasian federal district (98.55%).

# 4 Conclusion

Thus, it has been shown – by the example of Russia – that the institutional model of the digital economy creation in a modern region is based on three institutions: information society, digital business, and e-government. The institution of e-government is developed to a lesser extern in Russia, as compared to other institutions, and does not contribute to the general digitalization of regional economy. That's why its qualitative transformation (modernization) or refusal from its usage as a factor of the digital economy creation in regions of Russia is required. For managing the institution of the digital society and digital business, the target values of the corresponding indicators for all federal districts of Russia for the period until 2024 are calculated.

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# 13 Managing a Modern Region Based on Digital Technologies

## 1 Introduction

The leading technologies open wide opportunities for improving the practice of state management of a region. The existing approach to studying the digital economy comes from the potential possibilities of the new technological mode and forms – on their basis – the programs of digitalization of regions' state management. As the potential possibilities of digital technologies are equal in all regions, the programs of digitalization of regions' state management are universal.

Standardization and norming predetermine low flexibility and adaptability to the market conditions for the programs of digitalization of regions' state management and do not allow taking into account the specifics of region's economy. Equality of norms and plans of state management's digital modernization in the regional programs causes a situation when, on the one hand, unpopular but planned events are conducted in an unprepared regional economy and are characterized by increased resource intensity and low results. On the other hand, popular events do not receive sufficient resources and are not implemented in full.

Though the described approach allows increasing the competitiveness of the e-government system, it does not guarantee and often does not ensure factual advantages for the region. For example, the measures of digital tax administration, online public services, and digital monitoring of socio-economic development, which are widely implemented in regions of modern Russia by the example of the leading developed (OECD) and developing (BRICS) countries, require deep transformation of the economic practices for all subjects of market relations; however, they do not increase the effectiveness of economic activity from the positions of overcoming the shadow economy and reducing the level of bureaucracy and corruption.

The alternative is the institutional approach, which allows taking into account the specifics of region's economy during preparation of a program of digitalization of its state regulation's practice. The criterion of including the events in the region's program is not generalized capabilities of digital technologies but

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the level of institutionalization of successful practices of their application in the region. This chapter aims at developing an institutional basis for managing a modern region based on digital technologies by the example of Russia's regions.

## 2 Materials and Method

The theory and practice of a modern region management based on digital technologies, connected to authomatization of the managerial processes and provision of online public services, are studied in the works Andronova et al. (2019), Baranova (2015), Borzenko (2015), Dubova (2015), Litvinova (2015), Plotnikov et al. (2020), Popkova et al. (2019), Popkova and Parakhina (2019), and Ragulina et al. (2019a), Alpidovskaya and Popkova (2019), Inshakova and Bogoviz (2020), Popkova (2017), Popkova et al. (2020).

The scientific and methodological issues of developing the programs of modernization of a modern region management based on digital technologies with foundation on the criterion of capabilities of digital technologies and the region's need for them are studied in the works Belokurova et al. (2020), Ivanov et al. (2019), Popkova (2019), Popkova and Sergi (2020), Popkova and Gulzat (2020a), Popkova and Gulzat (2020b), Popkova et al. (2018), Popkova and Zmiyak (2019), Popkova and Sergi (2018), Popkova and Sergi (2019), Ragulina et al. (2019b), Sergi (2003), Sergi (2019), Sergi et al. (2019), Shulus et al. (2020), Stolyarov et al. (2020).

In this chapter, we use the institutional approach to offer and test – by the example of modern Russia's regions – a new criterion of developing the programs of modernization of a modern region's management based on digital technologies – the level of institutionalization of the practices of these technologies' application. The new criterion characterizes successfulness and popularity of the practices of the leading technologies' application and their adaptability to the region's market environment.

The research objects are top 10 regions of Russia by effectiveness of state management in 2020, according to the ranking of the Agency for political and economic communications (2020). Three blocks of effectiveness of state management in a region are distinguished in this ranking: political and managerial (relations with the federal center, bureaucracy, etc.), social block (healthcare, education, international and inter-confessional relations, and development of socially important transport infrastructure and housing and utilities infrastructure), and financial and economic block (investment climate and budget policy).

Regression analysis is used for determining the influence of the digitalization level on each block of effectiveness of state management in the studied regions. Institutionalization of the practices of increasing the effectiveness of state management in Russia's regions is evaluated by the value of estimate coefficients of regression – the higher the coefficient's value, the higher the level of institutionalization. The initial statistics for the research are shown in Table 13.1.

**Table 13.1:** Statistics of digitalization of economy and effectiveness of state management in Russia's regions in 2020, points 1–100.

| Region | Political and managerial block | Social block | Financial and economic block | Level of digitalization |
|---|---|---|---|---|
| | y | $x_1$ | $x_2$ | $x_3$ |
| Tyumen Oblast | 0.840 | 0.784 | 0.764 | 76.19 |
| Kaluga Oblast | 0.772 | 0.628 | 0.813 | 58.11 |
| Belgorod Oblast | 0.796 | 0.708 | 0.704 | 65.16 |
| Yamalo-Nenets Autonomous Okrug | 0.692 | 0.655 | 0.812 | 66.69 |
| Tula Oblast | 0.799 | 0.599 | 0.743 | 65.02 |
| Chechen Republic | 0.889 | 0.756 | 0.486 | 26.02 |
| Leningrad Oblast | 0.757 | 0.656 | 0.708 | 63.07 |
| Sakhalin Oblast | 0.619 | 0.730 | 0.764 | 51.57 |
| Republic of Bashkortostan | 0.694 | 0.668 | 0.712 | 65.73 |
| Rostov Oblast | 0.728 | 0.675 | 0.664 | 62.50 |

Source: compiled based on Agency for political and economic communications (2020), Institute of Scientific Communications (2020).

# 3 Results

For determining the level of institutionalization of the practices of state management of a modern region based on digital technologies in the three blocks of this management, let us use the results of regression analysis of the data from Table 13.1 (Figure 13.1).

As shown in Figure 13.1, only the financial and economic block has a high level of institutionalization of the practices of state management of a modern region based on digital technologies. This is proved by positive regression (0.0052 points) and a relatively high value of the correlation coefficient (55.9%). Therefore, more active use of digital technologies is expedient in the financial and economic block, and it is necessary to improve the practices of their application for future institutionalization in other blocks.

The institutional basis for modernizing the Russian regions' management based on digital technologies for each block is offered in Tables 13.2–13.4.

As shown in Table 13.2, for the financial and economic block the most perspective digital technologies for application in the practice of state management of a region are ubiquitous computing, mobile technologies, AI, blockchain, and Internet.

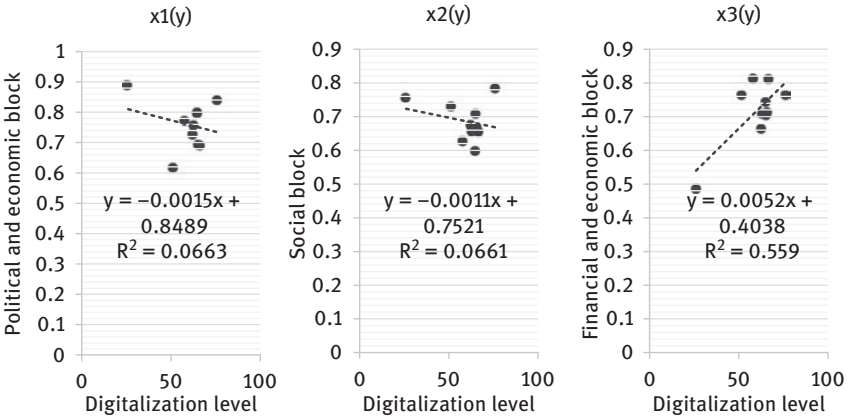


**Figure 13.1:** Regression curves of dependence of effectiveness of region's state management on digitalization in view of the management blocks in top 10 regions of Russia in 2020.
Source: calculated and compiled by the authors.

**Table 13.2:** The institutional basis for modernizing the Russian regions' management based on digital technologies in the financial and economic block.

| Component of the block | Perspective technologies | Possibilities of application | Advantages |
|---|---|---|---|
| Effectiveness of economic management | Ubiquitous computing and mobile technologies | electronic document turnover, digital taxation, and tax administration | simplification of economic accounting, taxation, and tax administration; overcoming of shadow economy |
| | AI | intellectual monitoring of sectorial markets | improved information and intellectual support for decision making in sectorial markets management |
| Improvement of the investment climate | Distributed register (blockchain) | interactive information on investments in the region | better information provision of investments in the region |
| Effectiveness of the budget policy | Internet | population's online participation in formation of the budget policy | involving interested parties and strengthening social support for budget policy |

Source: developed and compiled by the authors.

**Table 13.3:** The institutional basis for modernizing the Russian regions' management based on digital technologies in the political and managerial block.

| Component of the block | Perspective technologies | Possibilities of application | Advantages |
|---|---|---|---|
| Public support of the region's head | Internet | social Internet marketing and PR of the implemented socially important projects in the region | increase of population's loyalty to the region's head |
| Effectiveness of relations with the federal center | AI | intellectual decision support | harmonization of the practice of region management with the strategic national priorities |
| Effectiveness of the work of the bureaucratic machine | Internet | development of the system of online public services | increase of accessibility of public service in the region |

Source: developed and compiled by the authors.

As shown in Table 13.3, the most perspective digital technologies for application in the practice of state management of a region in the political and managerial block are Internet and AI.

**Table 13.4:** The institutional basis for modernizing the Russian regions' management based on digital technologies in the social block.

| Component of the block | Perspective technologies | Possibilities of application | Advantages |
|---|---|---|---|
| Healthcare | Internet | hospital electronic record | increase of medical services' accessibility |
| | RFID-, SRM-, and cloud technologies | electronic medical record | increase of medical services' quality |
| | Robotics, manipulators, and nanotechnologies | MedTech | increase of medical services' effectiveness |

**Table 13.4** (continued)

| Component of the block | Perspective technologies | Possibilities of application | Advantages |
|---|---|---|---|
| Education | Internet | remote education | increase of accessibility, inclusive education |
| | virtual and alternate reality | EdTech | increase of quality and effectiveness of education |
| International and inter-confessional relations | distributed register (blockchain) | anonymous participation in digital events | guarantee of social justice |
| | Internet | cultural exchange, social advertising | reduction of social tension |
| Development of socially important transport infrastructure and housing and utilities infrastructure | Internet | electronic transport services | increase of accessibility and effectiveness of transport |
| | AI, Internet of Things, ubiquitous computing | "smart" housing and utilities infrastructure (digital monitoring) | continuous work of the infrastructure |

Source: developed and compiled by the authors.

As shown in Table 13.4, the most perspective digital technologies for application in the practice of state management of a region in the social block are Internet, RFID-, SRM-, and cloud technologies, robotics, manipulators, nanotechnologies, virtual and alternate reality, blockchain, AI, the Internet of Things, and ubiquitous computing.

# 4 Conclusion

The results of the performed research showed the differences in perspectives of improving the practice of managing a modern region based on digital technologies in different blocks. The only block in Russia in which the considered practices passed the sufficient institutionalization is the financial and economic block. That's why it is expedient to implement digital technologies in it. In the political & managerial and social blocks, it is necessary to prepare and change the practice of digital technologies application. For all three blocks, applied recommendations in the sphere of a modern region management based on digital technologies are offered.

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# Part IV: **Macro-Level Institutions of the Digital Economy in the 21st Century**

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Aleksandra V. Zakharova and Sergei B. Chernov

# 14 State Institutional Regulation of Economy Digital Modernization

## 1 Introduction

Strategic significance of economy digital modernization for accelerating economic growth and supporting effectiveness and global competitiveness of the economic system, as well as the existence of a "market gap", which hinders the implementation of this process, predetermines the necessity for its state regulation. The existing approach to studying the digital economy envisages application of the methods of direct regulation of economy digital modernization: grants for R&D, state order for development of breakthrough technologies, and subsidies and tax support for implementation of digital technologies in the economic practices of production and consumption.

An obvious drawback of direct regulation is large burden on the state budget. Thus, according to World Bank (2020), the share of R&D expenditures, which are currently connected primarily to digital technologies, in GDP in very high in modern countries: 4.95% in Israel, 3.34% in Sweden, 2.84% in the USA, 2.19% in China, and 0.99% in Russia. Besides, a drawback of direct financing is the reduction of natural adaptive abilities of society and business and disruption of their market initiatives in the sphere of digitalization during constant wait for further support from the government. In the long-term, direct financing for economy digital modernization is an "institutional gap".

These drawbacks actualize the problem of refusal from direct regulation and transition to indirect regulation, aimed at supporting market agents' initiatives, and to digital modernization of their economic practices. Here an alternative – institutional – approach to studying the digital economy could be used. This chapter aims at substantiating the perspectives and developing the universal framework recommendations for state institutional (with the help of indirect measures) regulation of the process of economy digital modernization.

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## 2 Materials and Method

The issue of state regulation of economy digital modernization has been elaborated and studied in a lot of publications. The performed literature overview shows the most accessible and popular measures of indirect state regulation of the process of economy digital modernization:

- Intellectual property protection: Andronova et al. (2019), Shulus et al. (2020), Alpidovskaya and Popkova (2019), Inshakova and Bogoviz (2020), Popkova (2017), Popkova et al. (2020)
- Reduction of burden of government regulation (simplification of economic activities): Fedotova et al. (2020), Popkova et al. (2019), Popkova and Parakhina (2019)
- Government's responsibility for changes: Popkova and Sergi (2020), Popkova and Gulzat (2020a), Popkova and Gulzat (2020b), Popkova and Zmiyak (2019), Popkova and Sergi (2018), Popkova and Sergi (2019), Sergi et al. (2019), Stolyarov et al. (2020)
- E-participation: Baranova (2015), Borzenko (2015), Dubova (2015), Ivanov et al. (2019), Litvinova (2015), Popkova et al. (2018), Sergi (2003), Sergi (2019)
- ICT development: Popkova (2019), Ragulina (2019), Ragulina et al. (2019)

The problems in the existing research literature include the focus on the measures of direct state regulation of the digital economy with poor elaboration of the indirect regulation measures and consideration of the measures of indirect regulation in separation, which hinders the formation of a systemic scientific idea of them. In order to fill these gaps, the institutional scientific and methodological approach to studying the digital economy is used; according to this approach, all the above measures of indirect regulation are studied in the systemic manner as the institutions of state regulation, required during managing the economy digital modernization.

For quantitative characteristics of these institutions, the values of the corresponding indicators, calculated by the World Economic Forum and presented in the 2019 Global Competitiveness Report, are used. For measuring the results of the action of these institutions we selected two indicators of digital competitiveness, which are calculated by IMD: social adaptation to digitalization and digitalization of business. Regression analysis is used for determining dependence of the results on the institutions of state regulation. Due to the differences in qualitative treatment of the studied indicators' values (results are measures in positions in the ranking – thus, the lower the number the better; and institutions are measured in points – the higher the better), the positive influence of the institutions on results is achieved with negative values of regression coefficients.

For covering all participants of the global economic system, obtaining the most precise results, and compiling the universal recommendations, the research objects

are developed (top 3 developed countries of the IMD ranking), developing (top 3 developing countries of the IMD ranking), and underdeveloped (lower 3 countries of the IMD ranking) countries in 2020 (Table 14.1).

## 3 Results

For calculating the contribution of the institutions to achievement of the results of economy digital modernization, let us use the results of regression analysis (Figure 14.1).

For specifying the obtained results, let us use the models of multiple linear regression:

- $y1 = 91.62 - 1.65*x1 - 0.51*x2 + 1.57*x3 - 0.36*x4 + 0.11*x5$
- $y2 = 90.42 - 1.45*x1 - 1.67*x2 + 0.96*x3 + 0.35*x4 - 0.44*x5$

According to the obtained models, increase of the level of intellectual property protection by 1 points leads to improvement of a country's position in the global ranking of social adaptation to digitalization by 1.65 positions, and in the ranking of business digitalization – by 0.51 positions. Reduction (increase of the indicator's value in points) of the burden of government regulation by 1 point leads to improvement of a country's position in the global ranking of social adaptation to digitalization by 1.45 positions, and in the ranking of business digitalization – by 0.67 positions.

Government's responsibility for changes does not ensure a vivid improvement of the results of digital modernization (positive regression), but determines the general conditions for obtaining effect from the action of other institutions. Growth of E-participation by 1 point leads to improvement of a country's position in the global ranking of social adaptation to digitalization by 0.36 points. Growth of ICT development by 1 point leads to improvement of a country's position in the global ranking of business digitalization by 0.44 points.

For determining the specifics of the action of the studied institutions in developed, developing, and underdeveloped countries, we calculate correlation with the results for each category of countries (Figures 14.2 and 14.3).

As shown in Figure 14.2, the positive effect of action of the institutions of economy digital modernization for social adaptation to digitalization is most vivid in underdeveloped countries.

**Table 14.1:** Statistics of the results and institutions of the digital modernization of economy of developed, developing, and underdeveloped countries in 2020.

| Category of countries | Country | Results of digital transformation, positions 1–63 | | Institutions of state regulation, required during managing the economy digital modernization, points 1–100 | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Adaptive attitudes | Business agility | Intellectual property protection | Burden of government regulation | Government's responsiveness to change | E-Participation | ICT adoption |
| | | $y_1$ | $y_2$ | $x_1$ | $x_2$ | $x_3$ | $x_4$ | $x_5$ |
| Top 3: developed countries | USA | 2 | 2 | 78,3 | 57,7 | 68,9 | 98,31 | 74,3 |
| | Singapore | 19 | 6 | 89,3 | 74,4 | 85,2 | 96,63 | 87,1 |
| | Sweden | 8 | 13 | 76,9 | 45,9 | 56,1 | 93,82 | 87,8 |
| Middle 3: Developing countries | China | 24 | 1 | 58,3 | 56,3 | 49,8 | 90,45 | 78,5 |
| | Russia | 40 | 54 | 47,3 | 37,0 | 47,4 | 92,13 | 77,0 |
| | Saudi Arabia | 50 | 36 | 71,7 | 61,3 | 79,4 | 71,35 | 69,3 |
| Low 3: underdeveloped countries | Peru | 49 | 59 | 37,1 | 25,5 | 29,9 | 86,52 | 45,7 |
| | Mongolia | 31 | 63 | 34,3 | 30,1 | 25,9 | 73,60 | 46,5 |
| | Venezuela | 63 | 49 | 14,5 | 12,8 | 7,2 | 40,45 | 46,7 |

Source: compiled and calculated by the authors based on IMD (2020), World Economic Forum (2020).

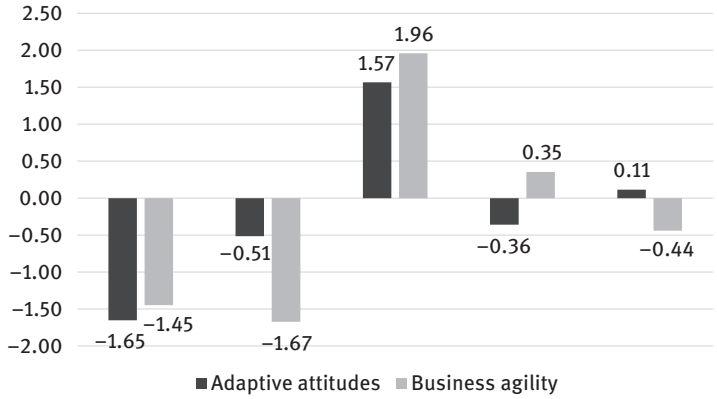


**Figure 14.1:** Regression coefficients in the models of dependence of the results on the institutions of economy digital modernization, position.
Source: calculated and compiled by the authors.

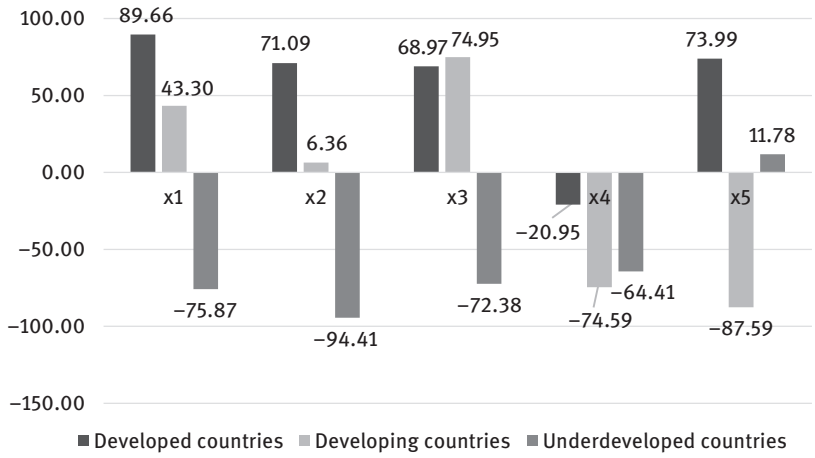


**Figure 14.2:** Correlation between digitalization of society and the institutions of economy digital modernization in developed, developing, and underdeveloped countries, %.
Source: calculated and compiled by the authors.

As shown in Figure 14.3, the positive effect of the action of the institutions of economy digital modernization for digitalization of business is most vivid in developed countries.

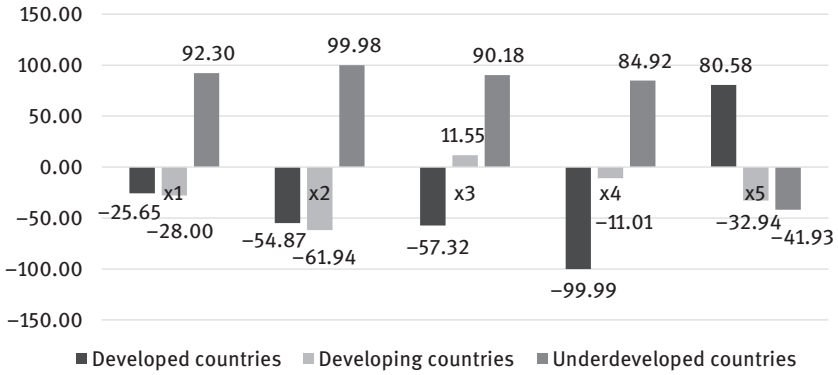


**Figure 14.3:** Correlation between digitalization of business and the institutions of economy digital modernization in developed, developing, and underdeveloped countries, %.
Source: calculated and compiled by the authors.

Based on the above, a hierarchical institutional model of state regulation of the process of economy digital modernization is developed (Figure 14.4).

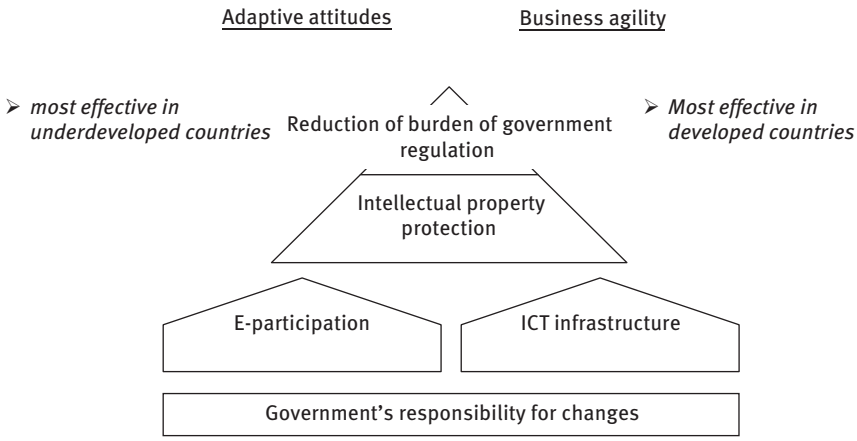


**Figure 14.4:** Hierarchical institutional model of state regulation of the process of economy digital modernization.
Source: developed and compiled by the authors.

As shown in Figure 14.4, the offered model recommends developing the institution of government's responsibility for changes and considering it as a measure of favorable conditions creation for obtaining a positive effect from the action of other measures. For ensuring social adaptation to digitalization, it is necessary to develop the institute of e-participation; for stimulating the business digitalization, it is necessary to develop ICT development. The universal and highly-effective

institutions are intellectual property protection and reduction of the burden of government regulation.

## 4 Conclusion

Thus, state institutional regulation of the process of digital modernization of economic systems allows achieving vivid results in the sphere of support for social adaptation to the digital economy and digitalization of business. This allows considering the institutional measures, which envisage indirect measures, as full replacement for the measures of direct regulation – which allows reducing the burden of digital modernization on state budget and using the market mechanism.

An hierarchical institutional model of state regulation of the process of economy digital modernization is offered as a universal framework recommendation. Though this model could be applied in countries of any category, it is most effective and preferable in developed and underdeveloped countries. In developing countries, the positive effect from applying the institutional (indirect) measures is limited, and so it is necessary to combine them with the measures of direct state regulation of economy digital modernization.

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# 15 The Role of Financial Institutions in Supporting the Digital Economy

## 1 Introduction

Digitalization is based on technological – the most capital-intensive – innovations, and thus the financial aspect of this process requires elaborate research. The traditional foundation on state financing of economy digital modernization is inaccessible in the conditions of large burden on the state budget, due to the necessity to implement the measures of social support for population with reduced tax flow and due to the fact that the main initiatives in the sphere of the breakthrough technologies implementation are realized in the practice of private and commercial, not public, entrepreneurship – so government support distorts the action of the market mechanism, restraining, not stimulating, the processes of business's development.

The institutional approach to studying the digital economy is an alternative view of the financial support for digitalization of entrepreneurship – from private financial institutions. They include the institution of private sector crediting, which allows for timely full-scale digitalization of business by means of borrowed capital, thus preserving or strengthening the market positions of business and guaranteeing long-term competitiveness in the target segment. They include the institution of financing of small and medium entrepreneurship (SME). As in most countries of the world, including the OECD and BRICS, the structure of entrepreneurship is dominated by small and medium subjects, they are treated as the potential main sources of entrepreneurship's digitalization.

The institution of venture investing should be also noted. Venture capital financing of breakthrough innovations raises their accessibility for business. Another institution is market capitalization of business, which determines the possibility of attracting additional capital based on shares emission, due to their high market cost in the national economy and globally. Also, there is the institution of business risks insurance, which leads to reduction of the risk components of entrepreneurship's digital modernization.

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The purpose of this chapter is to determine the role of financial institutions in support for the digital economy in the aspect of stimulating the digital modernization initiatives in entrepreneurship.

## 2 Materials and Method

Significance of financial support for the digital economy is noted in a lot of publications: Plotnikov et al. (2020), Popkova (2019), Popkova et al. (2019), Popkova and Gulzat (2020a), Popkova and Gulzat (2020b), Popkova and Parakhina (2019), Popkova and Zmiyak (2019), Popkova and Sergi (2019), Ragulina (2019), Ragulina et al. (2019), Sergi (2003), Sergi et al. (2019), Sergi et al. (2019), Shulus et al. (2020), Alpidovskaya and Popkova (2019), Inshakova and Bogoviz (2020), Popkova (2017), Popkova et al. (2020).

The works devoted to differences in the digital economies of developed and developing countries constitute a separate category of the research. They provide arguments in favor of the fact that accessibility of financial capital is one of the main reasons due to which developed countries were the first to start the processes of economy digital modernization and have the largest progress and the largest global digital competitiveness. These include Andronova et al. (2019), Baranova (2015), Belokurova et al. (2020), Borzenko (2015), Dubova (2015), Litvinova (2015), Popkova and Sergi (2020), Popkova and Sergi (2018), Sergi (2019), Sergi et al. (2019), Sergi et al. (2019).

Though the level of elaboration of the set problem is rather high, the level of its detalization is low, because only the general issues of financing of digitalization are studied, with insufficiently detailed description of the role of specific financial institutions in support for the digital economy. In order to fill this gap, we use the statistical data of each distinguished financial institute from the Global Competitiveness Report 2019 of the World Economic Forum. Variation method is used for determining the differences in the level of these institutions' development among countries with different socio-economic positions.

Regression analysis is used for determining the contribution of each financial institution (separately and as a system) to digitalization of business, presented in the IMD Digital Competitiveness Ranking for 2019. Simplex method is used for determining target values and the required growth of the values of financial institutions for realizing the potential of development of digital entrepreneurship in the global economy for the period until 2024.

For obtaining the fullest and the most precise and authentic results, we use the data for all three categories of countries, distinguished in the global economic system, including developed (top 3 developed countries of IMD ranking), developing (top 3 developing countries of IMD ranking), and underdeveloped (lower 3 countries of IMD ranking) countries (Table 15.1).

**Table 15.1:** Statistics of digitalization of business and development of financial institutions in developed, developing, and underdeveloped countries in 2020.

| Category of countries | Country | Financial institutions | | | | | |
|---|---|---|---|---|---|---|---|
| | | Digitalization of business, positions 1–63 | Crediting of private sector, points 1–100 | Financing of SME*, points 1–100 | Venture investing, points 1–100 | Market capitalization of business, % of GDP | Insuring business risks, % of GDP |
| | | y | $x_1$ | $x_2$ | $x_3$ | $x_4$ | $x_5$ |
| Top 3: developed countries | USA | 2 | 100.0 | 74.8 | 70.6 | 100.00 | 6.5 |
| | Singapore | 6 | 100.0 | 69.8 | 63.5 | 220.1 | 6.3 |
| | Sweden | 13 | 100.0 | 62.3 | 56.4 | 140.9 | 7.0 |
| Middle 3: developing countries | China | 1 | 100.0 | 57.2 | 57.0 | 70.2 | 3.1 |
| | Russia | 54 | 57.0 | 38.1 | 29.3 | 38.9 | 1.1 |
| | Saudi Arabia | 36 | 59.0 | 61.9 | 57.1 | 66.6 | 0.7 |
| Low 3: underdeveloped countries | Peru | 59 | 45.3 | 43.8 | 35.0 | 39.7 | 1.6 |
| | Mongolia | 63 | 57.5 | 32.2 | 19.6 | 7.0 | 0.4 |
| | Venezuela | 49 | n/a** | 29.2 | 17.7 | 2.5 | 3.1 |

Source: calculated and compiled by the authors based on IMD (2020), World Economic Forum (2020).
Note: *SME – small and medium entrepreneurship.
**n/a – data are not available in the source.

# 3 Results

Using the data from Table 15.1, we determine the average level of financial institutions' development and its variation among developed, developing, and underdeveloped countries in 2020 (Figure 15.1).

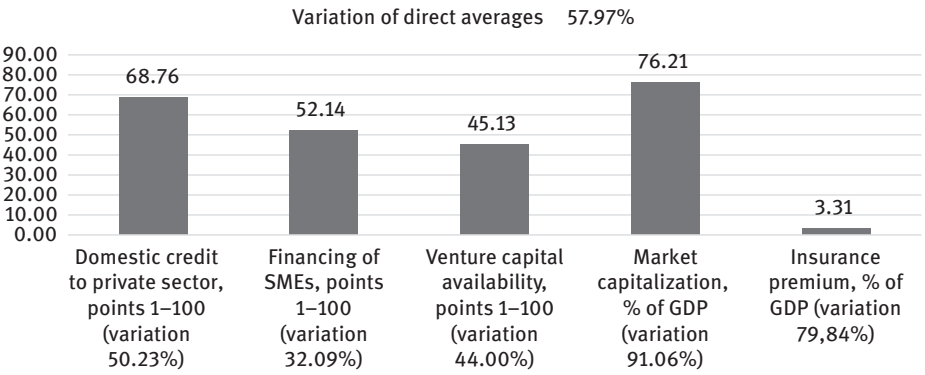


**Figure 15.1:** Average level of financial institutions' development and its variation among developed, developing, and underdeveloped countries in 2020.
Source: calculated and compiled by the authors.

Figure 15.1 shows a high (more than 30% in all cases) variation of the level of financial institutions' development among developed, developing, and underdeveloped countries in 2020, as well as variation of the average level of financial institutions' development (57.97%). On the whole, all institutions are well-developed, but differentiated in different categories of countries. Regression analysis of the data from Table 1 allowed receiving multiple linear regression equation: $y = 21.98 - 0.05^{*}x1 + 4.01^{*}x2 - 3.95^{*}x3 - 0.02^{*}x4 - 4.99^{*}x5$. Therefore, all financial institutions contribute to development of digital entrepreneurship (which is proved by the negative values of regression coefficients), except for the institution of financing of SMEs ($x_2$).

The landmarks of financial institutions' development for implementing the potential of entrepreneurship's digitalization for the period until 2024 (y = 1) are shown in Figure 15.2.

As shown in Figure 15.2, for implementing the potential of entrepreneurship's digitalization for the period until 2024, it is necessary by increase the institution of venture investing by 16.92%, up to 45.13 points; insurance of business risks – by 1.57%, up to 3.31% of GDP; crediting of private sector – by 0.315, up to 68.76 points; and market capitalization of business – by 0.15%, up to 76.21% of GDP. The performed calculations allow compiling a model of digital entrepreneurship's development on the basis of the financial institutions (Figure 15.3).

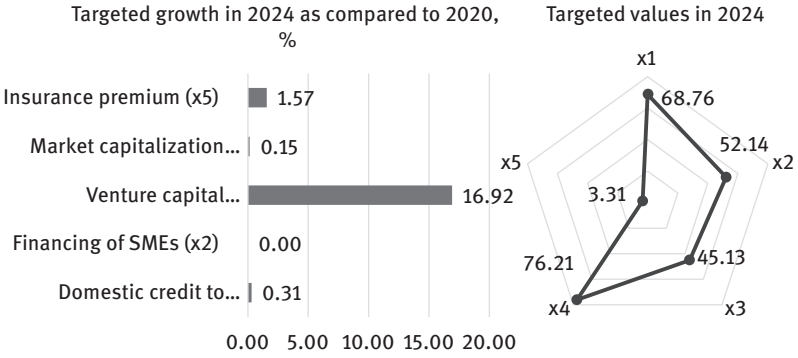


**Figure 15.2:** Landmarks of financial institutions' development for implementing the potential of entrepreneurship's digitalization for the period until 2024.
Source: calculated and compiled by the authors.

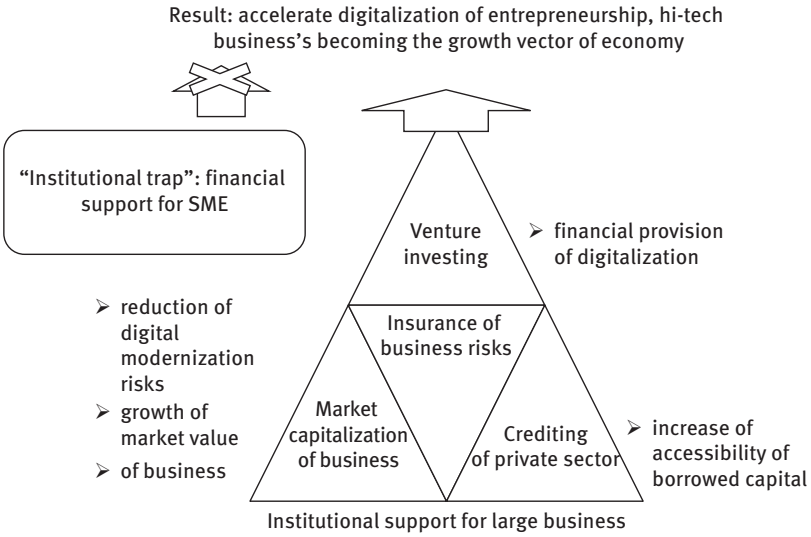


**Figure 15.3:** The model of managing the digital entrepreneurship's development on the basis of the financial institutions.
Source: developed and compiled by the authors.

The offered model is based on the institution of market capitalization of business, which stimulates the growth of its market value, and the institution of crediting of private sector, which increases the accessibility of borrowed capital. The core is the institution of insurance of business risks, which reduces the risks of digital modernization. The institution of venture investing, which finances digitalization, is at the peak.

Institutional support for large business helps achieving accelerated digitalization of entrepreneurship, and hi-tech business becomes the growth vector of economy. Financial support for small and medium entrepreneurship is an "institutional trap", as it is capital-intensive, but does not lead to achievement of the desired result.

## 4 Conclusion

Thus, financial institutions are very important and have several roles in supporting the digital economy. Not only do they ensure the financial provision of digitalization – they also increase the accessibility of borrowed capital, ensure the growth of business's market value, and reduce the risks of digital modernization. For the purpose of realizing the potential of entrepreneurship's digitalization for the period until 2024, a model of managing its development based on financial institutions is developed. In addition to the qualitative model, precise quantitative values of the statistical indicators, which characterize the level of the institutions' development, and their target growth for the period until 2024 are determined.

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# 16 Digital Economy of the 21st Century: A View from the Positions of Developed and Developing Countries

## 1 Introduction

The digital economy ensures multiple advantages, and its successfulness is determined through the prism of these advantages. The existing approach to studying the digital economy is based on the methods of countries' ranking. Thus, the higher the value of the gained advantages from the digitalization processes that more successful they are. Though from the scientific and theoretical point of view, this approach could be deemed logically correct, two contradictions arise from the methodological point of view.

The first contradiction consists in insufficient elaboration of the methodological provision of precise measuring of advantages from economy digitalization. At the fundamental level of economic science, the potential contribution of the digital economy to such positive phenomena of economic systems as acceleration of their innovative development and increase of their global competitiveness is acknowledged. However, at the empirical level, precise quantitative connections between these phenomena and digitalization have not been determined.

That's why the level of competitiveness and the rate of innovative development in the absolute expression are considered to be the advantages digitalization. As developed countries are characterized by higher global competitiveness of economy and the largest rate of innovative development, the advantages of digitalization are considered to be the most vivid in them. High competitiveness and innovativeness are the initial features of developed countries, not necessarily caused or strengthened by digitalization and not necessarily connected to it.

The second contradiction is that advantages of the digital economy pose different value for economic systems. For example increase of global competitiveness is more important for developing countries, while developed countries focus on acceleration of innovative development. These contradictions cause the problem of insufficient

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scientific argumentation of the hypothesis on higher successfulness of the digital economy of developed countries as compared to developing countries.

These contradictions could be overcome by the institutional approach to studying the digital economy. It allows for quantitative measuring of the contribution of digitalization to achievement of various advantages by economic systems, due to studying the institutional ties between them, and for accounting of significance (value, priority) of the advantages for various economic systems. This chapter aims at developing a scientific methodology of precise and correct quantitative measuring of successfulness of the digital economy of the 21st century in developed and developing countries and at using it for substantiating the differences between them from the positions of the institutional approach.

## 2 Materials and Method

Transition to the digital economy and Industry 4.0 in the process of the Fourth industrial revolution, as a global tendency of the 21st century, is studied in the works Popkova (2019), Popkova et al. (2019), Popkova et al. (2018), Popkova and Parakhina (2019), Popkova and Gulzat (2020a), Popkova and Gulzat (2020b), Popkova and Zmiyak (2019), Popkova and Sergi (2019), Ragulina (2019), Ragulina et al. (2019), Sergi et al. (2019), Sergi (2003), and Shulus et al. (2020). Digital economies of developed and developing countries are studied and differentiated in Andronova et al. (2019), Baranova (2015), Borzenko (2015), Dubova (2015), Kovazhenkov et al. (2019), Litvinova (2015), Petrenko and Shevyakova (2019), Popkova and Sergi (2020), Popkova and Sergi (2018), and Sergi (2019), Alpidovskaya and Popkova (2019), Inshakova and Bogoviz (2020), Popkova (2017), Popkova et al. (2020).

Thus, the theoretical basis of the research of this problem is rather strong, but the methodological basis requires further elaboration. In this chapter, the basis of the scientific methodology of quantitative measuring of successfulness of the digital economy of the 21st century is T.L. Saaty's hierarchy process. This envisages the following stages of the evaluation:

1. Ranking of advantages of the digital economy by the level of significance and assigning weight coefficients, which sum is to equal 1
2. Determining the correlation dependence of digitalization and manifestations of economy's development for measuring the scale of the advantages of the digital economy
3. Calculating hierarchy synthesis as a product of advantages and their weight coefficients. The higher the hierarchical synthesis, the more successful the digital economy

The procedure is performed separately for developed and developing countries for determining differences between them. Systematization, structuring, and ranking of advantages of the digital economy for developed and developing countries are performed in Table 16.1.

**Table 16.1:** Systematization, structuring, and ranking of advantages of the digital economy for developed and developing countries.

| Type (nature) of advantages | Advantages | Significance of advantages | | | |
|---|---|---|---|---|---|
| | | for developed countries | | for developing countries | |
| | | Significance | Weight | Significance | Weight |
| Social | Increase of quality of life | 10 | 10/60=0.17 | 6 | 6/60=0.10 |
| | Provision of sustainable development | 9 | 9/60=0.15 | 5 | 5/60=0.08 |
| | Stimulation of human development | 8 | 8/60=0.13 | 5 | 5/60=0.08 |
| | Provision of public well-being and happiness | 7 | 7/60=0.12 | 10 | 10/60=0.17 |
| | Aggregate social | 34 | 34/60=0.57 | 26 | 26/60=0.43 |
| Economic | Entering the world markets and increase of hi-tech products export | 5 | 5/60=0.08 | 10 | 10/60=0.17 |
| | Acceleration of innovative development | 6 | 6/60=0.10 | 7 | 7/60=0.12 |
| | Acceleration of the rate of economic growth | 5 | 5/60=0.08 | 9 | 9/60=0.15 |
| | Growth of global competitiveness | 10 | 10/60=0.17 | 8 | 8/60=0.13 |
| | Aggregate economic | 26 | 26/60=0.43 | 34 | 34/60=0.57 |
| Aggregate social and economic | | 10+9+8+7+5+6+5+10=60 | | 6+5+5+10+10+7+9+8=60 | |

Source: developed and compiled by the authors.

Table 16.1 shows that social and economic advantages of the digital economy are distinguished. Social advantages are more important for developed countries, and economic advantages are more important for developing countries. The research objects

**Table 16.2:** Statistics of the digital economy and its social and economic advantages in developed and developing countries with the highest digital competitiveness in 2020.

| Position in Digital Competitiveness Ranking | Country | Digital Competitiveness Ranking, points 1–100 | Social advantages | | | | Economic advantages | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Quality of life index, points 1–200 | Sustainable development index, points 1–100 | Human development index, shares of 1 | Happiness index, points 1–10 | Share of hi-tech products in the structure of commodity export, % | Innovations index, points 1–100 | Rate of economic growth, % | Global competitiveness index 4.0, points 1–100 |
| Top 5 developed countries | USA | 100.000 | 176.77 | 74.5 | 0.920 | 6.892 | 19.0 | 61.73 | 2.121 | 83.7 |
| | Singapore | 99.373 | 146.09 | 69.6 | 0.935 | 6.262 | 52.0 | 58.37 | 2.553 | 84.8 |
| | Sweden | 96.070 | 180.52 | 85.0 | 0.937 | 7.343 | 15.0 | 63.65 | 2.181 | 81.2 |
| | Denmark | 95.225 | 196.47 | 85.2 | 0.930 | 7.600 | 14.0 | 58.44 | 1.801 | 81.2 |
| | Switzerland | 94.648 | 196.08 | 78.8 | 0.946 | 7.480 | 13.0 | 67.24 | 1.600 | 82.3 |
| Top 5 developed countries | China | 84.292 | 99.87 | 73.2 | 0.758 | 5.191 | 31.0 | 54.82 | 6.000 | 73.9 |
| | Russia | 70.406 | 104.05 | 70.9 | 0.824 | 5.648 | 11.0 | 37.62 | 1.500 | 66.7 |
| | Thailand | 68.434 | 104.54 | 73.0 | 0.765 | 6.008 | 23.0 | 38.63 | 3.239 | 68.1 |
| | India | 64.952 | 115.41 | 61.1 | 0.647 | 4.015 | 9.0 | 36.58 | 7.791 | 61.4 |
| | Chile | 66.724 | 123.80 | 75.6 | 0.847 | 6.444 | 7.0 | 36.64 | 2.700 | 70.5 |

Source: compiled by the authors based on Institute of Scientific Communications (2020), World Bank (2020).

are top 5 developed and top 5 developing countries with the highest digital competitiveness, according to the IMD Ranking for 2019 (Table 16.2).

## 3 Results

The developed methodology of quantitative measuring of successfulness of the digital economy of the 21st century is tested by the example of developed and developing countries with the highest digital competitiveness in 2020. Cross correlation ($R^2$) of social and economic indicators with digital competitiveness in developed and developing countries in 2020 is presented in Figure 16.1.

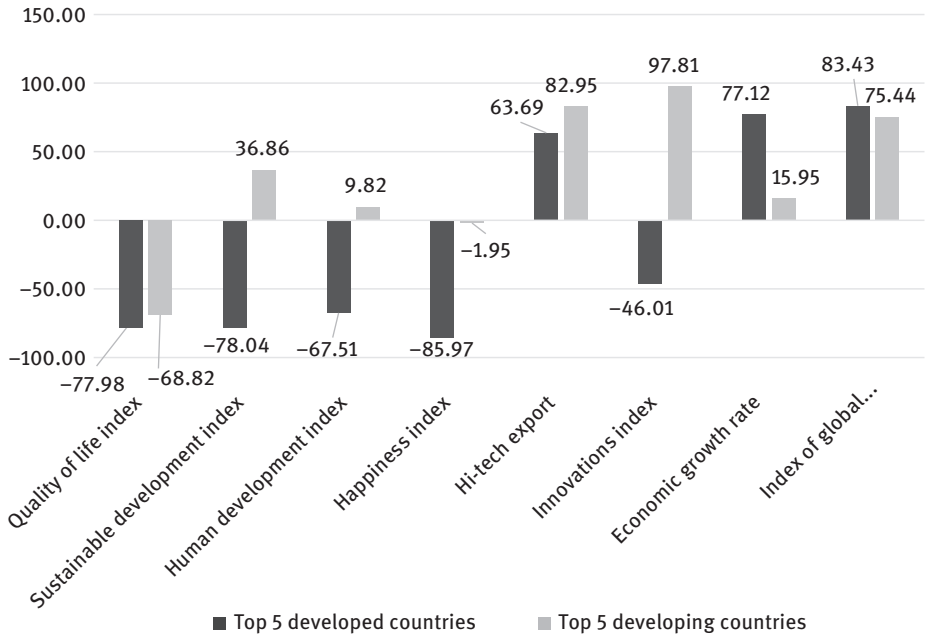


**Figure 16.1:** Cross correlation ($R^2$) between social and economic indicators and digital competitiveness in developed and developing countries in 2020, %.
Source: calculated and compiled by the authors.

Hierarchy synthesis of the advantages of the digital economy for developed and developing countries in 2020 is calculated in Table 16.3.

As shown in Table 16.3, the digital economy is more successful in developing countries (hierarchy synthesis: 41.77), as it created more vivid and more significant social and economic advantages than in developed countries (hierarchy synthesis: 25.45).

**Table 16.3:** Hierarchical synthesis of the advantages of the digital economy for developed and developing countries in 2020.

| Type (nature) of advantages | Advantage | Significance of advantages | | | | | |
|---|---|---|---|---|---|---|---|
| | | for developed countries | | | for developing countries | | |
| | | Value of advantage ($R^2$>0) | Weight | Weighted sum | Value of advantage ($R^2$>0) | Weight | Weighted sum |
| Social | Increase of quality of life | 0 | 0.17 | 0*0.17=0 | 0 | 0.10 | 0*0.10=0 |
| | Provision of sustainable development | 0 | 0.15 | 0*0.15=0 | 36.86 | 0.08 | 36.86*0.08==2.95 |
| | Stimulation of human development | 0 | 0.13 | 0*0.13=0 | 9.82 | 0.08 | 9.82*0.08==0.79 |
| | Provision of public well-being and happiness | 0 | 0.12 | 0*0.12=0 | 0 | 0.17 | 0*0.17=0 |
| Economic | Entering the world markets and increase of hi-tech products export | 63.69 | 0.08 | 63.69*0.08==5.10 | 82.95 | 0.17 | 82.95*0.17==14.10 |
| | Acceleration of innovative development | 0 | 0.10 | 0*0.10=0 | 97.81 | 0.12 | 97.81*0.12==11.74 |
| | Acceleration of the rate of economic growth | 77.12 | 0.08 | 77.12*0.08==6.17 | 15.95 | 0.15 | 15.95*0.15==2.39 |
| | Growth of global competitiveness | 83.43 | 0.17 | 83.43*0.17==14.18 | 75.44 | 0.13 | 75.44*0.13==9.81 |
| Hierarchy synthesis | | 0+0+0+0+5.10+0+6.17+ +14.18=25.45 | | | 0+2.95+0.79+0+14.10+ +11.74+2.39+9.81=41.77 | | |

Source: calculated and compiled by the authors.

# 4 Conclusion

It could be concluded that the digital economy of the 21st century – despite the universal foundation – is treated differently from the positions of developed and developing countries. The institutional approach to studying the digital economy and the proprietary scientific methodology of quantitative measuring of the digital economy's successfulness allow determining deep (institutional) causal connections of gaining advantages from the digital economy. As a result of approbation of the methodology, it is determined that, contrary to the existing hypothesis that the digital economy is more successful in developed countries, significant advantages of digitalization are more vivid in developing countries..

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# Part V: **The Global Institutions of the Digital Economy in the 21st Century**

Lyubov V. Postnikova, Denis G. Korovyakovskiy,
Sergey P. Udovenko and Julia V. Kuzminikh

# 17 International Trade in the Digital Sphere: Barriers and Prospects for Development

## 1 Introduction

A significant manifestation of the digital economy in the 21st century is the systemic character of economic processes' digitalization. This is explained by the fact that the process of transition to the Fourth technological mode, which was started in late 20th century, envisaged the pilot implementation of separate digital technologies in certain economic processes, among which production dominated. This period was peculiar for fragmentary digitalization, which was an addition to the traditional economic practices. The 2020's are peculiar for wide ousting of the traditional economic practices and for full-scale transition to digital technologies as the most effective technological platform of economic activities.

Thus, it is very important to study international trade in the digital sphere, which, firstly, shows the digitalization's coverage of not only production but also distribution, and, secondly, notes several economic practices, which include trade, import, and export. The existing approach to studying the digital economy is limited only to determination of the aggregate volume of international trade in the digital sphere and comparative analysis of this volume in different countries. The uncertainty regarding barriers and prospects for development in the digital sphere remains; it could be overcome by the institutional approach, developed and applied in this book.

From the positions of the institutional approach, it is possible to determine the factors of international trade in the digital sphere and define the prospects of managing these factors for overcoming the barriers and stimulate the development of trade. From the positions of regulation of international trade in the digital sphere, the factors should be logically classified by the criterion of the source of influence on it: factors of state regulation (source of influence: market regulators), factors of social environment (source of influence: society – consumers and employees), and factors of business environment (source of influence: market infrastructure and competing business structures).

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This chapter aims at determining the barriers and prospects of development in the digital sphere from the positions of influencing and managing various factors.

## 2 Materials and Method

The processes of international trade in the digital sphere are studied in the works Popkova (2019), Popkova and Sergi (2020), Popkova and Gulzat (2020a), Popkova and Gulzat (2020b), Popkova et al. (2018), Popkova and Zmiyak (2019), Popkova and Sergi (2018), Popkova and Sergi (2019), Ragulina (2019), Ragulina et al. (2019), Shulus et al. (2020), Stolyarov et al. (2020), and Strelets (2017). Managing international trade in the digital sphere is studied in the works Andronova et al. (2019), Borzenko (2015), Fedotova et al. (2020), Glazova (2015), Natsubidze (2015), Popkova et al. (2019), Popkova and Parakhina (2019), Sergi (2003), Sergi (2019), and Stislavsky (2015), Alpidovskaya and Popkova (2019), Inshakova and Bogoviz (2020), Popkova (2017), Popkova et al. (2020).

The performed literature overview shows that the categorical tools of this topic are not yet formed. There are a lot of terms, which include e-commerce, Internet trade, etc. Here we use the most general term – international trade in the digital sphere; it fully characterizes the research objects and fits its research from the positions of regulation.

This research is performed by the example of top 10 countries by the volume of international trade in the digital sphere, according to EMarketer ranking for 2019 (Figure 17.1).

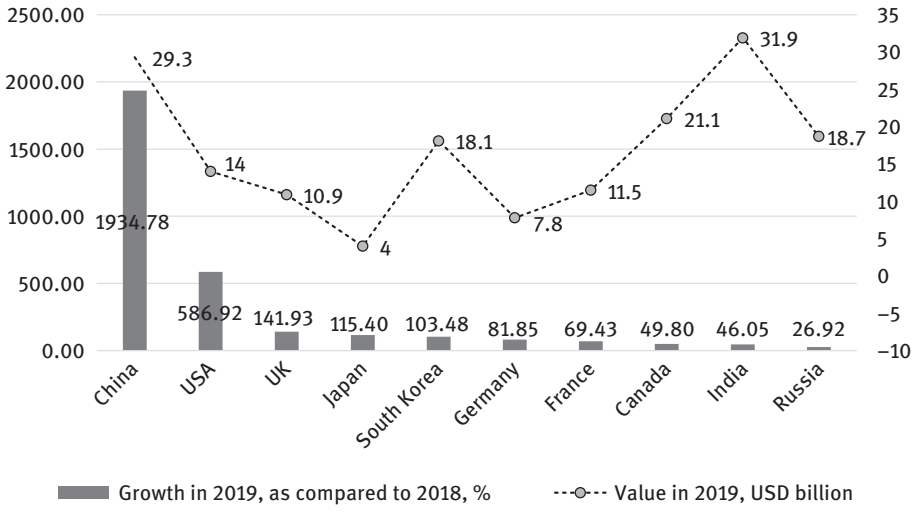


**Figure 17.1:** Characteristics of international trade in the digital sphere in top 10 countries by the level of its development in 2020.
Source: compiled by the authors based on EMarketer (2020).

As shown in Figure 17.1, the largest volume of international trade in the digital sphere in 2020 is observed in China (USD 1,934.78 billion), and the largest growth of this volume in the recent year took place in India (31.9%). For quantitative characteristics of the factors of international trade in the digital sphere we use statistical data of the World Economic Forum (Table 17.1).

**Table 17.1:** Statistics of international trade in the digital sphere and the influencing factors in top 10 countries by the level of its development in 2020.

| Country | Volume of international trade in the digital sphere, USD billion | Statistics of WEF*, points 1–100 (the higher the better) | | | | | |
|---|---|---|---|---|---|---|---|
| | | Factors of state regulation | | Factors of social environment | | Factors of business environment | |
| | | Legal framework's adaptability to digital business models | Trade openness | Digital skills among active population | Ease of finding skilled employees | ICT adoption | Domestic competition |
| – | y | $x_1$ | $x_2$ | $x_3$ | $x_4$ | $x_5$ | $x_6$ |
| China | 1,934.78 | 59.5 | 57.6 | 61.0 | 59.7 | 78.5 | 57.5 |
| USA | 586.92 | 78.0 | 67.0 | 72.2 | 72.1 | 74.3 | 70.2 |
| UK | 141.93 | 64.8 | 64.9 | 65.6 | 67.5 | 73.0 | 64.3 |
| Japan | 115.40 | 54.0 | 68.8 | 57.2 | 56.7 | 86,2 | 72.0 |
| South Korea | 103.48 | 55.2 | 58.6 | 66.5 | 65.1 | 92.8 | 53.5 |
| Germany | 81.85 | 67.3 | 66.7 | 67.8 | 65.1 | 70.0 | 69.7 |
| France | 69.43 | 50.8 | 62.2 | 58.2 | 59.6 | 73.7 | 62.2 |
| Canada | 49.80 | 58.0 | 67.5 | 67.9 | 64.5 | 70.3 | 60.1 |
| India | 46.05 | 58.9 | 43.9 | 57.2 | 52.8 | 32.1 | 56.9 |
| Russia | 26.92 | 48.1 | 50.7 | 65.8 | 58.7 | 77.0 | 55.2 |

Source: compiled by the authors based on EMarketer (2020), World Economic Forum (2020).
Note: *WEF – World Economic Forum.

Regression analysis is used for determining and modeling of the systemic influence of all factors on international trade in the digital sphere. Comparative analysis is used for determining the most significant factors (with the highest regression). Based on the obtained model of multiple linear regression, simplex method is used for determining the target values of the indicators that characterize the factors of

international trade in the digital sphere, for increasing its average volume in top 10 countries in 2022 by the maximum achieved (in India: 31.9%) growth, as compared to 2021.

# 3 Results

For finding the character and strength of the influence of the selected factors on international trade in the digital sphere we compiled a model of multiple linear regression. The values of the coefficients are shown in Figure 17.2.

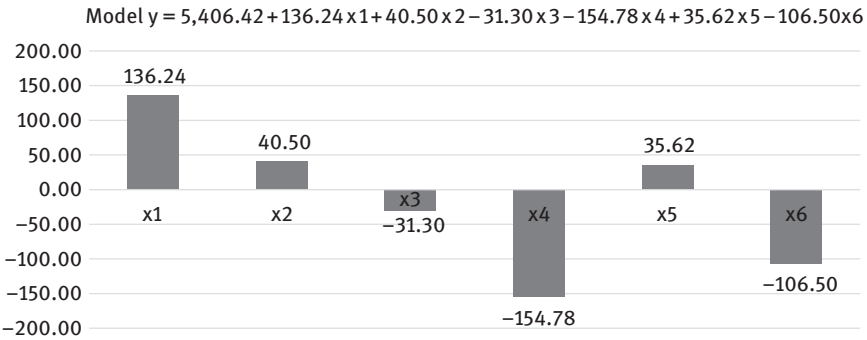


**Figure 17.2:** The model of regression dependence of international trade in the digital sphere on the influencing factors, USD billion.
Source: calculated and compiled by the authors.

According to the obtained model (Figure 17.2), the factors of state regulation have a positive influence – i.e., stimulate – on development of international trade in the digital sphere: legal framework's adaptability to digital business models ($x_1$) and trade openness ($x_2$), as well as the factor of business environment – ICT adoption ($x_5$).

Based on the obtained model, target values of the factors international trade in the digital sphere are determined. It has to be increased from USD 315.66 billion on average in top 10 countries in 2020 to USD 516.35 billion in 2021 (by 31.9%) (Figure 17.3).

Based on Figure 17.3, target growth of the factors of international trade in the digital sphere in 2021 is shown in Figure 17.4.

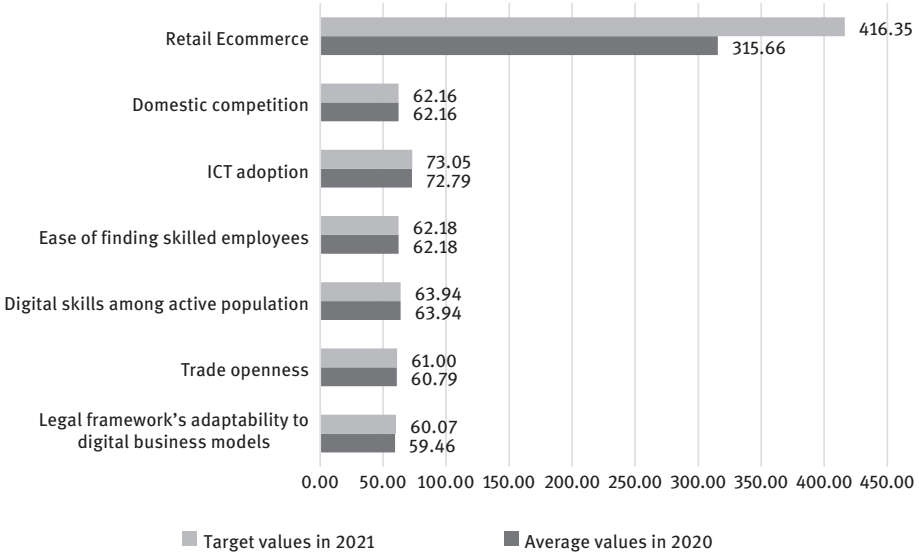


**Figure 17.3:** Average values in 2020 and target values in 2021 of the factors and volume of international trade in the digital sphere.
Source: calculated and compiled by the authors.

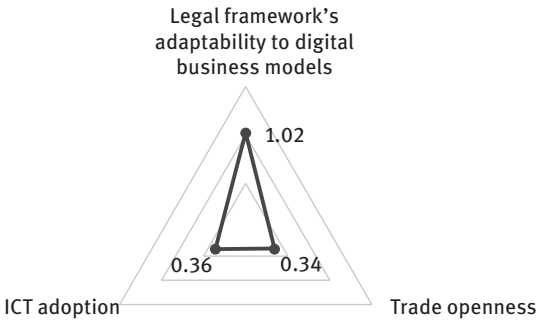


**Figure 17.4:** Target growth of the factors of international trade in the digital sphere in 2021, %.
Source: calculated and compiled by the authors.

As shown in Figure 17.4, target increase of the volume of international trade in the digital sphere in 2021, up to USD 416.35 billion, requires the growth of legal framework's adaptability to digital business models ($x_1$) by 1.02%, freedom of international trade ($x_2$) – by 0.34%, and telecommunication infrastructure ($x_5$) – by 0.36%.

## 4 Conclusion

Thus, the barriers to development of international trade in the digital sphere are unfavorable state regulation and business environment. The prospects of its development are connected to legal framework's adaptability to digital business models, provision of freedom of international trade (cancelling customs limitations, and development of the telecommunication infrastructure).

It should be noted that the factors of social environment – digital skills among economically active population and accessibility of skilled personnel – do not influence the development of international trade in the digital sphere. This could be a sign of social environment's unpreparedness for international trade in the digital sphere or of insignificance of social factors. The role of the factors of social environment in development of international trade in the digital sphere should be studied in further works on this topic.

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# 18 The Existing and Perspective International Institutions for Supporting Digital Transformation of Economy

## 1 Introduction

Among the advantages of the institutional approach to studying the digital economy, an important position belongs to the opportunity to study the international institutions of support for economy digital modernization. This ensures a systemic view of the causal connections of formation and development of the digital economy in the integrity of internal and external factors. That's why when studying digital modernization of economic systems it is necessary to pay attention to the problem of determining the sufficiency of support for this process from international institutions.

Influence of international institutions on development of the modern economic systems is very large; however, it could be stimulating or restraining. In view of the contradiction of the influence of international institutions on economic systems, it is possible to distinguish two alternative scenarios of development of the global digital economy in the long-term (for the period until 2030 and after).

The positive scenario envisages positive influence of international institutions on the processes of economy digital modernization in different countries, which is sufficient for full-scale external support for these processes and leveling of inter-country disproportions. This scenarios allows expecting achievement of the balance of the global digital economy by 2030. This will result in "healthy" competition in the global markets of hi-tech and hi-tech products, which stimulates their development. This will ensure achievement of the global goals of the Fourth industrial revolution, which consist in improving quality of life in the world.

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The negative scenario is connected to insufficient positive influence and/or provision of negative influence from international institutions on the processes of economy digital modernization. In this case, disproportions in the global digital economy will remain or grow by 2030. Too large differentiation of the level of digital development of different countries' economies will cause destructive competition in the global markets of hi-tech and hi-tech products, which, in its turn, will cause deficit and/or low quality of these products. The global goals of the Fourth industrial revolution will not be achieved.

This chapter aims at determining a scenario of development of the global digital economy by studying the existing and perspective international institutions for support for digital modernization of economy.

## 2 Materials and Method

The role of international institutions for supporting digital modernization of economy is emphasized in the works Andronova et al. (2019), Budin (2015), Ivashkin (2015), Laboikova and Dubova (2015), Pankova (2015), Plotnikov et al. (2020), Popkova (2019), Ragulina (2019), Ragulina et al. (2019), Shulus et al. (2020), Stolyarov et al. (2020), and Strelets (2017), Alpidovskaya and Popkova (2019), Inshakova and Bogoviz (2020), Popkova (2017), Popkova et al. (2020).

The existing experience of functioning of international institutions' support for digital modernization of economy is reflected in the works Popkova and Sergi (2020), Popkova et al. (2019), Popkova and Gulzat (2020a), Popkova and Gulzat (2020b), Popkova et al. (2018), Popkova and Parakhina (2019), Popkova and Zmiyak (2019), Popkova and Sergi (2018), Popkova and Sergi (2019), Sergi (2003), Sergi (2019), Sergi et al. (2019a), Sergi et al. (2019b), and Sergi et al. (2019c).

These publications form a reliable theoretical and empirical basis for studying the role of international institutions in development of the global digital economy. However, the existing studies do not allow determining the character and evaluating sufficiency of international institutions' support for digital modernization of economy and determining a scenario of the global digital economy's development in the long-term. These gaps are to be filled by this work.

The research is performed according to the systemic approach, due to which international institutions, the need for then, and the implemented practices of support for economy digital modernization are systematized and presented in the form of the following conceptual model (Figure 18.1).

As shown in Figure 18.1, the model is presented in the form of a pyramid of processes of economic systems' digital modernization. Importance for obtaining advantages from economy digital modernization of economy reduces, and complexity of

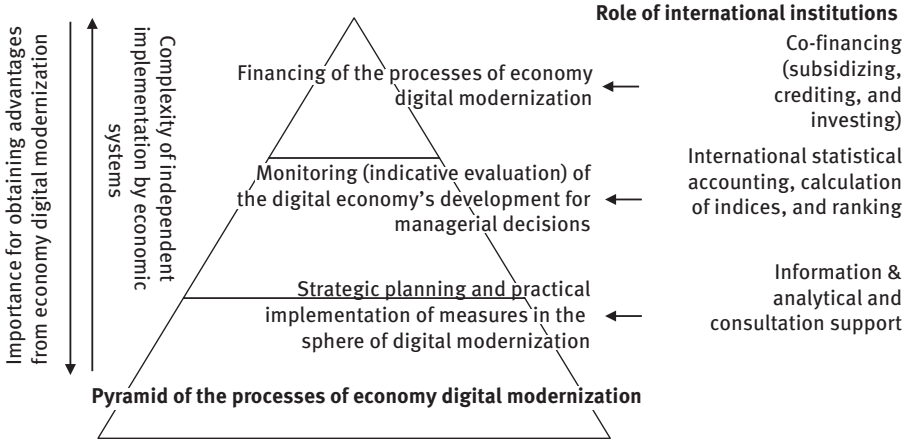


**Figure 18.1:** The conceptual model of international institutions' support for digital modernization of economy.
Source: developed and compiled by the authors.

independent implementation by economic systems grows in the course of increase of the pyramid's level. The pyramid's basis is strategic planning and practical implementation of measures in the sphere of digital modernization. The role of international institutions at this level consists in information & analytical and consultation support.

The central level consists of monitoring (indicative evaluation) of the digital economy's development for managerial decisions. International institutions are to perform international statistical accounting, calculation of indices, and ranking. Financing of the processes of economy digital modernization is at the pyramid's peak. The role of international institutions at this level consists in co-financing: subsidizing, crediting, and investing.

# 3 Results

As a result of studying the modern global experience, the model of international institutions' support for digital modernization of economy is built (Figure 18.2).

As shown in Figure 18.2, the pyramid of the processes of economic systems' digital modernization is turned over and does not have a reliable foundation. International institutions support primarily the most complex – for independent implementation – processes of digitalization. International institutions actively finance the digitalization of economic systems by commercial terms, for the purpose of receiving profit (profit from investments, and interest from credits).

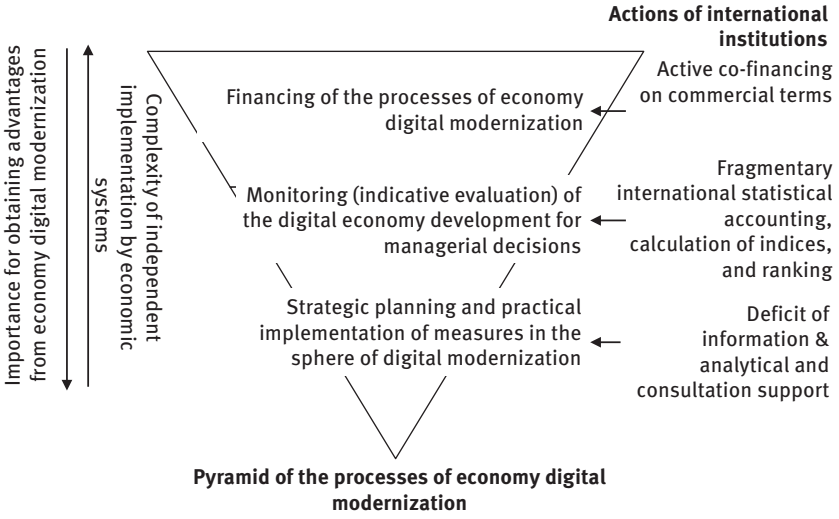


**Figure 18.2:** The model of international institutions' support for economy digital modernization. Source: developed and compiled by the authors.

Also, fragmentary international statistical accounting, calculation of indices, and ranking are performed. The processes which importance for obtaining advantages from economy digital modernization of economy is the largest do not receive sufficient support from international institutions. There's a deficit of information & analytical and consultation support. International institutions of support for digital modernization of economy are systematized in Table 18.1.

As shown in Table 18.1, the institution of co-financing, within which subsidizing, crediting, and investing in economy digital modernization are performed, is presented by the World Bank (WB) and the International Monetary Fund (IMF). Though this institution could be considered rather developed and effective, its drawback is limitations of financing.

Due this, financial support is provided either to the most competitive and investment attractive countries or to other countries but on unprofitable terms, which include bringing the national laws in accordance with the requirements of the international organizations that finance digitalization – which might contradict the interests of the national business and society.

The institution of international statistical accounting, calculation of indices, and ranking of countries is presented by the International Federation of Robotics (IFR), the International Telecommunication Union (ITU), and the International Institute for Management Development (IMD). Its drawbacks include fragmentary statistical accounting (narrow list of the indicators, absence of data on certain

**Table 18.1:** International institutions of support for economy digital modernization.

| Measures of support | International institutions that provide measures of support for digital modernization | International organizations that represent the institution | Institution's drawbacks |
|---|---|---|---|
| Co-financing (subsidizing, crediting, and investing) | | World Bank (WB), International Monetary Fund (IMFD) | Limitations of financing |
| International statistical accounting, calculation of indices, and ranking | | International Federation of Robotics (IFR), International Telecommunication Union (ITU), International Institute for Management Development (IMD) | Covers only the leaders of the global digital economy |
| Information & analytical and consultation support | Consulting on the issues of social, legal, and economic adaptation to the conditions of digitalization | In prospect: World Economic Forum (WEF) | Institutions are not formed |
| | Consulting on the issues of harmonization of digital and sustainable development | In prospect: United Nations Development Programme (UNDP) | |
| | Information support for international integration in the digital sphere | In prospect: World Trade Organization (WTO) | |

Source: developed and compiled by the authors.

countries) and coverage – with statistics and rankings – of only the leaders of the global digital economy. For example, the statistics and IMD Digital Competitiveness Ranking cover only 63 countries.

The institutions for provision of information & analytical and consultation support for digital modernization of economic systems are not yet formed – but could be created in the future. They have to ensure, firstly, consulting on the issues of social, legal, and economic adaptation to the conditions of digitalization. A perspective international organization within this institution is the World Economic Forum (WEF).

Secondly, consulting on the issues of harmonization of digital and sustainable development. A perspective international organization within this institution is the United Nations Development Programme (UNDP). Thirdly, information support for international integration in the digital sphere. A perspective international organization within this institution is the World Trade Organization (WTO).

# 4 Conclusion

Thus it has been determined that the existing practice of international institutions' support for digital modernization of economy does not fully satisfy their needs for external support. The processes of digitalization that are most complicated for independent implementation by the national economic systems are actively supported by international institutions. In particular, financial support for digitalization in various forms is provided, as well as empirical and analytical support in the form of special indices and international rankings.

At the same time, processes which importance for obtaining advantages from economy digital modernization is the largest are not sufficiently supported by the international institutions. This predetermines a high risk of realization of a negative scenario of development of the global digital economy in the long-term (2030 and after), which is connected to disproportion in the global digital economy and destructive competition in the global markets of hi-tech and hi-tech products.

Processes that require increased support include consulting on the issues of social, legal, and economic adaptation to the conditions of digitalization, consulting on the issues of harmonization of digital and sustainable development, and information support for international integration in the digital sphere. These directions determine the perspectives of improving international institutions' support for digital modernization of economy for the purpose of implementing a positive scenario of development of the global digital economy in the long-term, which envisages achievement of the global digital economy's balance.

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# 19 The Scientific and Methodological Approach to Provision and Evaluation of the Digital Economy's Global Competitiveness

## 1 Introduction

At all stages of the Fourth industrial revolution, countries of the world, which perform digital modernization of their economic systems, have been seeking external goals, which are equal or even more important than internal goals (increase of economic practices' effectiveness, growth of population's living standards). At the first stage, during the pilot implementation of digital technologies into separate economic practices, the goal of obtaining unique and sustainable competitive advantages was sought.

At the second (current) stage of the Fourth industrial revolution, we see wide dissemination and implementation of digital technologies for preserving the competitive positions in the world markets of hi-tech and hi-tech products, which are peculiar for high technological barriers. Thus, provision and evaluation of digital economy's global competitiveness are very important.

At present, IMD Ranking (2020) is the empirical and methodological basis for provision and evaluation of the digital economy's global competitiveness. As this ranking is compiled by an international organization, not an academic community, the working hypothesis of this research is that the existing methodological approach to provision and evaluation of the digital economy's global competitiveness does not fully conform to the set requirements (scientific principles).

These principles include completeness, systemic character, precision, universal character, correctness, structuredness, analytical support, transparency, and dynamics. This chapter aims at substantiating the incompleteness of the existing approach observing the scientific principle and at developing a new methodological approach to provision and evaluation of the digital economy's global competitiveness, which would fully observe the established scientific principles.

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## 2 Materials and Method

The conceptual and applied issues of determining the essence and provision of the digital economy's global competitiveness are studied in detail in the works Andronova et al. (2019a), Andronova et al. (2019b), Kovazhenkov et al. (2019), Popkova (2019), Popkova et al. (2019), Popkova and Gulzat (2020a), Popkova and Gulzat (2020b), Popkova et al. (2018), Popkova and Parakhina (2019), Popkova and Zmiyak (2019), Popkova and Sergi (2018), Popkova and Sergi (2019), Sergi (2003), Sergi (2019), Sergi et al. (2019), and Shulus et al. (2020), Alpidovskaya and Popkova (2019), Inshakova and Bogoviz (2020), Popkova (2017), Popkova et al. (2020).

Certain methodological issues of evaluation and provision of the digital economy's global competitiveness are studied in the works Budin (2015), Ivashkin (2015), Laboikova and Dubova (2015), Pankova (2015), Ragulina et al. (2019a), Ragulina et al. (2019b), and Stolyarov et al. (2020). Though the large number of publications on this problem shows a high level of its elaboration, the problem of methodological support for provision and evaluation of the digital economy's global competitiveness remains unsolved.

In order to solve this problem and to check the offered hypothesis, a critical analysis of IMD World Digital Competitiveness Ranking from the positions of observing the principles of the scientific and methodological support for evaluation of the digital economy's global competitiveness is performed (Table 19.1).

**Table 19.1:** Critical analysis of IMD World Digital Competitiveness Ranking from the positions of observing the principles of the scientific and methodological support for evaluation of the digital economy's global competitiveness.

| Principle | Essence (logical sense) of the principle | Observing the principle in IMD World Digital Competitiveness Ranking |
|---|---|---|
| Completeness | sufficient detalization of data | – incomplete list of indicators |
| Systemic character | aggregated indicators | – indicators are not sufficiently systematized, aggregated indicators are scarce |
| Precision | measuring of indicator in absolute units or points | – indicators are measured in positions, due to which they show a position in the ranking, not the level of economy digitalization |
| Universal character | coverage of all countries of the world | – ranking covers only 63 countries |
| Correctness | objectivity of data | – data are subjective – position in the ranking is determined in view of indicators bearing no relation to digitalization |

**Table 19.1** (continued)

| Principle | Essence (logical sense) of the principle | Observing the principle in IMD World Digital Competitiveness Ranking |
|---|---|---|
| Structuredness | classification of indicators by significance | – indicators are equal (not classified by significance) |
| Analytical support | contribution to analysis of causal connections | – indicators are not divided into factors and results, which hinders analytics |
| Transparency | transparency of indicators' calculation | – uncertainty of the logic of assigning positions to countries (absence of initial statistics) and calculation of aggregated and integral indicator |
| Dynamics | accessibility of time rows analysis | – ranking is static – presents data only for the current year (dynamics cannot be studied) |

Source: developed and compiled by the authors.
Note:
"+" – principle is observed;
"-" – principle is not observed.

As shown in Table 19.1, the principles of scientific and methodological support for evaluation of the digital economy's global competitiveness are not fully observed in IMD World Digital Competitiveness Ranking. The principle of completeness is not observed because of the incomplete list of indicators. For example, adaptability of laws to the conditions of the digital economy is not taken into account in the ranking.

The principle of systemic character is not observed, because the indicators are not sufficiently systematized and aggregated indicators are scarce. For example, aggregated indicator "technology" contains the indicator "immigration laws", which is not directly connected to digital technologies. There is no aggregated indicator that characterizes telecommunication infrastructure.

The principle of precision is not observed, as the indicators are measured in positions, due to which they show a position in the ranking, not the level of economy digitalization. The principle of universal character is not observed, because the ranking covers only 63 countries. The principle of correctness is not observed, as these data are subjective – position in the ranking is determined in view of the indicators that have no relation to digitalization – e.g., "starting a business" and "attitudes toward globalization".

The principle of structuredness is not observed, because the indicators are equal (not classified by significance). The principle of analytical support is not observed, because the indicators are not divided into factors and results – which hinders data analytics. IMD Ranking contains data on results and factors, due to which it might serve as analytical support for research of the digital economy. For example, "digital/technological skills" is a result, and "employee training" is a factor of achievement of this result.

The principle of transparency is not observed due to uncertainty of the logic of assigning positions to countries (absence of initial statistics) and calculation of aggregated and integral indicator. For example, by aggregate indicator "knowledge" Russia is ranked 22nd in the world, by indicator "technology" – 43rd, and by indicator "future readiness" – 42nd. However, by general global digital competitiveness Russia is ranked 38th – though direct average of aggregated indicators equals $(22+43+42)/3=34.3$. IMD uses a certain methodology, but this methodology causes certain doubts.

The principle of dynamics is not observed, as the ranking is static – it presents data only for the current year (dynamics cannot be studied). The data on aggregated indicators are given for previous years, and archive data on the basic indicators are not provided. Also, the provided data cannot be used for studying dynamics of the digital economy's development, for the change of the position in the ranking could be caused by the actions of other countries (quick or slow digitalization) and does not reflect, or even distorts, the state of affairs in the studied country.

# 3 Results

A proprietary scientific and methodological approach to provision and evaluation of the digital economy's global competitiveness is offered here. This approach allows using the data of IMD World Digital Competitiveness Ranking under the condition of full observation of the principles of the scientific and methodological support for evaluation of the digital economy's global competitiveness. The approach is shown in Table 19.2.

As shown in Table 19.2, the offered approach systematizes the data of the IMD ranking (dividing them into results and factors), supplements them with other data (indicator "legal framework's adaptability to digital business models", calculated by the World Economic Forum), and ranks them by the level of significance. Approbation of the proprietary scientific and methodological approach by the example of Russia in 2020 is performed in Table 19.3.

Table 19.3 shows statistical analysis of Russia's digital economy's competitiveness, due to absence of the data in dynamics for years. Factor analysis is not performed due to insufficiency of data. The components and evaluation of the Russian economy's digital competitiveness in 2020 according to the proprietary approach are shown in Figure 19.1.

As shown in Figure 19.1, according to the proprietary approach, Russia's digital competitiveness is ranked 34th in the world. It has been calculated as direct average of telecommunication infrastructure (42nd position), e-government (28th position), information society (33rd position), and digital business (33rd position).

**Table 19.2:** The scientific and methodological approach to provision and evaluation of the digital economy's global competitiveness.

| Result (target landmark) | Statistical or analytical indicator for measuring the result | Sources of achievement of result (factors) | Significance of result | Weight of indicator |
|---|---|---|---|---|
| Telecommunication infrastructure | Communications technology<br>Mobile Broadband subscribers<br>Wireless broadband<br>Internet users<br>Internet bandwidth speed<br>Cyber security<br>Sofware piracy | Investment in Telecommunications | 4 | 4/10==0.4 |
| E-government | E-Government | Legal framework's adaptability to digital business models | 3 Sum: 1+2+3+4=10 | 3/10==0.3 |
| Information society | Digital/Technological skills<br>E-Participation | Employee training<br>Robots in Education and R&D | 2 | 2/10==0.2 |
| Digital business | High-tech exports<br>World robots distribution<br>Use of big data and analytics | Funding for technological development | 1 | 1/10==0.1 |

Source: developed and compiled by the authors.

# 4 Conclusion

This, it has been proved that IMD World Digital Competitiveness Ranking does not fully conform to the principles of scientific and methodological support for evaluation of the digital economy's global competitiveness. For solving this problem, the proprietary scientific and methodological approach to provision and evaluation of the digital economy's global competitiveness has been developed.

However, full-scale use of the proprietary approach requires improvement of the international practice of statistical accounting of the digital economy. The data have to be measured not in positions but in points – for tracking the dynamics of economy digitalization. The performed evaluation of Russia's digital competitiveness (with the

**Table 19.3:** Approbation of the proprietary scientific and methodological approach by the example of Russia in 2020.

| **Result (target landmark)** | | **Statistical or analytical indicator for measuring the result** | | **Sources of achievement of result (factors)** | |
|---|---|---|---|---|---|
| Indicator | Value, position | Indicator | Value, position | Indicator | Value, position |
| Telecommunication infrastructure | $(43+33+36+45+43+44+53)/7=42$ | Communications technology | 43 | Investment in Telecom-munications | 33 |
| | | Mobile Broadband subscribers | 33 | | |
| | | Wireless broadband | 36 | | |
| | | Internet users | 45 | | |
| | | Internet bandwidth | 43 | | |
| | | speed | 44 | | |
| | | Cyber security | | | |
| | | Sofware piracy | 53 | | |
| E-government | 28 | E-Government | 28 | Legal framework's adaptability to digital business models | 51 |
| Information society | $(42+23)/2=33$ | Digital/ Technological skills | 42 | Employee training | 45 |
| | | E-Participation | 23 | Robots in Education and R&D | 8 |
| Digital business | $(34+34+31)/3=33$ | High-tech exports | 34 | Funding for technological development | 51 |
| | | World robots distribution | 34 | | |
| | | Use of big data and analytics | 31 | | |

Source: calculated and compiled by the authors based on IMD (2020), World Economic Forum (2020).

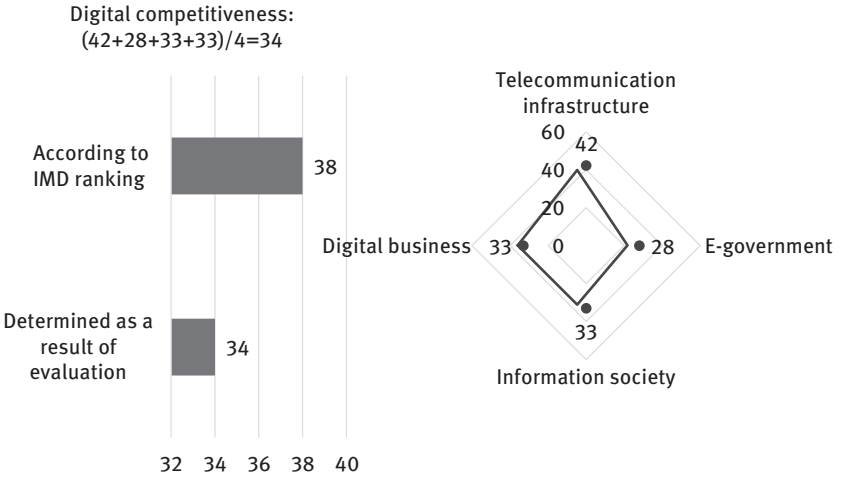


**Figure 19.1:** Components and evaluation of the Russian economy's digital competitiveness in 2020, position.
Source: calculated and compiled by the authors.

use of the proprietary approach) put it on 34$^{th}$ position, which is by 10.53% better than in IMD ranking (38$^{th}$ position) – which proves the advantages of the new approach.

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# 20 The Strategy of Optimal Development of the Digital Economy: A View from the Positions of Game Theory

## 1 Introduction

The perspectives of development of the digital economy within the existing scientific and methodological approach to its study include further acceleration of technological progress. The institutional approach allows for thorough research of the future development of the digital economy. The advantages of the institutional approach to studying the digital economy are connected, firstly, to evaluating the perspectives of its development from the positions of effectiveness. This envisages determining the results/costs ratio, refusing from emphasis on profits from digitalization, which is inherent to the existing approach, and covering also the potential drawbacks and losses as a result of the digital economy's development.

Secondly, there appears an opportunity for systemic coverage of the consequences of digitalization, which are not limited by the economic sphere but include also the social sphere – both of them are criteria for evaluating the effectiveness of digitalization from the positions of the institutional approach. The economic criterion envisages determining effectiveness through the ratio of economic growth, achieved due to digitalization (result for government and business), to expenditures for R&D (government and business's costs of economy's digitalization). The social criterion envisages determining the effectiveness of the digital economy through ratio of growth of population's quality of life due to digitalization (result for society) to unemployment (social costs of digitalization).

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Due to more detailed research of the digital economy, the institutional approach envisages variability of the strategies of its development. One of the strategies is connected to maximization of economic effectiveness, the second – to maximization of social effectiveness, and the third – to balance of social and economic effectiveness with the most probable forecast of digitalization. This chapter aims at finding a strategy of optimal development of the digital economy for developed and developing countries.

## 2 Materials and Method

The strategic foundations and landmarks for development of the digital economy are outlined in the works Andronova et al. (2019), Baranova (2015), Belokurova et al. (2020), Dashkova et al. (2015), Kovazhenkov et al. (2019), Mitina (2015), Ragulina (2019), Ragulina et al. (2019), Smetanina (2015), and Shulus et al. (2020). The social and economic manifestations of digitalization of the modern economic systems are differentiated and studied in the works Popkova (2019), Popkova and Sergi (2020), Popkova et al. (2019), Popkova and Gulzat (2020a), Popkova and Gulzat (2020b), Popkova et al. (2018), Popkova and Parakhina (2019), Popkova and Zmiyak (2019), Popkova and Sergi (2018), Popkova and Sergi (2019), Sergi (2003), Sergi (2019)б Sergi et al. (2019), and Zavyalova et al. (2018), Alpidovskaya and Popkova (2019), Inshakova and Bogoviz (2020), Popkova (2017), Popkova et al. (2020).

The literature overview shows sufficient elaboration of this problem. However, the strategy of optimal development of the digital economy has not yet been found, and the specifics of developed and developing countries are not studied sufficiently – which requires further scientific research. In this chapter, the research is performed according to the institutional scientific & methodological approach, with application of the methodology of game theory.

The indicator of social progress is social progress index, and the indicator of technical progress is Digital Competitiveness Ranking. The research is performed by the example of top 5 developed and top 5 developing countries by the level of global digital competitiveness, according to IMD ranking for 2019. The data are presented in Table 20.1.

At the first stage, regression analysis is used for determining the dependencies of social and economic manifestations on digitalization. At the second stage, forecasts of digitalization for developed and developing countries are compiled. At the third stage, evaluation of effectiveness of digitalization in developed and developing countries by economic and social criterion with different strategies of digitalization is performed. The optimal strategy is the one with the largest "game win" (effectiveness).

**Table 20.1:** Statistics of the digital economy and its social and economic manifestations in developed and developing countries with the highest digital competitiveness in 2020.

| Countries' position in the digital competitiveness ranking | Country | Digital Competitiveness Ranking, points 1–100 | Rate of economic growth, % | Quality of life index, points 1–200 | Unemployment rate, % of total labor force | High-technology exports, % of manufactured exports, % |
|---|---|---|---|---|---|---|
| Top 5 developed countries | USA | 100.000 | 2.121 | 176.77 | 4.480 | 19.0 |
| | Singapore | 99.373 | 2.553 | 146.09 | 2.100 | 52.0 |
| | Sweden | 96.070 | 2.181 | 180.52 | 6.600 | 15.0 |
| | Denmark | 95.225 | 1.801 | 196.47 | 5.800 | 14.0 |
| | Switzerland | 94.648 | 1.600 | 196.08 | n/a | 13.0 |
| Top 5 developing countries | China | 84.292 | 6.000 | 99.87 | 4.020 | 31.0 |
| | Russia | 70.406 | 1.500 | 104.05 | 5.500 | 11.0 |
| | Thailand | 68.434 | 3.239 | 104.54 | 0.700 | 23.0 |
| | India | 64.952 | 7.791 | 115.41 | n/a | 9.0 |
| | Chile | 66.724 | 2.700 | 123.80 | 6.425 | 7.0 |

Source: compiled by the authors based on Institute of Scientific Communications (2020), International Monetary Fund (2020), World Bank (2020).
Note: n/a – no data in the source.

# 3 Results

Based on the data from Table 20.1, regression curves are built – they reflect the influence of digitalization on social and economic characteristics of economic systems of developed (Figure 20.1) and developing (Figure 20.2) countries.

As shown in Figure 20.1, economic result (rate of economic growth) in developed countries shows a direct connection to digitalization, and social result (quality of life) shows a reversed connection. That's why the economy-oriented strategy envisages increase of digitalization, and the socially-oriented strategy – slowdown of digitalization.

As shown in Figure 20.2, economic result (rate of economic growth) and social result (quality of life) in developing countries show a reversed connection to digitalization. That's why the economy-oriented strategy coincides with the socially-oriented strategy and envisages slowdown of digitalization.

According to the data from Table 20.1, the average level of digitalization in developed countries equals 97.06 points (standard deviation – 0.37 points), and

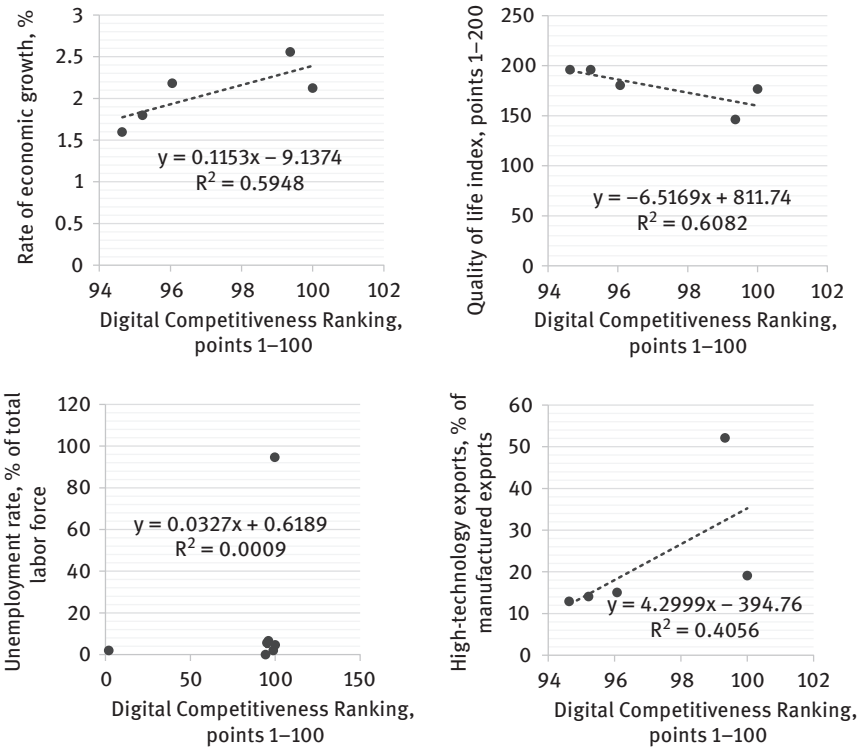


**Figure 20.1:** Regression curves of dependence of social and economic indicators on economy digitalization in developed countries.
Source: calculated and compiled by the authors.

in developing countries – 70.96 points (standard deviation – 7.72 points). The obtained values allow generating 100 random numbers, which reflect the forecast values of digitalization in developed and developing countries until 2024. These values were processed by computer and distributed in intervals; after this, histograms of their normal distribution were built – they show possible values and their probability (Figure 20.3).

As shown in Figure 20.3, the minimum forecast value of digitalization in developed countries equals 96.41 points (probability p – 1%), and the maximum forecast value – 97.74 points (p = 2), the most probable (p = 23) value: 97 points. In developing countries, the minimum forecast value of digitalization constitutes 48.83 points (p = 1%), and the most probable (p = 25%) – 70.71 points. Evaluation of effectiveness of digitalization in developed and developing countries by the economic and social criterion with various strategies of development of the digital economy is performed in Table 20.2.

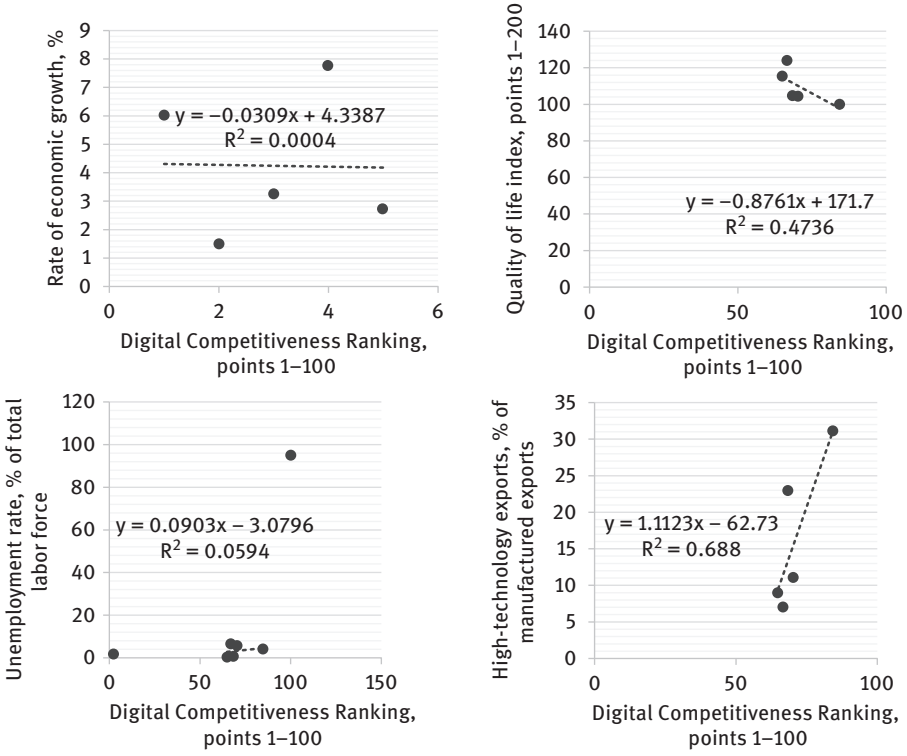


**Figure 20.2:** Regression curves of dependence of social and economic indicators on economy digitalization in developing countries.
Source: calculated and compiled by the authors.

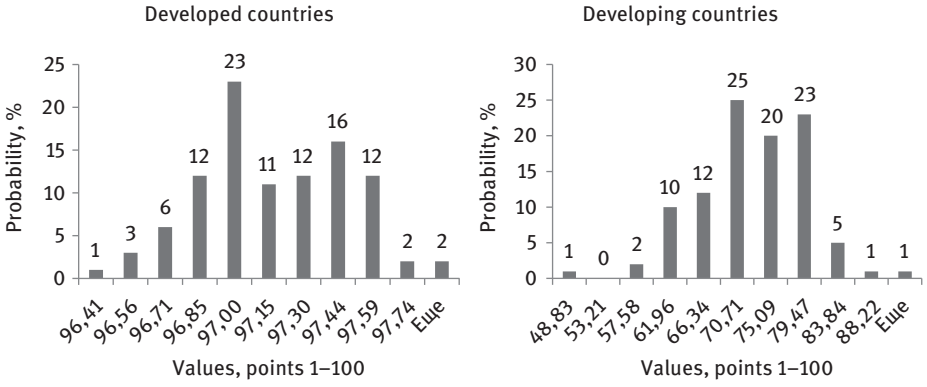


**Figure 20.3:** Histograms of normal distribution of forecast values of Digital Competitiveness Ranking in developed and developing countries for the period until 2024.
Source: calculated and compiled by the authors.

**Table 20.2:** Evaluation of effectiveness of digitalization in developed and developing countries by the economic and social criterion.

| Category | Strategy | | Economic criterion | | Social criterion | | P* | Economic efficiency: Ee=Re/Se | Social efficiency: Es=Ql/Ur | Integral efficiency: Ei=(Ee+Es)*p |
|---|---|---|---|---|---|---|---|---|---|---|
| | Title | Digital Competitiveness Ranking, points 1–100 | Rate of economic growth, % | Share of hi-tech exports, % | Quality of life index, points 1–200 | Unemployment rate, % of total labor force | | | | |
| | | | Re | Se | Ql | Ur | | | | |
| Developed countries | Economy-oriented | 97.74 | 1.04 | 1.13 | 0.98 | 1.01 | 0.02 | 0.92 | 0.97 | 0.04 |
| | Socially-oriented | 96.41 | 0.96 | 0.88 | 1.02 | 0.99 | 0.01 | 1.09 | 1.03 | 0.02 |
| | Well-balanced (max p) | 97 | 1.0 | 0.99 | 1.0 | 1.0 | 0.23 | 1.01 | 1.00 | 0.46 |
| Developing countries | Economy-oriented and Socially-oriented | 48.83 | 0.67 | −0.52 | 1.18 | 0.4 | 0.01 | −1.29 | 2.95 | 0.02 |
| | Well-balanced (max p) | 70.71 | 0.51 | 0.98 | 1.0 | 0.99 | 0.25 | 0.52 | 1.01 | 0.38 |

Source: calculated and compiled by the authors.
Note: *p – probability of scenario.

According to the calculations (Table 20.2), the largest effectiveness (E) in developed (0.46), and developing (0.38) countries is achieved during implementation of the well-balanced strategy of development of the digital economy.

## 4 Conclusion

A view from the positions of game theory allows substantiating that the strategy of optimal development of the digital economy envisages balance of digitalization and its systemic effectiveness: consideration of results and costs, social criterion and economic criterion, and the probability of interested parties' "win".

Based on empirical data on top 5 developed and top 5 developing countries by the level of digitalization for 2020, it has been shown that the strategy envisaging the balance of social and economic priorities is universal and more perspective as compared to alternative strategies, regardless of the category of countries. The received results allow developing the framework strategic foundations of the digital economy's development by 2024.

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# 21 The Institutional Model of Well-Balanced and Sustainable Digital Economy

## 1 Introduction

Balance of and sustainability are the priorities of the modern global economic system, which are to ensure its stable development in the long-term under the condition of simultaneous achievement. Though these priorities are equal and closely interconnected, their monitoring and management of economic systems are conducted separately, which is a limitation of the existing approach to studying the digital economy. Within the existing approach, only a surface view of these priorities form the positions of the achieved results is accessible.

Balance of the global economic system envisages overcoming the disproportions in its structure and reduction of the level of differentiation between the developed and developing countries. Sustainability means a balance ecological, economic, and social priorities, envisaged by the goals of sustainable development. The scientific and practical problem of simultaneous achievement of these priorities consists in their contradiction. Thus, technological progress, which envisages accelerated economic growth, contradicts the goals of supporting social stability and environment protection.

In addition to this, the balance of global economic system is complicated due to uncertainty of the prospects or impossibility of leveling developed and developing countries by the level of digitalization. If the current high rate of economy digitalization of developed countries is preserved, developing countries probably will not be able to perform accelerated digitalization and reduce the gap – even in the long-term. That's why the most obvious means of achieving the balance of the global digital economy is slowdown of the rate of digitalization of developed countries, which contradicts their national interests and the very idea of technological progress – for this will be a barrier to the Fourth industrial revolution.

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Here we offer a hypothesis that the institutional approach to studying the digital economy, due to its thorough research from the positions of the institutions, allows solving the set problem and outlining the perspectives of simultaneous achievement of the balance and sustainability of the global economic system. The purpose of this chapter is to develop an institutional model of well-balanced and sustainable digital economy.

## 2 Materials and Method

The institutions of the digital economy and the specifics of their functioning in developed and developing countries are studied in the works Andronova et al. (2019), Belokurova et al. (2020), Popkova (2019), Popkova and Sergi (2020), Popkova et al. (2019), Popkova and Gulzat (2020a), Popkova et al. (2018), Popkova and Parakhina (2019), Popkova and Zmiyak (2019), Popkova and Sergi (2019), Ragulina (2019), Ragulina et al. (2019), Sergi (2003), Sergi et al. (2019a), Sergi et al. (2019b), and Shulus et al. (2020).

The issues of balance and sustainability – as characteristics of the modern economic systems – are studied and discussed in the works Abramova and Pozdnyakova (2015), Beshanova (2015), Bulavitntseva (2015), Tsoi and Pozdnyakova (2015), Pichkov (2016), Plotnikov et al. (2020), Popkova and Serg (2018), Sergi et al. (2019), and Zavyalova et al. (2018), Alpidovskaya and Popkova (2019), Inshakova and Bogoviz (2020), Popkova (2017), Popkova et al. (2020).

However, despite the high level of elaboration of this problem, the institutional model of well-balanced and sustainable digital economy has not yet been formed. In order to determine not only the conceptual foundations but also the quantitative characteristics of this model and to outline the prospects of its implementation, we use a complex of economic statistics methods.

Variation analysis is used for determining the differentiation of countries by the level of digital competitiveness. Simplex method is used for determining the perspectives of reduction of differentiation (reduction of variation). Regression analysis is used for determining the dependence of digital competitiveness (as a manifestation of balance) and realization of sustainable development goals (as manifestation of sustainability) on the institutions of the digital economy's development: digital society, digital technologies, and digital economic practices. Then, simplex method is used again for finding the quantitative values of statistical indicators at which the target (high) level of balance and sustainability of the digital global economic system is achieved.

For obtaining the most precise and detailed results, the research is performed by the example of top 5 developed and top 5 developing countries by the level of digitalization, according to the IMD ranking 2019 (Table 21.1).

**Table 21.1:** Statistics of sustainability, balance, and institutions of the digital economy in developed and developing countries with the highest digital competitiveness in 2020, points 1–100.

| Countries' positions in Digital Competitiveness Ranking | Country | Indicators of sustainability and balance | | Institutions of the digital economy's development | | |
|---|---|---|---|---|---|---|
| | | Digital Competitiveness Ranking | Sustainable Development Goals Index, | Knowledge | Technology | Future Readiness |
| Top 5 developed countries | USA | 100.000 | 74.5 | 90.998 | 89.364 | 98.427 |
| | Singapore | 99.373 | 69.6 | 90.503 | 100.000 | 86.407 |
| | Sweden | 96.070 | 85.0 | 89.727 | 88.238 | 89.034 |
| | Denmark | 95.225 | 85.2 | 85.987 | 83.958 | 94.519 |
| | Switzerland | 94.648 | 78.8 | 90.850 | 84.292 | 87.593 |
| Top 5 developing countries | China | 84.292 | 73.2 | 78.067 | 72.856 | 80.743 |
| | Russia | 70.406 | 70.9 | 75.017 | 72.856 | 56.539 |
| | Thailand | 68.434 | 73.0 | 58.435 | 58.451 | 52.864 |
| | India | 64.952 | 61.1 | 63.721 | 54.978 | 54.946 |
| | Chile | 66.724 | 75.6 | 53.772 | 62.034 | 63.156 |

Source: compiled by the authors based on IMD (2020), UNDP (2020).

# 3 Results

The performed variation analysis (based on the data from Table 21.1) shows that direct average of digital competitiveness of all 10 studied countries constitutes 84.01 points, and variation constitutes 17.59%. The analysis also showed that variation among developed countries is small (not exceeding 5%) and, therefore, for leveling the disproportions in the global digital economy it is necessary to raise the level of digitalization in developing countries (Figure 21.1).

As shown in Figure 20.1, for ensuring the balance of the global digital economy by 2024, the level of economy's digital competitiveness should grow by 6.46%, up to 89.74 points, in China; in Russia – by 26.79%, up to 89.27 points; in Thailand – by 29.90%, up to 88.90 points; in India – by 35.36%, up to 87.92 points; in Chile – by 32.59%, up to 88.47 points.

In this case, variation of the digitalization level among 10 studied countries will drop to the acceptable level (5%). Then, direct average of digital competitiveness of developing countries will increase from 70.96 points to 88.86 points – the target

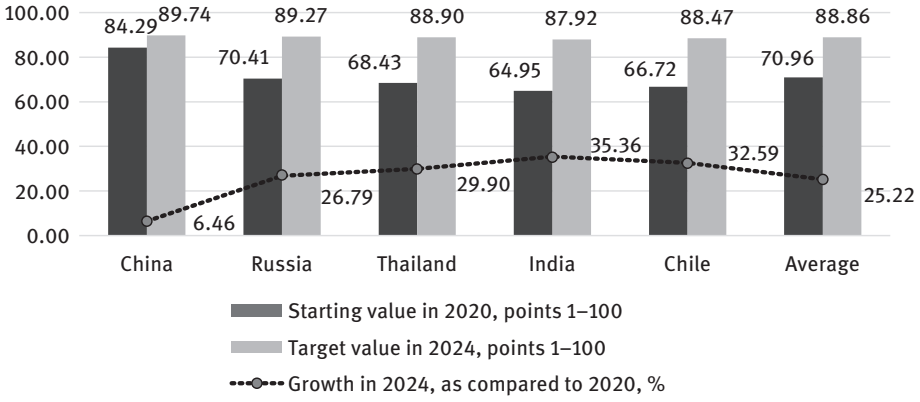


**Figure 21.1:** Target values and growth of developing countries' global competitiveness for provision of the balance of the global digital economy for the period until 2024.
Source: calculated and compiled by the authors.

level of digitalization within the priority of balance. For determining the target value of the indicator of sustainability, let us use the results of regression analysis (Table 21.2).

**Table 21.2:** Regression statistics of dependence of digitalization (balance) and sustainability on development of the digital economy institutions in developed and developing countries in 2020.

| Regression statistics | Dependent variable | | | |
|---|---|---|---|---|
| | Developed countries | | Developing countries | |
| | Digital Competitiveness Ranking | Sustainable development index | Digital Competitiveness Ranking | Sustainable development index |
| Multiple determination (r) | 99.9999 | 0.8900 | 0.9521 | 0.9212 |
| Constant | 7.07 | 288.35 | 22.46 | 50.13 |
| Coefficient for the institution of digital society | 0.33 | **–1.34** | 0.26 | –0.69 |
| Coefficient for the institution of digital technologies | 0.33 | **–0.73** | 0.05 | 0.92 |
| Coefficient for the institution of digital practice | 0.33 | **–0.28** | 0.46 | 0.11 |

Source: calculated and compiled by the authors.

As shown in Table 21.2, developed countries are peculiar for reverse connection (negative values of regression coefficients) of sustainable development index and the digital economy's institutions. Therefore, for ensuring sustainability of developed countries' economic systems, their digitalization should be limited. The priority of sustainability for developed countries is preservation of the average value of digital competitiveness at the 2020 level (97.06 points).

For developing countries, the target level of sustainable development index is 78.62 points – i.e., achievement of the average value of this indicator in developed countries and closing the gap between them. Based on the obtained quantitative landmarks, we determine target values and growth of the indicators in developing countries for ensuring the balance and sustainability of the global digital economy for the period until 2024 (Figure 21.2).

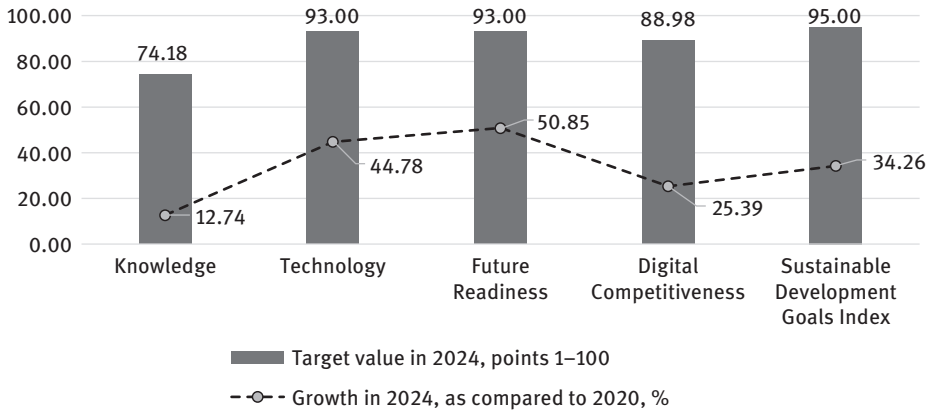


**Figure 21.2:** Target values and growth of the indicators in developing countries for ensuring the balance and sustainability of the global digital economy by 2024.
Source: calculated and compiled by the authors.

As shown in Figure 21.2, simultaneous achievement of the established control values of digitalization index (at least 88.86 points) and sustainable development index (at least 78.62 points) in developing countries is possible if the institution of digital society grows by 12.74% (up to 74.18 points), institution of digital technologies – by 44.78% (up to 93 points), and the institution of digital practices – by 50.85% (up to 93 points). Due to this, digitalization index will grow by 25.39% (up to 88.98 points), and sustainable development index – by 34.26% (up to 95 points).

## 4 Conclusion

Thus, the offered hypothesis has been proved – the institutional approach allows substantiating the possibility of simultaneous achievement of sustainability and balance of the global digital economy and outlines the quantitative features of the institutional model of well-balanced and sustainable digital economy. It has been determined that optimization in developed countries is impossible, as digitalization reduces the level of their sustainability.

Precise planned values of the institutions of digital economy have been offered for developing countries – they allow reducing the gap between them and developed countries (balance of the global economy) and ensuring the necessary (corresponding to the level of developed countries) sustainability of their development for the period until 2024.

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# 22 The Institutional Mechanism of Managing the Digital Economy's Development

## 1 Introduction

The perspectives of development of the modern economic systems are connected to further digitalization, which actualizes the problem of managing this process. Though the existing approach to studying the digital economy distinguishes its structural elements, it considers them separately – through the prism of the global rankings. This allows for a detailed study of global competitiveness of the digital economy and determination of the factors of its progress, but hinders the management of its development due to certain gaps in the scientific knowledge.

One of the gaps is uncertainty of the subject-object relations in the process of managing the digital economy's development. E-government is a structural element of the digital economy. Thus, there arises a question, whether it is the exclusive regulator of the digital economy or is subject – as its component – to state management by the regulators of the higher level. This gap hinders determination of the essence of the digital economy management.

Another gap is obscureness of the logical ties between the structural elements of the digital economy and the non-systemic character of their management. It is obvious at the theoretical level that the digital economy is a system – a totality of interconnected elements. However, at the empirical level, the connection between the digital economy's components is not clearly determined and not measured quantitatively. This raises the issue of effectiveness of managing the digital economy and the perspectives of its increase based on obtaining the "scale effect" in case of proving the ties between the elements and the systemic character of management.

The third gap is a result of the first two gaps and consists in the absence of a clear idea on the tools of managing the digital economy's development. The subject of management (e-government or general economic regulators) determines the technological mode or the set of available tools of management. Separation or systemic character of the management objects defines the requirements to the complexity and

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scale of the implemented managerial tools. Both these issues are still unsolved if the existing approach to studying the digital economy is used.

These gaps could be filled with the help of the institutional approach to studying the digital economy, for it considers its structural elements as sustainable economic practices – institutions – and is oriented at establishment of logical ties between them and at formation of a systemic idea of their functioning and development. This chapter's purpose is to develop an institutional mechanism of managing the digital economy's development.

## 2 Materials and Method

Certain issues of state management of the digital economy's development are studied in the works Andronova et al. (2019), Belokurova et al. (2020), Popkova (2019), Popkova and Sergi (2020), Popkova et al. (2019), Popkova and Gulzat (2020a), Popkova et al. (2018), Popkova and Parakhina (2019), Popkova and Zmiyak (2019), Popkova and Sergi (2019), Ragulina (2019), Ragulina et al. (2019), Sergi (2003), Sergi et al. (2019a), Sergi et al. (2019b), and Shulus et al. (2020).

Empirical practice of implementation and perspectives of improving the existing practices of state management of the digital economy's development are outlined in the works Abramova and Pozdnyakova (2015), Beshanova (2015), Bulavintseva (2015), Tsoi and Pozdnyakova (2015), Pichkov (2016), Plotnikov et al. (2020), Popkova and Sergi (2018), Sergi et al. (2019), and Zavyalova et al. (2018), Alpidovskaya and Popkova (2019), Inshakova and Bogoviz (2020), Popkova (2017), Popkova et al. (2020).

The institutional foundations and the scientific mechanism of state management of the digital economy's development are not yet formed – which requires further elaboration of its managerial aspect. The methodological basis of this research consists of correlation analysis, which is used for determining the ties (calculating cross correlation) between indicators that characterize the development of the digital economy's' institutions.

The institution of information society is studied through such indicators as digital skills and e-participation. This institution reflects accessibility of digital personnel (digitalization of labor market) and demand for hi-tech products. E-government includes digital monitoring and management (e.g., digital tax administration) of digital economic practices and provision of online public services.

The institution of telecommunication infrastructure reflects the whole totality of the elements of the digital economy's infrastructure, including accessibility of telecommunication technologies, venture investments, etc. The institution of hi-tech business is studied through such indicators as robotization of business and application of big data in business. It reflects the level of digitalization of economic processes in entrepreneurship. For determining the universal ties between the selected

**Table 22.1:** Statistics of the digital economy's institutions in developed and developing countries with the highest digital competitiveness in 2020, positions 1–63.

| Countries' positions in the Digital Competitiveness Ranking | Country | Institution of information society | | E-Government | Institution of telecommunication infrastructure | Institution of hi-tech business | |
|---|---|---|---|---|---|---|---|
| | | Digital/ Technological skills | E-Participation | | | World robots distribution | Use of big data and analytics |
| Top 5 developed countries | USA | 9 | 5 | 11 | 5 | 4 | 6 |
| | Singapore | 8 | 13 | 7 | 1 | 15 | 15 |
| | Sweden | 10 | 19 | 5 | 7 | 17 | 7 |
| | Denmark | 11 | 1 | 1 | 11 | 30 | 17 |
| | Switzerland | 17 | 37 | 15 | 10 | 27 | 29 |
| Top 5 developing countries | China | 15 | 28 | 50 | 26 | 1 | 12 |
| | Russia | 42 | 23 | 28 | 43 | 34 | 31 |
| | Thailand | 49 | 56 | 53 | 27 | 10 | 37 |
| | India | 22 | 15 | 58 | 49 | 13 | 30 |
| | Chile | 33 | 41 | 35 | 41 | 47 | 52 |

Source: compiled by the authors based on IMD (2020).

indicators, the research objects are top 5 developed and top 5 developing countries by the level of digitalization, according to the IMD ranking 2019 (Table 22.1).

# 3 Results

The detailed cross correlation of indicators of development of the digital economy's institutions is presented in Table 22.2.

**Table 22.2:** Detailed cross correlation of the indicators of development of the digital economy's institutions, %.

| | Digital skills | E-participation | E-government | Telecommunication infrastructure | Robotization of business | Use of big data in business |
|---|---|---|---|---|---|---|
| Digital skills | **100.00** | 73.07 | 61.01 | 69.04 | 31.80 | 76.77 |
| E-participation | – | **100.00** | 56.05 | 35.56 | 15.66 | 67.96 |
| E-government | – | – | **100.00** | 78.51 | –21.69 | 50.43 |
| Digital infrastructure | – | – | – | **100.00** | 31.48 | 69.67 |
| Robotization of business | – | – | – | – | **100.00** | 65.85 |
| Use of big data in business | – | – | – | – | – | **100.00** |

Source: calculated and compiled by the authors.

As shown in Table 22.2, despite the fact that all indicators are taken from the Digital Competitiveness Ranking and are measured in the same units and calculated by IMD, correlation dependencies between them are different – fro, 76.77% of correlation between use of big data in business and digital skills to – 21.69% of correlation between robotization of business and e-government. The generalized cross correlation of the institutions of the digital economy is determined by calculating direct average of the corresponding indicators from Table 22.2 (Table 22.3).

**Table 22.3:** Generalized cross correlation of the digital economy's institutions, %.

| | Information society | E-government | Telecommunication infrastructure | Hi-tech business |
|---|---|---|---|---|
| Information society | **100.00** | 58.53<br>moderate | 52.30<br>moderate | 48.05<br>weak |
| E-government | – | **100.00** | 78.51<br>high | 14.37<br>almost absent |
| Digital infrastructure | – | – | **100.00** | 50.58<br>weak |
| Hi-tech business | – | – | – | **100.00** |

Source: calculated and compiled by the authors.

As shown in Table 22.3, the institution of e-government shows high correlation (78.51%) with telecommunication infrastructure and moderate correlation (58.53%) with information society. Correlation between information society and telecommunication infrastructure is also moderate (52.30%). Therefore, there is a vivid connection between these institutions, and this their systemic management is expedient. Correlation (connection) between other institutions is weak or almost absent. The determined correlation dependencies (and their absence) allow developing the following institutional mechanism of managing the digital economy's development (Figure 22.1).

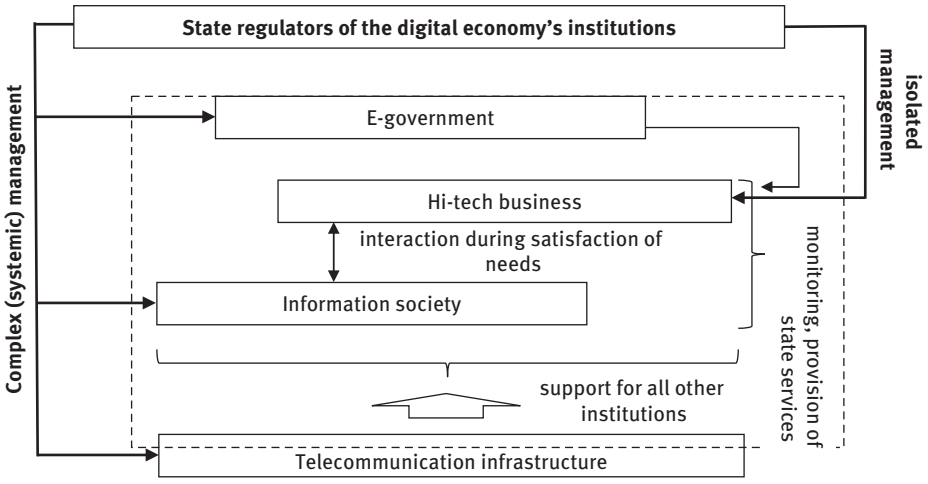


**Figure 22.1:** Institutional mechanism of managing the digital economy's development.
Source: developed and compiled by the authors.

As shown in Figure 22.1, the subject of managing the development of the digital economy is general economic state regulators. They control all institutions of the digital economy, including e-government – which, in its turn, conducts monitoring and control and provides public services in the digital form to hi-tech business and information society. They interact during satisfaction of needs. Telecommunication infrastructure supports all other institutions.

State regulators the institutions of the digital economy conduct isolated management of hi-tech business. This management envisages financial (tax, subsidiary) support for development of digital business and stimulation of its competition. Regulators also perform systemic management of information society, e-government, and telecommunication infrastructure with the help of the following measures:

- Improving the practice of provision of public services to society (population and employees)
- Developing the telecommunication infrastructure of e-government
- Increasing the accessibility and quality of telecommunication infrastructure for population and workers in the labor market

# 4 Conclusion

The developed institutional mechanism of managing the digital economy's development has shown that there is close interconnection between certain institutions of the digital economy, while the interconnection between other institutions is weak or absent. This envisages flexibility of managing the digital economy's development, which subject should be general economic state regulators.

On the basis of the latest experience of developed and developing countries, the expedience of isolated management of hi-tech business and of systemic management of information society, e-government, and telecommunication infrastructure are shown. The perspective managerial measures for both distinguished directions of management are recommended.

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# Part VI: **Case Studies of Institutions of the Digital Economy in the 21st Century**

Elena A. Miroshina and Ludmila M. Kuprianova

# 23 Problems and Prospects of Economic Cooperation Between Russia and Mexico

## 1 Introduction

Our countries have mutual interest in the cooperation. In 2004, the Presidents of Russia and Mexico signed a joint statement on cooperation. Russian President Vladimir Putin said that Mexico is an "interesting partner" for Russia. "We have a traditional interest in Mexico, and it is based on Russia's interest in Mexican culture," he said at a press conference. – "But the interest in Mexico is caused not only and not so much by the popularity of Mexican TV series in Russia, but by the growth of economic potential in Mexico, the strengthening of its sovereignty and authority in the international arena". At the same time, the Russian leader noted, the trade turnover between the two countries that time had been extremely low. "Russia's trade with Latin America is just over $ 6 billion and almost zero – several hundred million – with Mexico, " Putin said. "But the potential is good," – he said. As an example, the Russian President called the plant of automotive equipment and repair of Russian helicopters. "These are specific, interesting, but small contracts," Putin said. He said that "the Russian government supports these projects and will support". "But other projects are much more ambitious," the Russian leader said. Among them, he mentioned the already ongoing joint work in the electric power industry, when Russian specialists took part in the construction of power plants in Mexico. The Russian President also called the oil sector very promising for cooperation (Putin, V. 2004).

For his part, Mexican President Vicente Fox noted in 2004 that there was nothing on the part of Mexico that would hinder the development of economic relations with Russia. At a joint press conference with the President of the Russian Federation, he said that Mexico "is ready to remove all obstacles to clear the way for new relations in the field of trade and investment." "We do not divide countries by the type of their economies and do not see anything that would hinder the development of our relations with Russia," he said. The President of Mexico also noted that "it was possible to achieve much greater indicators in trade and

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economic relations, which today do not meet the potential of the economies of the two countries." "Mexico", he noted, "attaches strategic importance to the Russian economy and market."

Following the talks, Vladimir Putin and Mexican President Vladimir Fox signed a joint statement on the Russian-Mexican initiative: towards a new era of cooperation. The document stresses that the first-ever visit of the Russian President to Mexico "is of particular importance for strengthening the traditional relations of friendship and mutually beneficial cooperation." Vladimir Putin and Vladimir Fox noted the importance of "more active involvement of business and public circles in intergovernmental contacts". The statement notes that the presidents agreed to instruct their governments to intensify efforts to find "new areas of bilateral cooperation, the creation of support mechanisms that would allow entrepreneurs, investors, scientific and public organizations of both countries to use the untapped potential" (Putin, V., Quesada, V. 2004).

5 Joint documents were signed in Mexico city in the presence of V. Putin and V. Fox. Among them: The Agreement between the governments of Russia and Mexico for avoidance of double taxation with respect to taxes on income, The Cooperation agreement between Vneshtorgbank and the National Bank of foreign trade of Mexico, The Agreement between Vnesheconombank, Roseximbank and the National Bank of foreign trade of Mexico on cooperation in the joint financing of exports to third countries, The Agreement "On the transfer of sentence persons sentenced to deprivation of liberty", as well as a Memorandum of cooperation and understanding between the Ministry of culture and mass communications of the Russian Federation and the National Council for culture and art of Mexico (Rosoboronexport 2019).

## 2 Methodology

As the research methodology we use the following principles: substantiation of the hypothesis about the insufficient level of development of cooperation between Russia and Mexico, the task of the study will be to conduct a statistical analysis to confirm it. Subject of research: the interaction of Mexico and Russia in the field of trade, investment and tourism, we concretize the problem of research on the basis of methods of analysis of the volume, dynamics, structure of foreign trade, investment interactions and tourist flows using reliable, up-to-date data. The correctness of the hypothesis is believed on the mass material for a long period of time from 2004 to 2019 in the unity of theory and practice. The usefulness of the study in socio-economic terms can be determined by the recommendations to expand cooperation between the two countries in the above areas.

# 3 Results

Mexico seeks to participate in world politics. According to the Russian foreign Ministry, Mexican diplomacy promotes initiatives on a wide range of international issues – from comprehensive reform of the UN system and responding to new threats and challenges, promoting sustainable development to disarmament and human rights. The Mexican government is providing humanitarian assistance to Haiti. Together with French specialists, the Mexicans developed a program of training and education for the police force there. The Mexican government believes it is necessary to combine the efforts of the United States, the EU and Latin American States to stabilize the situation in Haiti.

Official relations between Mexico and the Russian Empire were established in 1890, between Mexico and the USSR in August 1924. In 1930, diplomatic relations between the USSR and Mexico were interrupted. After the restoration in 1942 and up to the present time, relations between the two countries have been developing harmoniously and cover several areas.

On the eve of the celebration in 2011 of the anniversaries of Mexican statehood, the 200th anniversary of Mexican Independence and the 100th anniversary of the Mexican revolution, coinciding with the 120th anniversary of the establishment of Russian-Mexican diplomatic relations, Ambassador extraordinary and Plenipotentiary of Mexico to Russia Alfredo Perez Bravo resumed that Mexico was among the 15 most developed countries in the world. It was inhabited by 110 million people, another 30 million Mexicans lived in the United States. Mexico ranked 12th in the world in terms of economic development and eighth in terms of foreign trade. While in 1980s 80 per cent of Mexico's exports were oil, in 2011 they accounted for only 7 per cent, making Mexico's economy less vulnerable. The most important trading partner is the United States, with a border of 3,200 kilometers – the most active in the world. Every year 500 million people cross it. The volume of trade with the United States in 2011 was 450 billion dollars. Mexico is heavily dependent on the US economy. The crisis of 2008 in the United States came to it in 2009. The Impacts for Mexico and Russia are about the same. Both economies are now catching up. In the first half of 2010 growth in Russia was 5 percent, in Mexico: 4.5 percent. The recovery of the Mexican economy was due to the improvement of the situation in the United States and the return to the previous level of tourist arrivals. The most important components of Mexico's income were foreign trade turnover of $ 500 billion, remittances of Mexicans from abroad to their families at home-about $ 20 billion, as well as income from foreign tourists, the number of which annually reached 20–22 million. The tourism sector, accounting for 9 per cent of the economy, provided jobs for many Mexicans (Pedroza, J. D. 2017), (Rosoboronexport 2019) .

There were no conflicts between Russia and Mexico. Very good relations developed in the 1970s and 1980s, primarily in the cultural sphere-largely thanks to

Professor Yuri Knorozov, who deciphered the Mayan hieroglyphs. Culture of Mexico, unfortunately, knows little Russian youth. This is partly due to the fact that there has been little high-level contact between Russia and Mexico since Russia's independence in 1991 and throughout the 1990s.

In 2005, Mexican President Vicente Fox paid a return visit to Russia. But the next four years were not characterized by active relations. Bilateral trade amounted to only $ 700 million. It is significant that in 2009, in the context of the global crisis, it had already reached almost a billion. But this was not enough for the potentials of Russia and Mexico.

What are the results up to the end of 2019 of the bilateral cooperation since 2004?

Foreign trade and investments:

In 2006, the trade turnover exceeded $ 433 million, in 2007 – $ 697 million. The trade balance was negative – in 2005, 2006, respectively –63 and –121 million dollars, and in 2007 – positive –127 million dollars (Political Atlas of Our Time 2019).

The trade turnover between Russia and Mexico for 2018 was more than $2.4 billion, the main turnover occurred in "Metals and products from them" (55%), "machinery, equipment and facilities" (12%). In the structure of trade turnover by Mexico China is on the first place (16%), on the second place is Germany (9%). Mexico is Russia's No. 40 partner with 0.4% share. At the end of 2018, the growth of mutual trade between Russia and Mexico increased by 214% in relation to 2017. In the structure of trade between two countries, the share of Russian exports to Mexico accounted for 68% (+32% compared to 2017), the share of Russian imports from Mexico accounted for 32% (–2% compared to 2017). Russian exports amounted to 2.94 billion dollars. The bulk of exports from Russia to Mexico were semi-finished products made of iron or non-alloy steel (66.7%). Russia also supplied Mexico with wheat and meslin (9.3%); synthetic rubber (3.9%); nitrogen fertilizers (3.7%); steel alloyed in ingots or other primary forms and semi-finished products from other types of alloyed steels (3%); potash fertilizers (1.9%); raw aluminum (1.3%); ferroalloys (1.3%); Kraft paper and Kraft cardboard (1.1%); oil and petroleum products derived from bituminous breeds (1%) and other goods (Information Agency Ru-stat.com 2019).

The bilateral Commission approved a two-year action plan in December 2009. It is engaged in economic, cultural, scientific and technical cooperation, as well as Maritime transport. The Commission was established during the Soviet period, but it seemed that Russia and Mexico met for the first time. The work began in the field of air transportation, customs cooperation, energy, in which Russian investors were investing.

Mexico bought hydro turbines in Russia. There is practically no Mexican investment in Russia, except for a joint venture in Kaluga for the production of spare parts for VOLVO buses. Today Mexico needs Russian investments. And this is the next step in our cooperation. By opening businesses in Mexico and using local labor and raw

materials, foreign investors are able to deliver duty-free finished products to the U.S. market. The investor would have paid a fee for the introduction of domestically produced goods into the US market. This is the attraction of Mexico for investors.

Contacts between Russian and Mexican entrepreneurs and bilateral investments are being established. In 2009, suppliers of fruits, meat and other products came to Russia. The Embassy had to work hard to get permission from the Russian authorities to import Mexican meat. Because of swine flu, Mexican meat imports were banned in may and June, but then allowed. Horse meat and cattle worth $ 20 million were sold to Tatarstan. Mexican products were sold in Moscow and St. Petersburg. Deliveries to Yekaterinburg, Irkutsk, Kazan and Omsk were also planned. In Moscow, under the auspices of the Ministers of agriculture of Mexico and Russia, a Russian-Mexican business forum was held (Davidov, V. 2015), the result of which was an increase in sales of Mexican agricultural products to the Russian market and the purchase of Russian fertilizers and agricultural equipment by Mexicans.

Tourism. In 2007, it took 45 days to obtain a visa to Mexico. From 2011, the term of registration is only two days, without an invitation from the Mexican side, reusable and for ten years. Russians can request it on the Internet. Simplification of the visa regime has significantly increased the flow of Russian tourists to Mexico. If in 2006 there were no more than a thousand people, in 2009–25 thousand (Labetskaya, K. 2011).

The Federal Ministry of tourism of Mexico (Sectur) provided data according to which in 2018 Mexico was visited by 64,282 Russian citizens. This is 72.4% more than 37,279 Russian citizens who visited the country in 2017. More than 80% of Russians who visited Mexico in 2018 entered the country through Cancun international airport. If in 2017 Russia was on the 25th place in the number of citizens who visited Mexico, by January 2019 it rose to the 19th place. The increase in the number of Russian tourists in Mexico is primarily due to the resumption of regular flight programs from Moscow to Cancun. Since the spring of 2018, Nordind (tour operator Pegas Touristik) has resumed non-stop flights to Cancun and now operates from with a frequency of 3 times a month. Since October 2018, Azur Air (tour operator Anex Tour) has started flying from Moscow to Cancun. Currently, Azur Air operates flights to Cancun twice a week, but in the winter schedule of 2019–2020, the airline promises to increase. It is attractive not only by beaches and sun, but also by ancient original culture, excellent cuisine, diverse nature (mountains, forests, deserts). Tourists are offered to visit pre-Columbian attractions, colonial cities, as well as eco -, extreme and VIP – tourism. Mexico, which annually receives up to 21 million tourists, has excellent tourist infrastructure. Only in Cancun, the Riviera Maya, on the Yucatan Peninsula operates 200 five-star hotels (Information site “Go to Mexico!” 2019).

The tourism sector in Mexico is attractive for Russian investments. Most hotels in Mexico are owned by major American, European and Japanese chains. Real estate and land are not as expensive as in Europe. Investments in the hotel pay off

after five years and begin to generate income. There are programs to attract investment in infrastructure-private highways, airports. It is necessary to reconstruct the railway network in Mexico.

## 4 Conclusion

Cooperation between Russia and Mexico, countries similar in geography, territories, population, level of development and social processes has been actively developing in the last 15 years from 2004 to 2019. Thanks to the initiatives of the presidents of Russia and Mexico, which were based on their meetings in 2004 and the long history of cooperation from the 19th century. This is facilitated by the global economic environment and scientific and technological progress. Transportation of goods from Russia to Mexico and Vice versa became more affordable, new opportunities for investment development and expansion of tourist flows appeared. Some problems of interaction between the two countries require more active participation of heads of state and business. These include the insufficiently high dynamics of the development of foreign trade partnership, the structure of trade, investment, tourist exchange. In the sphere of foreign trade – the main share is accounted for by "Metals and products from them" (55%), "Machinery, equipment and facilities" (12%). At the end of 2018, the growth of mutual trade between Russia and Mexico increased by 214% in relation to 2017. But Russia is still only 40 in importance partner for Mexico.

There are prospects in the field of sales of hydro turbines from Russia, expansion of investments in Russia, not only in Kaluga, but also in other cities of Russia. Russians can also profit from cooperation with Mexico, thanks to using local labor and raw materials, they are able to deliver duty-free finished products to the U.S. market. Mutual investments in the exchange of agricultural goods and in particular the purchase of Russian fertilizers and agricultural equipment by Mexicans are expanding not only in the major Russian cities of Moscow and St. Petersburg, but also in the constituent entities of the Russian Federation, for example, in Tatarstan. In tourism, simplification of the visa regime has significantly increased the flow of Russian tourists to Mexico: in 2018, the increase was 72.4% more than 37,279 Russian citizens who visited the country in 2017. The increase in the number of Russian tourists in Mexico is primarily due to the resumption of regular flight programs from Moscow to Cancun. The main companies catalysts in the development of Mexican-Russian tourism were Nordind (tour operator Pegas Touristik), Azur Air (tour operator Anex Tour).

More Mexican students came to study in Russia in 2018–2019 (Ministry of science and higher education of the Russian Federation 2019). Labour migration between our countries is developing (Blog mejores opiniones de Mexico 2019).

At last we would like to say that there are a lot in common in the lives of Russians and Mexicans: these two peoples are open, friendly, sociable. We are close to the same cultural values: the postulates of religion, culture, we love to sing the same, dance, have fun, enjoy the success of our children and students. Despite the long distance between our countries, which is significantly reduced due to technological progress, the Russians and Mexicans sincerely respect the achievements of the economy, science, technology, culture, social responsibility of both countries.

There are still many social, economic, global problems that need to attract public attention, there are still many promising economic, investment, social, educational, scientific projects that could be organized in the sphere of cooperation between these two countries. The main thing – do not give up on this fertile field, which is sure to bear fruit.

The interest of the Russian and Mexican peoples in each other originates and develops just from a small point of view: an interest to study of Russian, Spanish, poetry, music, economy of these two countries, the preparation of joint cultural and educational events, mutual financial projects within the framework, cooperation at the level of heads of state and state institutions, embassies, industrial, educational and other organizations and individuals.

Moscow Financial University under the government of the Russian Federation is ready to open its doors to Mexican students in 2019 and already makes a great contribution to the development of Russian-Mexican cooperation and Friendship with its constant research in the sphere of the world economy and the world finance. The University has created a unique environment where future members of Russian and Mexican society elite could actively communicate with, visit parties of the Russian-Mexican friendship, studying Russian and Spanish languages, international economy and international finance.

Thanks to formed in Moscow financial university under the Russian government reverent attitude to the creation of a better human and professional qualities of foreign young people learning here, there are already and there will be many incarnations of the friendly feelings of different countries in real cases of the international economic, scientific, cultural, social cooperation. Like small but deep streams, filling rivers and seas, the contributions to the development and enrichment of relations between the two brotherly countries affect the progressive course of world progress and sustainable development of all mankind.

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# 24 Innovative Critical Success Factors for Public – Private Partnerships (PPP) in Infrastructure Projects of Developing Countries. A Case of Zambia

## 1 Introduction

Infrastructure is said to be the promoter for economic growth. The global infrastructure needs are about 4% of the global GDP or US$4 trillion per year (Estache, et al., 2015). This suggests that developing countries require about US1.5 trillion per year per year of infrastructure investment by the year 2030 (Ruiz-Nunez & Wei, 2015). The Organisation for Economic Corporation and Development (OECD) estimates that these countries spend about US800-900 billion (OECD, 2013 cited in Estache, 2015: 279).

To address the cost of infrastructure, about $93 billion a year is required and around a third is need for maintenance which is higher than twice the Commission for Africa' s 2005 estimates (Fombad, 2015). In Africa, the central government' budget which is the main driver of infrastructure investment, domestically finances a large share of infrastructure in Africa. Niazi and Painting (2018) indicate that Africa would still face an infrastructure gap of US$31 billion a year regardless of whether the potential efficiency gains are captured. This gap would be closed once private sector initiatives such as the use of public private partnerships (PPPs) participate in the infrastructure development (Akampurira, et al., 2008).

Since 1964, Zambia has experienced a deficit in infrastructure that has prevented developmental and economic growth (Zulu, 2016). This has led to poor performance in the provision of infrastructure both at state and local government levels amongst which are: unreliable power supply; water shortages; fuel scarcity; shortage/unreliable healthcare services, unstable educational system, poor roads and fickle telecommunication services. The challenge of Zambia's infrastructure is enormous, according to as reports made recently that suggest there is need for about US$1.6 billion yearly for the next 10 years to meet the average infrastructure requirements (Dominguez-Torres & Foster, 2011). The Zambian government on its own cannot gather the required resources needs. That is why a mainstream of

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infrastructure projects are presently ongoing and underway in most government ministries in Zambia are driven by PPPs in various sectors (Zambia Development Agency (ZDA), 2010). These PPPs are mostly being applied in the energy sector, road transport, water and waste management, health sector.

However, the problem of PPPs has been that of poorly implemented critical success factors that have led to deprived financing of infrastructure, budget constraints, inefficiencies in managing infrastructure on the side of the public sector, and poor public spending poor public spending and inefficiencies in managing infrastructure on the public sector side (Croce & Gatti, 2014). This has led to reconsider the significance of shifting the investment effort to the private sector which would entail identifying critical success factors (CSF) appropriate for the Zambian infrastructure projects. Hence, the aim of the study was to determine the CSF that are essential for PPPs and can be used to minimise insufficiencies in the provision infrastructure projects in Zambia.

## 2 Literature Review

The CSF are key areas of activities where positive outcomes are completely necessary to meet the goals of the organisation, sector or a government (Chan, et al., 2008). In PPPs, a number of researchers have studied CSFs (Qiao, et al., 2001; Tiong, 2006; Jefferies, et al., 2002; Stonehouse, et al., 2006; Grant, 2006). They identified infrastructure delivery of CSFs as suitable allocation of risk, and sharing of risk with objectives that are beneficial. Additionally, they acknowledged CSFs in the delivery of infrastructure to include favourable legal framework and a well-organised public sector; involvement of government in ensuring support and backing; sharing of authority among the public and private sectors; public/private sector commitment; technical feasibility for projects; consortium of the private sector that is strong; macro-economic environment that is stable and with a favourable legal framework; technology transfer and technical innovation; financial market that is readily available; social support and stability of the political scene; good governance; transparency and the procurement that is competitive; and a robust innovation in the methods of financing by the consortium. Hardcastle et al. (2006) identified nine PPP projects CSFs which are:

*Competitive procurement process*: Demonstrate an effective procurement process that is competitive and transparent throughout the process of procurement to enhance value for money in projects (Hardcastle, et al., 2006).

*Thorough and realistic assessment of cost and benefits*: Private actors cannot be forced to join a PPP, but can enter into partnership with the public entities only if they see the success of the project and that their interests preserved throughout their participation (Alshawi, 2009).

*A favourable framework*: A legal framework that is favourable and allows projects of PPP in nature to be developed with less legal restrictions on the private sector involvement that facilitates 2planning and implementation, and instill confidence and understanding for all participants in the PPP process (Akintoye, et al., 2001).
*Appropriate risk allocation and risk sharing*: Guarantees maximum benefits from the PPPs by risk limitation, mitigation and allocation to the best qualifying partner (Sanvido, et al., 2002).
*Provision of a guarantee by public sector*: A guarantee provided for by the public sector shows commitment and it is vital for a stable public role within PPPs with the provision of multi-annual public funding and financial support (Walker & Smith, 2005).
*Political support*: The decision to adopt a PPP must firstly be political where the government considers the social implications and adequate political will to drive its implementation (Zambia Development Agency (ZDA), 2010).
*Stable macroeconomic condition*: There is need for a country to improve the PPP model in order to suit its peculiar needs, that is, by stating that the initiative must deliver clear benefits without leaving its people with problems (Anderson, 2000).
*Sound economic policy*: For the success of any project, economic viability is critical by long term demand for services or products that can be offered by a project, creating limited competition from other projects; adequate profits from the projects to attract investors; lenders should be attracted to the long term cash flows; for the formal operation of the project, long term availability of suppliers are needed (Zhang, 2005).
*Availability of suitable financial markets*: This provides for public and private champions of PPP, that is effective in partnership and public interest protection (Zhang, 2005).

Nonetheless, the lack of experience in PPP by various countries leads to poor domestic skills in managing PPP projects that could have a constraint in the introduction of the required methods and practices that are new.

## 3 Research Methodology

The study was both qualitative and quantitative with descriptive survey. A self-administered questionnaire was used as an instrument for the collection of data. While the sample selected was from a non-random cross section of professionals in the public and private institutions, PPP financiers, stakeholders and contractors

that are involved in PPP projects. In the questionnaire, scale with the 5-points weighted from one to five respectively was used in the questionnaire as it has a strong potential to produce distributions that can be treated as interval data (Kothari, 2004). Interviews were also used to collect data.

The study sites were in Lusaka province and included Lusaka City Council, RDA, Zambia Air Force; Society Business Park; Lubarma market, East Park Mall; Levy Mall, and AVIC International.

# 4 Findings

An aggregate total of 68 questionnaires were purposively administered to respondents who are participants in the PPP projects of which only 49 copies were collected indicating 72% representation and is acceptable according to Creswell (2014) hence found suitable for further analysis. Only 30 respondents were interviewed.

## 4.1 Highest Academic Qualifications

Table 24.1 shows that 49% had a bachelor's degree while 32.7 had a diploma while respondents with master's degree were 18.4%. This indicated that the respondents had satisfactory training to issue consistent and reliable information for the study.

**Table 24.1:** Highest Academic Qualifications.

| | Frequency | Percentage | Valid Percentage | Cumulative Percentage |
|---|---|---|---|---|
| Highest HND | 16 | 32.7 | 32.7 | 32.7 |
| BSc | 24 | 49.0 | 49.0 | 81.6 |
| MSc | 9 | 18.4 | 18.4 | 100.0 |
| **Total** | 49 | 100.0 | 100.0 | |

Professional experience for respondents indicated that 41% had 0 to 5 years' experience, 29% had 6 to 10 years' experience, 14% had only had experience of 11 to 15 years, and finally, 8% had only 16 to 20 years and more than 20 years of professional experience. It was estimated that the work experience for all the respondents was estimated at eight years indicating that the respondents are experienced enough to supply reliable information for this research study.

## 4.2 Awareness of Public Private Partnerships

In order to institute knowledge of the theory and practice of PPPs, respondents were asked whether or not they were aware of and whether or not PPPs could be the best strategy to procure infrastructure. Only 49% were aware as compared to 15% who were not aware and 36% had some knowledge (Figure 24.1)

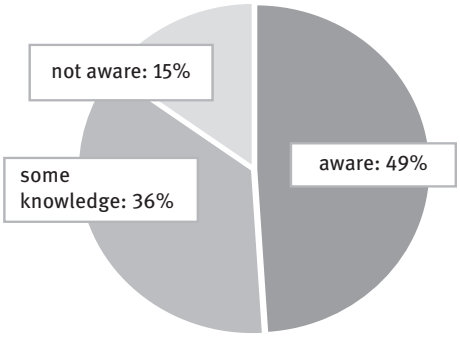


**Figure 24.1:** Display of tyres in direct sunlight by informal tyre resellers.

A follow interviews was done to determine other strategies that were chosen to suit the infrastructure being procured. It was observed that there was little knowledge and information given to those that availed themselves to answer the questions. Many people that were contacted did not know whether there is a framework on PPPs or not. The extracts below from some institutions attest.

## 4.3 Options for PPP

About half of the respondents indicated that the best PPP option for procuring infrastructure in Zambia was service contracts (51%) while debentures (2%) were the least used (Table 24.2).

**Table 24.2:** PPP options mostly used to procure infrastructure.

| No | PPP Options | Percentage |
|---|---|---|
| 1. | Service Contracts | 51% |
| 2. | Management Contracts | 10.2% |
| 3. | Lease | 40.8% |
| 4. | Concessions | 61% |
| 5. | Debentures | 2% |

## 4.4 Ranking of Critical Success Factors (CSFs) for the Public Private Partnerships (PPPs) in the infrastructure industry

Table 24.3 indicates that the uppermost six CSFs include transparency (0.79), competitiveness (0.74), good governance (0.74), well-organized and committed public sector (0.72), social support (0.72) and shared authority (0.69) with realistic assessment of the cost and benefit mean scores (MS) which are high.

On the other hand, government support (0.62), multi-benefits (0.62), political support (0.61), stable macro-economic (0.60), sound economic policy (0.59) and availability of financial resources (0.59) with (MS) values of a lower mean score indicating less CSFs in the Zambian PPPs infrastructure delivery.

**Table 24.3:** Ranking CSFs for the infrastructure delivery projects using PPPs.

| CSFs | 1–3 | 4–6 | total | MS | Ranking |
|---|---|---|---|---|---|
| Transparency | 6 | 43 | 49 | 0.79 | 1 |
| Competitive procurement process | 11 | 38 | 49 | 0.74 | 2 |
| Good Governance | 13 | 36 | 49 | 0.74 | 2 |
| Well Organized and committed public sector | 13 | 36 | 49 | 0.72 | 4 |
| Social Support | 17 | 32 | 49 | 0.70 | 5 |
| Shared Authority | 20 | 29 | 49 | 0.69 | 6 |
| Thorough and realistic assessment of the cost and benefits | 17 | 32 | 49 | 0.68 | 7 |
| Framework that is favourable | 19 | 30 | 49 | 0.68 | 7 |
| Project Feasibility | 17 | 32 | 49 | 0.67 | 9 |
| Risk Sharing | 21 | 28 | 49 | 0.66 | 10 |
| Commitment/Responsibility | 21 | 28 | 49 | 0.66 | 10 |
| Private Consortium | 30 | 27 | 49 | 0.63 | 12 |
| Government involvement | 21 | 28 | 49 | 0.62 | 13 |
| Multi-Benefits | 23 | 26 | 49 | 0.62 | 13 |
| Political Support | 24 | 25 | 49 | 0.61 | 15 |
| Stable Macro-Economic | 27 | 22 | 49 | 0.60 | 16 |
| Sound Economic Policy | 27 | 22 | 49 | 0.59 | 17 |
| Availability of Financial markets | 25 | 24 | 49 | 0.59 | 17 |

Note:
1–3 – not applicable; not important; rarely important.
4–6 – sometime important; important; very important.

## Hypothesis Testing

*Null hypothesis ($H_0$)*: There is no significant difference in the opinion of public and private sectors over the CSFs in the PPPs on the provision of infrastructure.

*Alternative Hypothesis ($H_1$)*: There is a significant diffecrece in the opinion of public and private sectors over the CSFs in PPPs on infrastructure provision.

Table 24.4 shows that procurement process transparency, good governance, committed and well organised public sector, shared authority between the public and private sectors, social support, technical feasibility of projects, responsibility and commitment of public and private sector, private consortium that is strong,

**Table 24.4:** The CSFs' T-test results in the PPPs on infrastructure delivery.

| CSFs | T-cal | T-tab | Df | Sig | Decision |
|---|---|---|---|---|---|
| Transparency | −2.2 | 1.96 | 36 | S | Accept $H_1$ |
| Competitive procurement process | −1.55 | 1.96 | 36 | NS | Accept $H_0$ |
| Good Governance | −2.4 | 1.96 | 36 | S | Accept $H_1$ |
| Well Organized and committed public sector | −3.5 | 1.96 | 36 | S | Accept $H_1$ |
| Social Support | −2.46 | 1.96 | 36 | S | Accept $H_1$ |
| Shared Authority | −2.25 | 1.96 | 36 | S | Accept $H_1$ |
| Thorough and realistic assessment of the cost and benefits | −1.39 | 1.96 | 36 | NS | Accept $H_0$ |
| Framework that is favourable | −1.49 | 1.96 | 36 | NS | Accept $H_0$ |
| Project Feasibility | −2.78 | 1.96 | 36 | S | Accept $H_1$ |
| Risk Sharing | −1.51 | 1.96 | 36 | NS | Accept $H_0$ |
| Commitment/Responsibility | −3.52 | 1.96 | 36 | S | Accept $H_1$ |
| Private Consortium | −2.02 | 1.96 | 36 | S | Accept $H_1$ |
| Government involvement | −1.9 | 1.96 | 36 | NS | Accept $H_0$ |
| Multi-Benefits | −3.61 | 1.96 | 36 | S | Accept $H_1$ |
| Political Support | −1.6 | 1.96 | 36 | NS | Accept $H_0$ |
| Stable Macro-Economic | −1.41 | 1.96 | 36 | NS | Accept $H_0$ |
| Sound Economic Policy | 0.5 | 1.96 | 36 | NS | Accept $H_0$ |
| Availability of Financial markets | −0.04 | 1.96 | 36 | NS | Accept $H_0$ |

Note: 1 – not applicable; 2 – not important; 3 – rarely important; 4 – sometimes important; 5 – important; 6 – very important.
*Key: S – Significant; NS – Not Significant.*

and multi-benefits indicated calculated values of (t-cal. ¼ 2.20, 2.4, 3.50, 2.46, 2.25, 2.78, 3.52,2.02, 3.61) that were found to be greater than the values tabulated by (t-tab. ¼ 1.96).

Nonetheless, the study found However, there is no significant difference in the perception of public and private sector organizations as to CSFs in PPPs on infrastructural projects delivery such as competitive procurement process, thorough and realistic assessment of the cost and benefits, framework that is favourable, risk sharing, government involvement, political support, stable macro-economic, sound economic policy, availability of Financial markets as indicated with calculated values of (t-cal. ¼ 1.55, 1.39, 1.49, 1.51, 1.90, 1.60, 1.41, 0.50, 0.40) that are lesser than the tabulated values of (t-tab. ¼ 1.96).

# 5 Discussion

The CSF that were significant based on the results implying that the hypothesis is true that 'there is a significant difference in the perception of public and private organisation that are concerned with the identified CSFs in the managing the PPP based infrastructure development'. From the results, include the need to have a procurement process that is transparent, good governance, committed and well organised public sector, shared authority among public and private sectors, social support, technical feasibility of projects, responsible and committed public and private sector, private consortium that is strong and decent, and multi-benefits are important CSFs that support infrastructure projects in Zambia. However, this was not the case in the study done by Niazi and Painting (2018) whose study was done in the Afghanistan construction industry and indicated that availability suitable financial market, sound economic policy, good governance, risk sharing and applicable risk allocation, macroeconomic condition that is stable, thorough and realistic assessment of the and cost and benefit. Similar factors were disclosed by Akampurira et al. (2008) and Zulu (2016).

The varying CSFs from the study based on the results can be attributed to public and private sectors being separate entities that operate in different government with varying ideologies and divergent views over the CSFs that could be considered suitable. Additionally, the divergent in views is because of what they consider critical for the implementation of PPS in infrastructure project provision. For instance, the private sector is more about the technical feasibility of the projects, how beneficial the objectives are, and the expected profits to be attained from the partnership contract (Alshawi, 2009; Estache, et al., 2015). On the contrary, the public sector is more driven by the timely and quick execution of the infrastructure projects and if the social benefits are acceptable (Niazi & Painting, 2018).

Nevertheless, the study indicated that the difference in perceptions between the public and private entities on the CSFs on the delivery of infrastructure projects, was non-affirmative and can be assumed that successful implementation of the projects was more cardinal to both and was believed to help achieve the objectives of the contract. The none affirmative CSFs based on the study results include availability of suitable financial market, sound economic policies and condition, stable macro-economic conditions, political support, involvement of government by providing a guarantee, risk sharing through appropriate risk allocation, favourable policy framework, receptive and realistic cost/benefits and a procurement process that is competitive For this reason, there is bound to be an agreement with respect to the identified CSFs.

## 6 Conclusion and Recommendation

The study objectives of coming up with CSFs for PPPs infrastructure delivery in Zambia was met. For optimum delivery of PPPs, Zambia needs complete partnerships among the public and private sectors. The study recognised nine CSFs that can be applied in the development of infrastructure projects using PPPs. The study hence, concluded that properly organised public sectors; political support; technical feasibility of projects, and objectives that have benefits that are multiple in nature are the CSFs significant to the development of PPPs and private investors.

The study recommends that both the public and private sectors should give maximum attention to the identified CSFs in order to maximally achieve the objectives of the partnership and to successfully execute the infrastructural projects using PPPs. Additionally, there is need for conducting evaluation mechanisms including monitoring the performance of the projects. Further, formulating performance indicators that will have targets and outputs, and performance bonuses need to be optimised for successful CSFs.

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# 25 Prediction Mechanism of the Territorial Socio-Economic Processes in Formation of the Information Systems

## 1 Introduction

Unsuitable ecological situation that reflect the problems of the intensity of work in the field of health care, education, as well as a decrease in the level of food security, have highlighted a new vector – the vector of sustainable development. Sustainable development is beginning to change the thinking of entrepreneurs and society about activities that will save the ecosystem in the future for new generations. Sustainable development involves restoring the consequences of economic life, which requires resources and time. The genesis of sustainability concept dates back to 1987 at the General Assembly conference OHH. Representative of the environment Commission G. H. Brundtland[1] insisted on recognizing the entity of economic growth without environmental destruction. In the conceptual general understanding of «sustainable development» – «long-term continuous development that does not harm future generations, while meeting the needs of people living today» (Brutland, 1988). In this definition, there are two directions of sustainability:

1) ecological
2) socio-economic (Tsapieva, 2010)

That is why there are new orders and requirements for reports, which should reflect the fact of sustainable development, as a reasonable balance, balancing the socio-economic laws of human development and preservation of the environment that will reduce the economic disparity between developed and developing countries in the context of a rapid technological process, and rationalize consumption (Koptyug, 1992).

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## 2 Discussions

The structure, content and quality of information are discussed at the level of international policy, law and accounting as evidenced by the concern of the Director General of the International Federation of Accountants (CEO of the International Federation of Accountants) I. Ball who is declared in his speech about global interest in a sustainable society. I. Ball stated that the accounting statements "are not able to insure a sustainability by themselves, it considers a powerful mechanism that help us to make the right decisions about what we consume and life we live".[2] Non-financial reports that is represented to the financial statements allow to provide the interested users with additional disclosing of the company's contribution to sustainable development, specifically: ecological, social and economic information.

The study shows that the needed information for the data, which reflect the main positions of the social responsibility level of transnational corporations to society puts forward new qualitative requirements for financial and non-financial indicators in financial statements.

At the present time, the urgent task of the modern economic system is to study and use of new technologies with a high ability to provide information quickly and accurately. Information and communication technologies have become an integral component of information systems. Management processes in the second half of the last century were accompanied by a rapid transition to the use of information systems, which contributed with effective development of activities to obtain useful information that contribute in making effective decision at the level of country, region, economic entity for predicting and control the facts of economic life and the economic, social and ecological results. Information systems have begun to be considered as strategic tools for organizations and governments (Koskosas, 2011). Evidently, that the necessary information systems for prediction are consists of human resources (personnel), equipment, programs, a database and special instructions for the collection, distribution, use and maintenance of these systems (Parakkattu, 2015).

Also, information systems are considered as an integrated mechanism that includes a set of qualified specialists, technological equipment, programs and databases, which interacting with each other not only to provide useful information for numerous users, but also to support the process of making the right decisions. (Shamala, 2016). Generally, the author sees the subject content of "information systems" in the conceptual chart (Figure 25.1).

2 Why we need integrated reporting? // Newsletter. 2010, December. Iss. 1. p. 1–7. URL: http://integratedreporting.org/wp-content/uploads/2011/03/IIRCNewsletterDec2010.pdf (accessed: 15.11.2019).

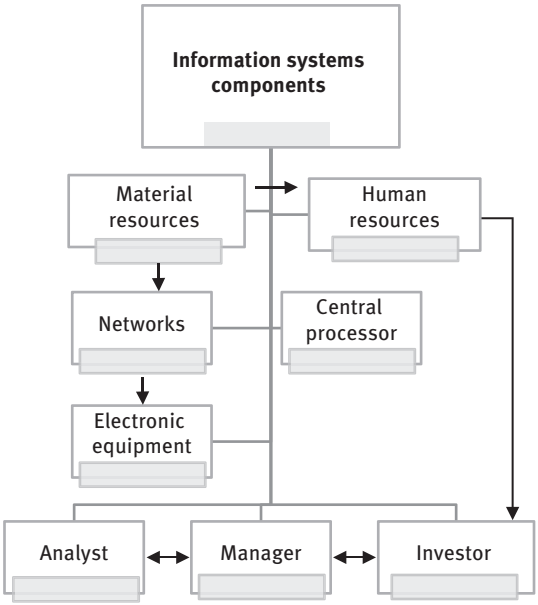


**Figure 25.1:** Information systems components for Predicting the socio-economic processes. Source: O'Brien (2015)

Thus, we can conclude that the information system is represented by employees who use a set of material elements that ensure the collection of information for predicting (tools and applications) in conformity with specific principles, goals and objectives of users who are interested in such information.

## 3 Materials and Methods

In the study of existing and new mechanisms for predicting territorial socio-economic processes in the terms of information systems formation, methods of deduction and induction, system analysis and approaches of ontological synthesis were used.

Predicting mechanisms ontology of territorial socio-economic processes cannot be separated from ensuring economic security and unity of the territory, which is exacerbated in the digital economy as an integral attribute of society informatization.

The predicting system should cover the scope of methodology and organization of prediction development, informational, economical and mathematical, econometric and technical organizational of management processes for ensuring the development of predictions and promoting their use.

# 4 The Research Part

From the point of view of M. Romney, human resources as main component of the system consists of managers, lawyers, economists and experts who use the system to perform various tasks. They "are responsible for its work and must have a high level of training, qualifications, experience, scientific and practical skills in the field of information systems" (Romney, 2017).

N.A. Bagranoff, M.G. Simkin, and S.N. Carolyn pay attention to the fact that the database plays an important role in the design of the information system, since it has quick and easy access to the stored data, at the same time K. Alrefaee notes that having a central database can help in integrating the subsystems information for exchange the information from one source (Bagranoff, 2009).

Information system is considered as one of management's components, which allow predicting changes in the qualitative and quantitative parameters of as many vital processes of the region's society as possible to identify the expected changes, and the patterns of their operation. The works of many scientists are devoted to study the features of prediction methods and methodology in a market economy (Bates, 2011; Blair, 2011; Holupka, 2011; Lennart, 2003; Nelson, 1993). However, there is a need to work out in the aspects related to substantiating the concept of prediction the socio-economic development of territories.

The informatization as a process of organizing and developing the social life at the level of individual territories and variety of economic activities significantly increase the importance of predicting strategy of regional government entities. It is difficult to justify the decisions made without predicting results, and also to minimize the risks as undesirable results in shifts in socio-economic processes.

Predicting qualitative and quantitative positive shifts in the life activity of the region's society allows us to determine and take into account the nature and trends of expected changes, the laws of their operation, forms and directions of development, and, consequently, to choose select structural policy routes, taking into account the expected changes in the external environment. This causes the need to revise and improve the content of the mechanisms, technologies and procedures of prediction.

The effect is one of the components that determines the "operating quality characteristic of any system". At the same time, internal effects as results of economic entities' activities (expenses and income) are directly perceived by economic interests' system of entities. External effects are the results of these entities activities that are implemented outside their economic interests, that is, they are perceived by other entities through changes in their expenses and/or income. Precisely the external effects make it possible to take into account the influence of the economic entities activities on the situation of ecosystems and public health.

Predicting of economic and social development of the region covers aspects and levels of its operation, based on the totality of all the predicts listed above,

which means it has a complex character. The development of any predict is the search for a possible realistic, economically correct solution. Any predict detects, analyzes and justifies the probability of various development options. It contains the necessary materials necessary for developing plan and economic documents and making reasonable managerial decisions.

Predicting of socio-economic processes possibilities are determined mainly by determination the nature of social development laws. The foundations of determinism theory are based on the theory of predicting as the main logical-epistemological principle and on the predict ontological substantiation.

Moreover, absolute determinism is excluded by an objective randomness. There are events that are not currently defined by any processes, and therefore cannot be foreseen. In this regard, the degree of determinism of the future is indeed the limit of predicting accuracy. This postulate is a fundamental key that determines the main direction of prediction development as a science. It is possible to provide just general properties and patterns that reflect stable relationships. However, for them there is no absolute determinism. The reliability of the predicts that are being developed is largely determined by the level of knowledge about the trends under study, as well as about the patterns of change in the trends themselves.

Functions of predicting the development of regions in a market economy are becoming much more complicated and should acquire a new quality. The results of their implementation should give an answer about the expected situation of development processes in the region in the future, taking into account the dialectical determination of predicted phenomena and a certain probability of the predicted results of their implementation in the condition of expanding the region's independence of and activity areas.

The construction of a regional predict that focus on the study of sustainable indicators and profitable management of the territory, should be carried out from the standpoint of identifying and eliminating threats that determine the basic factors of external and internal impact on the balance of the region. In managing the regional economy, it is necessary to identify strategically the factors that pose a threat to the balanced and sustainable socio-economic development of the integral territory of any country (Kayl et al., 2020).

To construct a predict, it is necessary to study modern concepts of regional analysis, which allow synthesizing a territory-oriented framework that aims to constructing qualitative and quantitative indicators, which reflects the factors that affect the socio-economic security. The predict should be based on the principles of territorial isolation of the region as a platform for economic security, which is ensured by a continuous process of identifying factors of favorable and unfavorable impact. The influence area of favorable and unfavorable factors in the region extends to: balanced expenditure of the region's resources; use of region sources (own, borrowed); mobilization of the region's resource reserves;

resource saving processes in the region; region investment policy; region innovation policy; information security in the region; institutional building (Shokhnekh at al., 2020; Melnikova et al., 2020).

The results of prediction processes of socio-economic development of the region should be scientifically grounded answers to a number of questions:

- how the social needs will change in the future
- what opportunities exist in society to meet these goals in the future
- what the social and economic development results that can provide the necessary level of needs satisfaction of needs
- what useful paths to choose to achieve them
- what resources are needed for their implementation and the level of their availability in society
- what are the problems that threaten further development and what are the ways to bias or eliminate these problems
- what are the complex of scientific, legislative and organizational and technical measures that can provide the expected results, and others

To answer these questions, the regional predicting system must have a meaningful methodological and structural unity regardless of the specifics of the predicted objects.

Priority directions for the development of industries, subsystems and components of the regions' social sphere of the today are:

- demographic predicting, health predicting; education and culture; social protection of the population
- preservation, reproduction and accumulation of human capital; provision of social needs of the population; social infrastructure
- development the social services market, housing, transport; financial support for social development
- formation of state and local budgets (revenue and expenditure structures, sources of formation, fiscal policy and fiscal forecasts), etc

The selected areas and processes of activity for predicting the socio-economic development of the region, should include a list of the main resulting indicators of socio-economic development at the first stage of the system's operation, with their gradual increase due to factors that affect it. It is advisable to include the types of predicting the socio-economic development of regions – search and research, regulatory, program, design, organizational and others, which already have certain theoretical and practical developments, the instrumental basis for their development and substantiation can cover all possible aspects of future development in a certain period of time. They should be accompanied by qualitative verification of predicts and justification of spent funds, assessment of the

quality of results of use and development of measures to reduce possible management threats and risks.

## 5 Effective Part

It should be noted that the predicting methodology recently has been supplemented with a number of effective methods of strategic analysis, information technologies and programs, and technological products. The most common methods and models used in forecasting processes are shown in Figure 25.2.

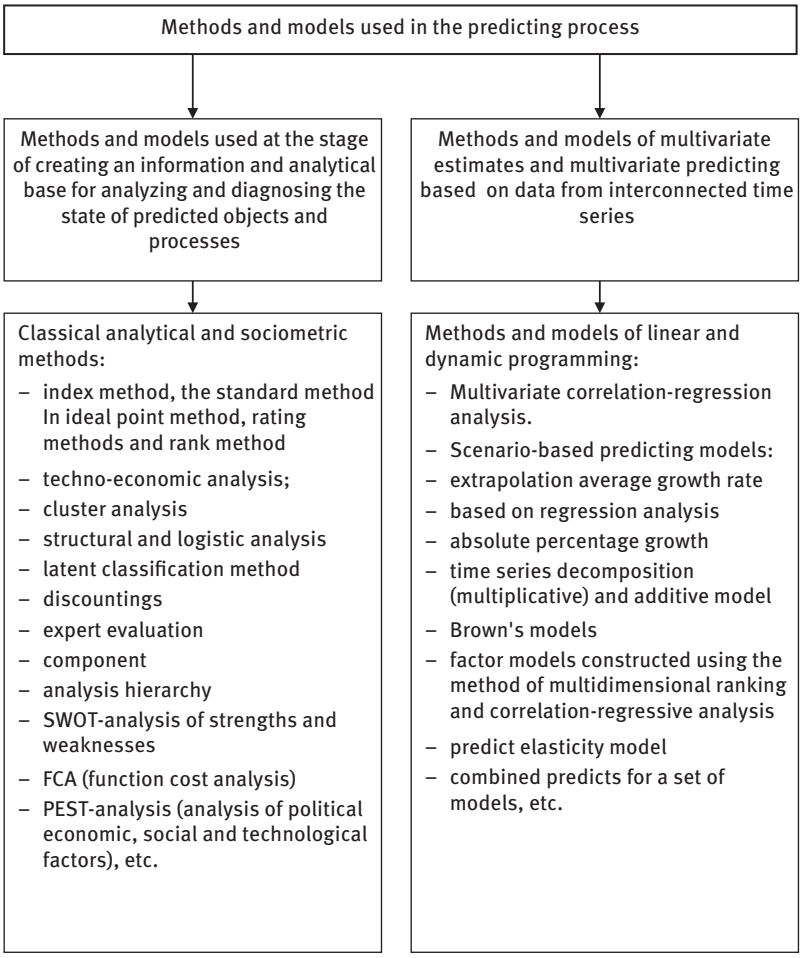


**Figure 25.2:** Methods and models for constructing and implementing predicting processes.

Among the main methods of predicting, methods of strategic analysis are gaining more and more development. Foresight technologies also occupy a leading place in the condition of growing competition in the high-tech market for predicting socio-economic development – methods for developing scenarios in the future (Lennart L., 2003).

Using these methods and models makes it possible to determine clearly the parameters of the predicted objects and their connections in a timely manner, coordinate the goals and interests of regional institutional units, reflect the influence of the development parameters of the predicted objects on the change in economic stability and preserve the level of development of the region, determine the ratio and interdependence of economic processes in the region. At the same time, special attention will be required to methods for verifying the predicts and evaluate predicts quality and reliability.

However, the socio-economic development of the region cannot be separated from the stimulation of small and medium-sized economic entities. It is important to note that the small and medium-sized business (SME) sector plays a key role in providing employment for the population of the regions and the country as a whole, increasing the income of the population. Currently, SMEs in certain developing countries, such as Syria, face many challenges that prevent their growth. Therefore, it is necessary to develop strategies to increase the competitiveness of such enterprises in the business environment. Development trends and fierce competition in the business world have a serious impact on the introduction of information technologies in the operation of SMEs, which is consider mandatory in the modern economy (Sidunova et al., 2019).

The mechanism of socio-economic development regional predicting should level out the risks, which are manifested as inability of the territorial business to acquire the necessary technical means and software technologies to integrate into the information society (Wang, 2014). Predicts of territorial socio-economic development should include the necessary tools for solving the problems faced by SMEs in their activities during the implementation of information systems.

# 6 Conclusion

In conclusion, it is important to note that sustainable development and social informatization dictates the refusal to identify the territorial development with economic growth. Therefore, a total increase in economic indicators is not a doctrine of sustainable development in its new paradigm, which has replaced sustainable economic growth. Regional sustainable development always implies achieving a high quality life in the positive dynamics system for a set of indicators. The General requirements of sustainable development determine the balance, security, rationality

and efficiency of development that makes it possible to achieve the goals and priorities of social, environmental and economic laws.

During the predict process, it is important to: 1) identify the critical points of regional socio-economic situation and the investment development level, to create investment strategy indicators in a sustainable development model; 2) develop a security mechanism for the existing and invested regional assets of the territory and do a moral assessment of their suitability in the information society; 3) develop a mechanisms for leveling fraud, corruption, and misuse of investment flows; 4) identify deviations of the regional investment strategy from the perspective of sustainable development and Informatization of society; 5) formation of government pilot investment maps to increase entrepreneurial activity in the sustainable development model and Informatization of society.

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# 26 Specific Economic Security Regulations in the Context of Pathological Crises of Digital Transformation of Agricultural Organizations

## 1 Introduction

In the study of conditions of pathological crises of digital transformation of agricultural organizations, it is important to emphasize that the problems can be solved through the integration of agricultural producers with enterprises of other fields of the agro-industrial complex, engaged in processing and sales of finished products. The transformation of land market institutions which serves as an efficient indicator of the state of land and agrarian relations, which is characterized by the goal-directed movement to the extended reproduction of soil fertility, development of rural areas, and cooperation, is essential as the need of improvement of the effectiveness of using land resources within the scope of sustainable development of bioenvironment and living matter and the rise in profitability of agriculture (Melnikova Y.V. et al., 2020; Shcherbina T.A. et al., 2019; Shokhnekh A.V. et al., 2020).

The current specifics of transformation and operation of private farms are determined by the need for the increase of the share of agricultural products in the gross volume of production and sales. The research shows that the following attitudes are subject to changes in the context of pathological crises: to the high ratio of the cost of products consumed in rural areas in the total cost of food products; to the rise in unemployment levels and the proportion of population whose income is below poverty line; to the reduction in the number of agricultural organizations (Melnikova Yu.V. et al., 2019; Shokhnekh A. V. et al., 2014).

Pathological crises are responsible for the incompleteness of transformation the agricultural economy, namely: sophistication of the organization structure; negotiation

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of the deindustrialization trend; transition from reduction to extension of agricultural space; change in the trends of manufacture of products; change of the agricultural profile; intensification of processes of concentration and polarization of rural areas (Asriyants K.G., 2016; Melnikova Y.V. 2020).

## 2 Discussions

Digital transformation is manifested as a relatively new wave in all sectors of economic activity, where digital tools shall be understood to mean technologies and platform solutions that are intended for generation, processing, in-depth analysis and translation of results of the analysis in the form of numerical information about the objects and subjects of the agricultural economy. Such platforms serve to accumulate and process information for the subsequent well-founded management decision-making providing technological breakthrough in the agro-industrial complex (Ganieva I.A., 2019; Rogachev A.F., 2015).

The research suggests that digital transformation has not yet become a means of development of the competitive advantage of agricultural organizations. Low activity in terms of the use of innovations in management decisions can be explained by the long-standing mindset that has developed in the context of the continuous monopolization of industries where the bulk of the market was controlled by a few large producers which were mainly operating due to government allowances and subsidies. Such barriers must be minimized in the formation of specific strategic economic security regulations in the context of pathological crises of digital transformation of agricultural organizations. However, high-quality specific regulations belong to the range of hard-to-solve problems which cannot be solved without the introduction and the change of organizational culture, transformation of local systems in the context of the digital economy.

Current economic relations and management methods that have been established earlier, cannot provide sufficient necessary conditions that would make it possible to improve the efficiency of producers in the nonfinancial (producing) sector of economic activity. The outdated techniques aimed at transforming the system of administration of agricultural producers are the crucial shortcomings in management. De facto, the individual improvement of structures and business processes that have no essential interrelations in a single agro-industrial complex, is implemented in practice (Salomatin V.A., 2011; Makarova N.N., 2019; Botashev A.Y., 2016). A comprehensive approach that would enable the improvement of the structures of the economic mechanism based on market needs and consumer expectations should become an important principle of the innovative transformation in the management of agricultural organizations in the agro-industrial complex (Gerashchenkova T.M., 2014; Rogachev A.F., 2018).

A comprehensive approach that would enable the improvement of the structures of the economic mechanism based on market needs and consumer expectations should become an important principle of the innovative transformation in the management of agricultural organizations in the agro-industrial complex (Shcherbina T.A., 2019; Shokhnekh A.V. 2019; Grudkina T.I., 2014).

## 3 Materials and Methods

Statistical analysis and synthesis of ontological approaches to the drawing-up of specific strategic economic security regulations of agricultural organizations in the context of pathological crises of digital transformation are used to test the proposed hypothesis.

## 4 Research Part

The drawing-up of specific regulations is mainly characterized by financial and time expenditures, which reduces the innovative activity of agricultural enterprises. Therefore, we can distinguish the most common types of pathological crises of digital transformation of agricultural organizations that are shown in Figure 26.1.

Important vectors are justified through the prism of logic and expediency, implying changes in relations with government institutions, partners and contractors.

At present, the transformation of relationship with the state in the direction of the formation of GR-management in the context of patronage and government assistance becomes mandatory. The reduction of terms for the adaptation of technologies and their intensive integration is impossible without the state support of an agricultural producer. It is evident that the following promotion levers are required: provision of subsidies and allowances with simplified document management support; reduction of key loan interest rates; legislatively defined transparency and expediency of insurance of producing units and property with due account for special aspects of agriculture; availability and willingness of the state to help with achieving well-developed infrastructure which is currently in crisis not only in rural settlements, but also in towns (Kayl I.I., 2020; Lennart L., 2003; Taroyan V.M., 2015).

It is expedient to draw up new specific strategic economic security regulations in subjective relations between labor resources and rural population from the perspective of development and application of informatization and digitization technologies in society. In the context of pathological crises of digital transformation of agricultural organizations, an entrepreneur and a worker cannot provide themselves with computing capacity, information systems and services, as well as digital platforms created with priority use of domestic technologies due to their high cost. In addition,

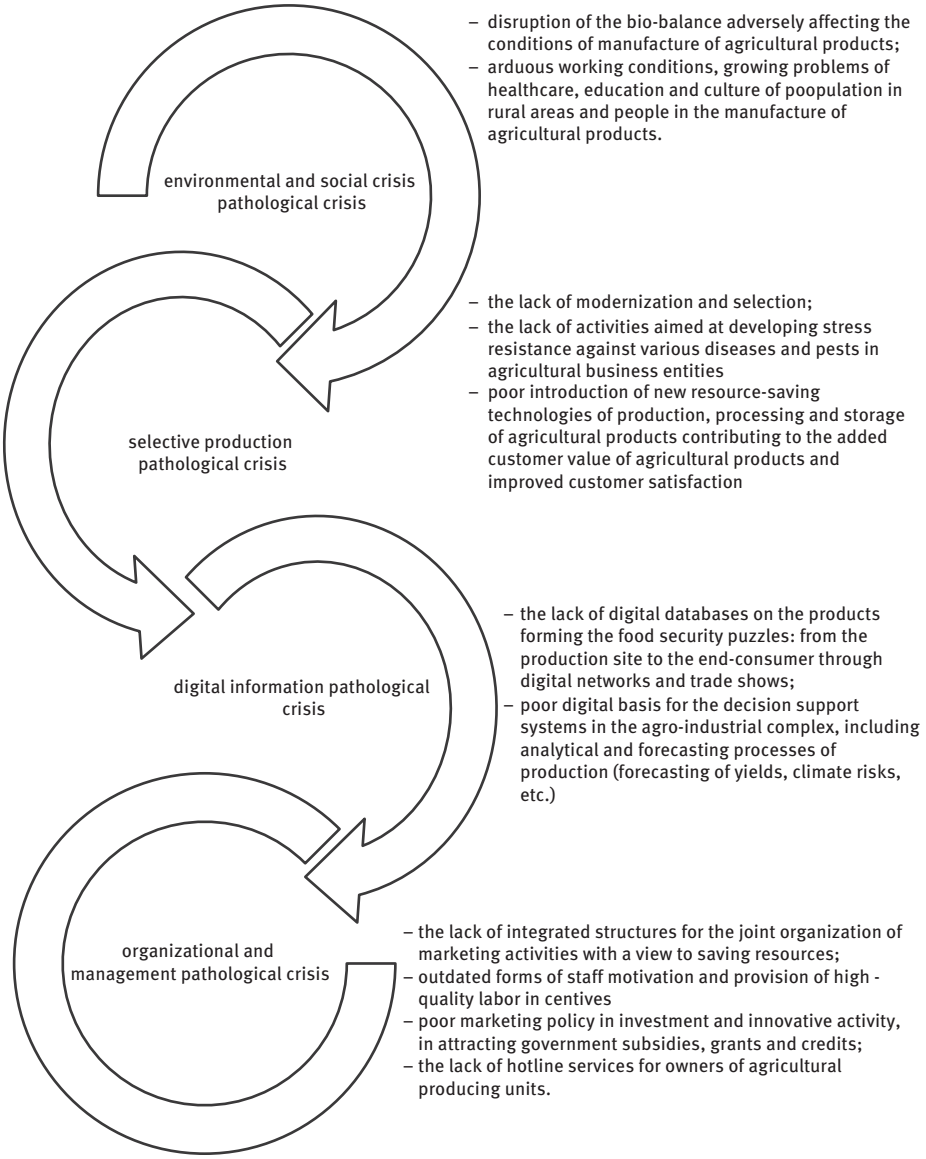


**Figure 26.1:** Types of pathological crises of digital transformation of agricultural organizations.

it is obvious that the agricultural producer will have no own or raised funding for the digital information technologies due to low yield in the field, which is a barrier to the equal development of all regions of Russia.

The following problem is a crisis in attitudes to the sense of insecurity of financial sector in agriculture, including the lack of special sparing bankruptcy (financial insolvency) procedures of an agricultural producer.

Besides, we can distinguish the crisis in terms of possible agricultural risk-taking. The resulting risk must be minimized by the insurance coverage of force majeure circumstance that must be obtained for the agricultural production through simplified procedures.

Crisis in attitudes to the means of manufacture of agricultural products that are hard to buy and acquire for the manufacture of environmentally-friendly and high-technology products with a view to ensuring food security in the context of sustainable development.

In addition, we should distinguish the crisis of attitudes to the solution of problems regarding the formation, modernization and development of the production infrastructure used for treatment, processing, and storage of agricultural products.

The crisis in relations with supervisory authorities was always clearly manifested and was relevant not only in the context of informatization of society. The conditions of development of agricultural producers will only be favorable after fundamental changes in attitudes to the supervision process both on the part of government institutions and on the part of agricultural business entities.

Pathological crisis is exacerbated by the lack of appropriate institutional units that can train competent staff in the context of the digital economy. There is a clear change of attitudes to the process of development of professional competences in the process of education of labor resources for the agricultural system. The authors point out in their research that the use of modern automated control systems and information systems, providing for the increase in the volume of manufactured products in crop production and animal production, generates additional competitive advantages. However, the global demand for food products is growing, which is conditioned by the population increase. Food security can be achieved through the increase in production capacity. It is the process of introducing modern automated and cognitive systems of an agricultural enterprise that increases manageability and operational efficiency.

However, it is important to acknowledge that investments belong to the main factors contributing to the provision of food security and economic recovery of rural areas. Today, the economy of rural areas is in need of the implementation of various capital investment projects, but at the same time, this is hindered by poor economic, financial and organizational indicators of investment facilities. Such indicators should primarily include the system of tax arrangements focused on the increase in investment activity, as well as development of innovation technologies in the economy.

Specific strategic economic security regulations are significantly influenced by the activity of investment processes and the development of investment infrastructure in the context of pathological crises of digital transformation. Investment processes serve as an indicator which points to the overall economic status of the state, national income amount, the object of investment ambitions of other countries. The term “investment” is multiple-valued. It can be construed as the purchase of profitable securities with a view to obtaining financial profit; it is also used in referring to tangible assets, such as manufacturing equipment which is required for

the manufacture and sales of goods and services. In the broadest sense, investment is a specific risk-related mechanism which is required for funding, growth and economic development of the state. That said, investment processes and development of investment infrastructure shall be understood as the financial flow not only from external stakeholders as investors but also from business owners and capital investment project owners. Investment processes as the result of the impact of investment on the economy cannot be parallel, they interact, interlink in various areas, thereby accelerating economic, social, production, scientific, labor and environmental investment effects from the introduction of certain investment projects. Investment, as an instrument in which productive resources can be put in, allows preserving or increasing their value and providing a positive revenue position. Investment activity as the process of investment of capital and the package of practical measures for the realization of investment (Rogachev A.F., 2015; Rogachev A.F., 2016; Shokhnekh A.V., 2020.):

- next generation equipment, cutting-edge technologies and solutions, information databases, qualification of employees and their reeducation, the latest management decisions
- reorganization of main forms of modern reproduction in the agro-industrial complex
- establishment of a new capital formation system
- structural adjustment of the agricultural system and mechanisms for funding and support of agricultural organizations
- provision of resources for transition of the agricultural system to the innovation-based development, which is an inevitable corollary of attraction of investment flows in the economic process
- a group of socially important functions, where investment processes lead to the formation of new jobs in agriculture, development of social sphere of people employed in the agro-industrial complex, as well as the expansion of the group of social assistance measures and engagement of new staff in agricultural production
- as a result of food sanctions within the scope of the food security policy, agriculture still remains one of the promising directions of economic development in Russia

The optimum areas of adaptive reforming of agriculture of the Russian Federation imply:

- an increase in the share of subsidization of agricultural producers in the field of animal production, since a significant imbalance in funding of crop production has been revealed for the last 4 years, and focus areas of food security require that a balance is achieved
- elaboration of differentiation criteria for various zones and businesses with various levels of income from sales of agricultural products for the reasonable planning of budgetary inflows

- arrangement of conditions for the cooperation of agricultural producers and, as the end result of these transformations, an increase in the share of profitability of each of them as part of consolidated producing units
- social development of rural areas – it is necessary to establish and approve, on an interdepartmental basis, a scientifically grounded system of standards of social development, standards of living of rural settlements, strengthen the tax potential of rural areas by reforming the structure of local taxation, creating the system of concessional mortgage lending, and developing the parameters of innovational economic mechanism for the labor power intake
- improvement of the system of management of the agro-industrial and food industry – at present, it is necessary to clarify the range of management functions and the list of functions, since the wide diversity of powers effectively excludes personal responsibility of state administration bodies for the decisions taken in agriculture

# 5 Final Part

The concept of innovation and investment policy as a brand new approach to production, distribution, exchange, and reproduction in the context of techno-economic modernization is based on a specific example, idea or area of activity that has brought financial, social or technological result for the provision of economic security of agricultural organizations in the agro-industrial complex.

Investment is expected in brand new technologies, approaches or projects that can multiply productivity, but with due account for a differential approach judging from the wide variety of the fields of agricultural organizations. Investing in innovations as the implementation of novel solutions in equipment, technology, labor management or business administration, based on the use of scientific achievements and advanced experience, ensures high-quality improvement of the effectiveness of the production system or quality of products.

The conceptual basis of innovation includes not only the potentiality for success, but also the risk of losses. It is difficult to predict that losses due to risks can be covered or justified.

The processes of innovation and investment policy exert a significant impact on the formation of strategic management decisions of agricultural organizations which are aimed at investigating additional advantages of resource consumption and achieving commodity and food sovereignty of both the region and the entire country, which will make it possible to: 1) increase the rhythmicality and productivity of labor; 2) reduce losses of economic resources; 3) ensure the financial availability of high technologies to small agricultural enterprises,

Another key point is that innovation and investment policy of agricultural organizations is based on the modelling of sustainable development of both the regional economy and the national economy. The inclusion of quantitative estimates of financial indicators of innovation and investment policy of agricultural organizations in conjunction with the equilibrium level of the ecosystem will make it possible to: 1) ensure food security; 2) mitigate risks of environmental damage; 3) improve quality of population of rural areas; 4) mitigate the risk of depletion of natural resources; 5) ensure economic security; 6) ensure environmental security for the coming generations; 7) improve the culture of consumption of eco-friendly and safe products.

In the process of generation of a system of indicators of specific strategic economic security regulations, the externalities (neighborhood effects) that are determined in the course of activities, must be taken into account. Thus, the activities of economic agents have irretrievable negative and positive effects on nature, personality, group of individuals, economic entities etc., that is, they directly or indirectly affect financial and non-financial assets and benefits of external stakeholders (third parties). It is expedient to note that innovation and investment policy meets global and national requirements for the provision of environmental security which were put forward in such international acts as: 1) Rio Declaration on Environment and Development, adopted by the United Nations Conference on Environment and Development in Rio de Janeiro (June 3–14, 1992); 2) Johannesburg Declaration on Sustainable Development, adopted at the World Summit on Sustainable Development (Johannesburg, South Africa, August 26 – September 4, 2002. http://www.un.org/ru/documents/decl_conv/decl_environment.shtml). Therefore, strategic economic security regulations must include all innovation and investment aspects of activity of agricultural organizations in the context of pathological crises of digital transformation.

# 6 Conclusion

To conclude, it is important to note that the mechanism of drawing-up of specific economic security regulations in the context of pathological crises of digital transformation of agricultural organizations includes the goal, objectives, principles, micro-level goal, meso-level goal, and subjects of innovation and investment policy. The effects from the implementation of such regulations at the micro-, meso- and macrolevels must be declared by the scientifically-based agro-industrial clusters, which contribute to: improved level of integration of agricultural organizations in the global community; increase in the level of employment and income of employees in rural areas; increase in the number of innovations in agricultural enterprises; improvement of the ecological state of rural areas. The principles of specific economic security regulations are as follows: consistency as the provision

of structure; strategic orientation as an activity focused on future together with the stage-by-stage process of development of an agricultural enterprise; individuality as the implementation of innovation and investment policy in accordance with specific features of a particular agricultural organization; scientific validity from the perspective of disciplinary interrelations; structuredness as a relation to other fields of activities of agricultural organizations.

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# Conclusion: Institutional Perspectives of the Digital Economy's Development in the 21st Century

The institutional nature of the digital economy in the 21st century determines the expedience of applying the institutional approach not only to its research but also to forecasting and management of the process of its development. High knowledge-intensity of production and consumption, which was achieved by 2020, creates a new challenge for the markets of higher education and labor. There is a need for mass mastering of digital competencies and development of the practices of remote interaction of employers and job seekers. An effective response to this challenge requires a systemic integration of the higher education market and labor market, as well as their full-scale modernization and flexible globalization.

Another future challenge for the digital economy is specifying the methodological foundations of measuring the economic systems' progress. The institutional view at the digital economy clearly showed that its nature is not limited by technique and technologies, but includes complex social interactions and progressive economic practices. However, it is obvious that the digital economy is a certain part of modern economic systems, and a lot of aspects of their functioning are beyond its limits. The issues of labor migration, increase of the number of women in science, and environment protection have to be reconsidered through the prism of digitalization. It is necessary to consider the influence of digitalization on these issues, and, at the same time, to acknowledge their separation – their indirect relation to the digital economy.

The future challenges for the digital economy, which will likely to appear in the 2020's, include the contradiction of interests of social and economic integration. The issues of economic integration are regulated by international law and national interests, envisaging the search for a balance of freetrading and protectionism, which is unique in each country of the world. On the contrary, social integration is not limited by anything and envisages spontaneous processes, which are less subject to regulation and control. Social integration covers international communications and trans-national labor migration. There might be a need for a special institution, which will regulate and support social and economic integration, as well as ensure their balance and effectiveness.

The research, which was conducted in this book, set the foundations of applying the institutional approach to studying and managing the development of the digital economy in the 21st century and outlined new problems of the digital economy in 2020's, which require additional elaboration. In particular, we can see the outlines of new institutions of the digital economy, which include the digital labor market without geographical and other limits, international socio-economic

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cooperation in the digital sphere, virtual exchange of information, knowledge, and technologies, breakthrough technologies – AI, big data, the Internet of Things – and machine learning. All this should be studied in further works on this topic.

Elena G. Popkova, Artem I. Krivtsov and Aleksei V. Bogoviz

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