Economy Digitalization: Information Impact on Market Entities

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Abstract

The development of priority areas of science and technology - locomotive industries that stimulate innovation activity of the economy as a whole supports the development and competitiveness of national economic systems. Nowadays there is a problem of changing the system of priorities generated by the fourth industrial revolution and its key direction – digitalization. The purpose of the article is to assess the impact of the digital economy elements on modern socio-economic processes. The authors present an analysis of industrial revolutions and their projections for further economic and technological breakthroughs. Based on an interdisciplinary approach and based on well-known institutional economic theories, the authors identify new economic trends emerging in the digital economy. The theoretical forecast of the economic market subjects’ behavior in the conditions of information influence is executed.

Keywords: Economy Digitalization, Socio-Economic Processes, Economic and Technological Breakthroughs, Digital Economy

1 Introduction

Increased attention to the problems of digitalization of the areas of social and economic life can be noted not only in Economics but also in social development and psychology (7, 14, 15, 17, 20, 26). This indicates a significant interdisciplinary connection between the problems of integration of digital technologies in the life of both individual subjects, social groups and institutions. The study, according to the authors, among other things, is also relevant due to the following reasons. The introduction of new digital technologies increases productivity, reduces business costs, increases the availability of information and reduces barriers to entry into new markets – and has a multiplier effect on the development of the economy as a whole. Being aware of the high importance of digital technologies, many countries are taking steps to accelerate digital development. According to the Organization for economic cooperation and development, 32 of the 36 member countries of the organization, as well as 6 partner countries have national digital strategies. Large-scale programs for the development of the digital economy operate in the US, China and the European Union countries.

According to Boston Consulting Group data, the share of digital technologies in GDP has tended to increase in the last decade in different countries. Thus, according to 2018, the absolute leaders in the share of digital GDP are the US with 25% and China with 13%. With the ratio of digital to global GDP, the US owns 25% of digital GDP and 35% of global GDP, China — 25% of global GDP. However, this figure is growing more rapidly than in other countries. The digital share of French GDP of slightly more than 8%, share of the digital German GDP was slightly less than 8%. The remaining countries' digital GDP is well below global GDP (10).

All digital technologies have significantly changed the world, and there has been a total change in business models. The modern development of markets is characterized by an
increasing use of technological solutions. Investments from traditional sectors are increasingly flowing into digital ones. Moreover, in the global aspect, this leads to a high degree of market uncertainty, as well as competitive risks caused not so much by economic factors as by social and political trends in recent years. Together, this creates an institutional environment in which market actors interact. The study of trends in this environment is relevant in the context of the expansion of theoretical views and approaches in the field of institutional Economics, as well as due to the high dynamics of the digital economy.

2 Materials and Methods

2.1 Digitalization as a Result of the Industrial Revolution

The digital economy as a modern key direction was proclaimed at the 46th world economic forum, held in Davos in 2016. The motto of the forum Leading the Fourth industrial revolution was defined by K. Schwab (2016); this revolution is "a mixture of technologies of the physical, digital and biological world, which creates new opportunities and affects political, social and economic systems". The author, considering the importance of revolutionary changes in the development of society, identifies the following periods of industrial revolutions:

1. The first industrial revolution (1760-1840s), is characterized by the construction of Railways, the invention of the steam engine, the development of mechanical production.

2. The second industrial revolution (Late XIX –mid XX century), is characterized by the spread of electricity and the introduction of the conveyor, the emergence of mass production.

3. The third industrial revolution (the Beginning of 1960 -ies of XX century – the end of XX century), is characterized by the development of semiconductors, electronic computing machines, personal computers, the Internet.

4. The fourth industrial revolution (the beginning of the XXI century – now), is characterized by mobile communication and the spread of the Internet, miniature production devices, the development and application of artificial intelligence in all fields of knowledge, digital technology, the development of biological engineering; flexible interaction at the global level of virtual and physical systems of production forms.

Radical technological breakthroughs based on software, characteristic of the third industrial revolution, are being modified every year, becoming perfect, transforming production and economic activities, improving the quality of life. The second machine age is not only about smart and interconnected machines and systems. Its range of action is much wider. At the same time, there are waves of further breakthroughs in a wide variety of areas: from decoding information recorded in human genes up to nanotechnology, from renewable energy up to quantum computing. A distinctive feature of the last industrial revolution from the previous three is the self-synthesis of innovative technologies into increasingly advanced and efficient ones, that is, the development of technologies is exponential. The speed of the avalanche-like flow of innovations, the pace of their development and diffusion are unprecedented. Based on the driving force of science there is an optimization of the system of involvement in the production of a new generation of specialists capable of creating a highly intelligent environment focused on the development of the digital economy. Thus, the fourth industrial revolution, which is multifaceted and affects such indicators as investment, gross domestic product, productivity, education, consumption, trade, employment, inflation, etc., will lead to irreversible transformation in production and business (2, 3, 9).

Therefore, there is a need for new responsive mechanisms for the transition of all systems to the digitization in all spheres of life, which is they should be supplied by the new regulatory challenges, developed a new scheme of data management, and solved educational problems of specialists’ training of a new type, capable to exist in the new digital culture.

2.2 Information base and research methods

The information base for the study is the official data sources, as well as the analysis of the experience and practice of a number of large and medium-sized enterprises operating in Russia in the fields of industrial production and information technology. The study was conducted through audits and in-depth interviews with company executives. The basis of the study was the institutional approach system of cognitive principles that focus on the interpretation of historical reality in line with institutional theories developed in various fields of social and humanitarian knowledge (13, 23). While analyzing institutional approaches in the field of sociology and at the same time analyzing them from economic positions, it is impossible not to pay attention to the problems of institutional dynamics, and what social phenomena are the basis of consumer preferences and expectations are. Therefore, N. Fligstein (1996) identifies three main elements:

- Institutional formations, or institutional arrangements, allowing agents to organize their activities in the markets;
- Motivational structure of agents [structure of incentives], which determines the immediate motivational reasons for their actions;
- Concepts of control [conceptions of control], helping to develop an understanding of business processes and strategies for their own actions.

V.V. Radaev (2001) defines institutional entities as rules that are both the basis and the result of economic actions. Their structure includes the following basic elements: property rights; management structures; exchange rules. In the context of the high dynamics of the modern world, it is noteworthy to define the institutional dynamics of H. Schelsky (1970), according to which the dynamics is the basic circumstance for social change due to the continuous process of production of new needs.

According to the authors, the following institutional theories should be considered in the context of the topic:

- the theory of property rights, in which in addition to the work of R. Coase (2007) "The firm, the market and the low and A.A. Alechian (1977) "Economic forces at work" we allocated the classification of A.M. Honoré (1961), namely:
ownership, use, management, sovereign rights, perpetual rights and the rights of ownership non-use to the detriment;

The theory of transaction costs, considering the transaction as the basic unit of analysis of market participants' interaction. The nature of the theory is microanalysis, behavioral analysis, study of the specificity of assets, etc. O. Williamson (1996) in "The Economic Insights of Capitalism" indicates that the activities of modern organizations are largely based on minimizing transaction costs. It is important to note that it is necessary to study the elements of this theory, which are acquiring a completely new meaning in modern conditions;

- the theory of optimal contract (authors – Nobel laureates, 11), which determines the system of relationships in determining the terms of the contract in terms of error in the information space of the transaction or the specifics of the integration of agents in the process of their economic interaction. In addition to conflict resolution, contract theory explores opportunities to increase trust between the parties and contributes to the development of General terms and conditions of contracts and agreements;

- the theory of public choice (5), which studies the various ways and methods by which people use government agencies and public institutions in their own interests, the subject of its analysis is the decision-making process in both external and internal uncertainty. The theory explores the processes taking place in society, the correspondence of public choice to the real preferences of society and the conditions of their convergence. The theory is of research interest because of the transformation of political and social institutions, as well as the gradual change in the priorities of national economies.

3 Results

The development and structure of modern markets is determined by the nature of factors that reflect the objective processes taking place in the world economy. The nature of the factors is, first, technological development, and especially data transfer and storage technologies; second, increased political and economic competition between developed and developing countries; and third, changes in consumption and choice patterns that threaten the development of traditional sectors of the economy in the medium term.

The modern role of information is remarkable, which can be considered both as a means of production of services (for example, introduction into social rating systems of individuals and legal entities), and as a product that has an impact on economic decision-making (information on the financial solvency of the contractor). At the same time, information does not pose a threat to traditional industries, but rather expands their capabilities through the emergence of appropriate technologies of cloud solutions, technologies of Internet of things, big data, etc.

Thus, the trend of information influence has a global impact on the development of socio-economic systems. For example, we can trace the following pattern, which is based on the above-defined information influence: the emergence, development and availability of technologies for the creation and transfer of information content greatly facilitates the actions of subjects in the field of promotion of views, opinions, ideas; this in turn expands the capabilities of each individual subject - consumer to conduct an active social life and position that can be perceived by such a subject as their own development and well-being; private social activity naturally generates demand and economic supply, which is expressed not only in increasing the number of non-profit organizations, but also in the development (primarily) of small businesses that are ready to provide services, for example, in the field of crowdfunding.

It is appropriate to evaluate the information impact from the standpoint of institutional analysis: on property rights (theory of property rights); the theory of transaction costs; the theory of optimal contract; the theory of public choice. The result is presented in table 1.

It is clear from the table at present:

1) property rights and opportunities for their use by the owner are limited economically and socially, namely, on the one hand, by the problem of saving resources, reducing costs and the production of a competitive product, and on the other hand, by public control (analysis in the framework of the theory of property rights);

2) Transaction costs are directly affected by information, i.e. trend — information impact. Firstly, transaction costs vary depending on the application of modern information technologies to the process of concluding an economic transaction — contract; secondly, the social side of the issue is as follows: the adoption and approval by the society of information technologies' use, as well as the availability of confidence in this is a key factor influencing the economy of the transaction. Thus, the main conclusion on the theory of transaction costs is the convergence of economic and sociological approaches. It is important to note that the focus of the theory shifts from the description of the behavioral characteristics of the subject to the analysis of the behavioral aspects of social groups (analysis in the framework of the theory of transaction costs);

3) It is possible to implement the concept of smart contracts, described in the work of N. Szabo (1994). Its main idea is that almost all types and terms of contracts related to obligations, information protection and property rights could be implemented using digital technologies. The deal made by the principals will strive for optimality, and the negative impact of opportunism and asymmetry of information will be minimized. This should be achieved through the operation of a special computer Protocol, which is based on algorithms that allow automating the transaction, while the Protocol provides full control of the transaction.

4) Economics and politics in the theory of public choice act as mutual prerequisites, interact with each other, and constantly move one into another.
Table 1: Analysis of information impact in the context of institutional analysis

<table>
<thead>
<tr>
<th>Institutional theory</th>
<th>Impact analysis</th>
<th>Degree of influence</th>
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<tbody>
<tr>
<td>Type of right</td>
<td>Possessions</td>
<td>The development of the information technology market reduces the cost of property control due to the technical capabilities for rapid access to information from anywhere.</td>
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<td></td>
<td>Use</td>
<td>Information technologies provide the owner with previously unavailable opportunities for investment planning and analysis of the counterparty’s activities.</td>
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<tr>
<td>Theory of property rights</td>
<td>management</td>
<td>The procedure of granting rights to contractors for access to resources or property is simplified. This reduces transaction costs and allows you to refuse the services of intermediaries.</td>
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<td></td>
<td>Sovereign right</td>
<td>Due to the development of information transparency and the availability of third parties to control the actions of the owner, the owner him/herself may be limited in the rights to dispose of property in view of the obligations to third parties.</td>
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<td></td>
<td>Perpetual right</td>
<td>The trend has a significant impact on the market and contributes to the emergence of products with limited ownership over time. This could include any cashiering services when the owner is limited to the time of use of the product.</td>
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<td></td>
<td>not using the property to harm</td>
<td>In this case, only the level of development of the information society can put before the owner a moral barrier to the use of property to the detriment of third parties. Often reputation costs can be extremely high.</td>
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<th>Transaction cost theory</th>
<th>ex-ante transaction costs</th>
<th>Characteristic</th>
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<tbody>
<tr>
<td>Drafting of contract projects and other documents related to economic exchange</td>
<td>The use of IT technologies in the preparation of the contract allows integrating the most complex aspects of economic exchange (transaction) in the General planning scheme, which contributes to the drafting of the most complete contract. The speed of dissemination of information allows you to respond quickly to the actions of the counterparty. Transaction costs are reduced, but variables are growing.</td>
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<tr>
<td>Negotiation</td>
<td>Extensive opportunities for the creation and storage of information content on the one hand allow more complete use of all open sources of information, but on the other — it leads to the emergence of garbage sources. The cost of negotiations is increased by the need to process an array of information. In the future, such costs will be reduced due to the emergence of new algorithms for information analysis, which does not exclude variable costs.</td>
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<tr>
<th>Transaction cost theory</th>
<th>Ex-post transaction costs</th>
<th>Characteristic</th>
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<tbody>
<tr>
<td>Guarantee provision</td>
<td>Does not affect the problem of contract guarantee costs</td>
<td></td>
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<tr>
<td>Adapting to unexpected events</td>
<td>It is expressed in the development of IT able to predict the outcome of economic exchange, causing the possibility of creating the optimal configuration of the contract for contractors. It is also evident in the implementation of the current monitoring of the contract, when due to the growth of sources of information there are many opportunities to fully assess the parameters of the transaction at the implementation stage and, thus, reduce the ex-post cost.</td>
<td></td>
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<tr>
<td>The exact fulfillment of the obligations under the contract</td>
<td>Does not affect the problem of costs of the exact fulfillment by the counterparty of obligations under the contract</td>
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<tr>
<th>Optimal contract theory</th>
<th>Circumstances</th>
<th>Decision</th>
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<tr>
<td>The opportunism and the asymmetry of the contract</td>
<td>Reducing the generation of unproductive (including alternative (imputed) costs increases the efficiency of resource allocation.</td>
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<tr>
<td>Contract design goals</td>
<td>1. Controllability (observability), as the ability of participants to monitor the performance of each other's contract or to prove their effectiveness to other principals.</td>
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<td></td>
<td>2. Verifiability, as the principal's ability to prove to the arbitrator that the contract has been performed or breached, or the arbitrator's ability to find it in other ways.</td>
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<td></td>
<td>3. Privacy, as the principle that information and control over the content and performance of the contract should be distributed between the parties only to the extent necessary for the performance of this contract.</td>
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<tr>
<th>Public choice theory</th>
<th>Problems</th>
<th>Degree of influence</th>
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<tbody>
<tr>
<td>The problem of pricing and market deficits, as well as the elimination or limitation of market competition in the field of electronic economy</td>
<td>Information, especially on the actions of state institutions in the field of regulation of the electronic economy, significantly affects the actions of market participants. (Example – the collapse of bitcoin). The information in this case is of significant investment interest.</td>
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<tr>
<td>The probability of making a false decision at a high (state) level</td>
<td>State institutions of power do not always have the opportunity to receive reliable information about the state of the market and make the right decision.</td>
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<tr>
<td>Restriction of subjects in the right to make economic decisions</td>
<td>It is possible only in the case of prohibitions on access to sources of information through technical blocking.</td>
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Transparency and openness of information creates the need to create flexible mechanisms that can balance the economic basis of behavior in the political process and the political methods of intervention in the market economy, since the prohibitions within the framework of information influence are unproductive (27).

4 Discussion and Conclusion

Economic theories, in contrast to sociological theories, appeal to the behavior of market participants, whose actions are carried out in the existing institutional environment.

The behavioral characteristics of subjects are Central in institutional economic theories. The views expressed in economic theories give an idea of the consequences of subjects’ actions, but to a lesser extent reveal the root causes of social nature, which are fundamental. In turn, sociological approaches consider institutionalization more fully through the fundamental social nature, and the economic approach allows better assessing the consequences of market actors’ interaction under favorable or unfavorable conditions of the internal and/or external institutional environment. The set of institutional theories makes it possible to give the multidimensional assessment of information impact on socio-economic relations (4, 9, 22, 25).

Information technology, which is part of the digital economy, has an impact on transaction costs. This obvious conclusion would be incomplete if the authors did not add to it the fact that modern society and markets are not always ready to accept and use information technologies, even despite the reduction of possible costs. This once again proves the irrationality of market participants’ behavior. According to the authors, the issue of trust also depends on the scale of the economic transaction — the smaller the potential financial risks, the higher the trust. The authors would like to highlight the theory of transaction costs as a theory that, in their opinion, most clearly demonstrates the impact of economic but also social factors on the rationality of contractors’ behavior.

First, under the influence of trends, there are changes in the institutional environment, as modern solutions (especially digital) lead to the emergence of new institutions and the abolition or transformation of old ones; secondly, we can increasingly talk about the strengthening of the influence of external factors (primarily socio-political), which have a destructive impact on the development, as a whole industry areas, and individual companies. This makes it more urgent for market players to reduce costs in the medium and long term and overcome isolation barriers; thirdly, in solving problems related to the economic development of the Russian Federation, the public role is increasing, reflecting the position of audiences on the effectiveness of the functioning of domestic political and economic institutions. In this case, the mechanisms of the digital economy, providing feedback, come to the first place; fourth, the digitalization of the economy enhances the competitiveness of both traditional market sectors, and contributes to the refinement of strategic directions of development, including through the objectification of individual entities’ participation in economic processes (adaptation or withdrawal from the market).

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