

# *Information Economy: Institutions and Model of Functioning*

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**Abstract:** New institutions of the information economy, that coordinate the interaction of state institutions, business and individuals, the state policy of development of organizational and information infrastructure of modern economy were identified; foreign and domestic experience in the development of elements of the institutional structure of the information economy were presented, an author's model of institutional relationships between subsystems of the information economy was developed, the assessment of the economic efficiency of the information economy from the point of view of reducing the value of information and transaction costs was proposed, the relationship between modern information innovations and low transaction costs, their impact on competitiveness at micro-, and macro-levels is considered, promising financial instruments of the information economy, modern trends in the development of payment systems in Russia and Belarus are presented.

## **1. Introduction**

Information economy is a complex multifaceted phenomenon, which includes the acquisition of formal and informal economic institutions and institutional structures in the macroeconomic information space. In the information economy, the speed of formation of new needs is significantly increasing, and in the sphere of commodity production, most intangible assets are included. At the same time, consumers acquire new qualities - high intelligence, informatization, ability to quick cooperate and realize the elements of prosumerism.

The institutional basis of the information economy is the national innovation system, and the transfer of knowledge is mediated through institutions (state, clusters, research centres, virtual and material enterprises, etc.), and long-term sustainable development (new quality of economic growth) is possible cause to innovation direction of subjects actions.

## **2. Institutional interrelationships between subsystems of information economy**

On the basis of the use of information technology, new institutes of interaction between government agencies, businesses and citizens are formed, in particular, the institutes of electronic

government services, electronic information management, electronic network management, etc. However, the introduction and use of new technologies usually outweighs their institutional regulations, which hampers their integration into the field of socio-economic relations. The process of IT-implementation is often described as material and technical innovations that have different forms of realization. Similar innovations are diffuse, distributed on the multiplicity of objects that lead to radical transformations of the entire economic system; they not only contribute to the formation of new products, services and industries, but also modify the traditional production in the industrial economy, increasing its efficiency. Branch technologies at the industrial stage of economic development were the main source of scientific progress.

Information economy as a co-acquisition of institutions implies the establishment of interrelationships between its subsystems (Figure 1). Important aspect of its development are the growth rates of the data subsystem.

Information logistics (e-logistics) allows to achieve time savings by redirecting commodity flows from the producer directly to the consumer without the participation of intermediaries and without the use of warehousing and distribution centres, realization of the principle of network.

Electronic government (e-government) plays an important role in the institutional and legal support of the interaction of the information economy subsystem for the organization of sustainable information links between the bodies of state, citizens, organizations, foreign counterparts. The e-government is based on a distributed IT-infrastructure developed on the scale of a state. The main data infrastructure is the system of electronic document management, informatization of state management, intellectualization of management processes at the macro- level, which allows to increase the effectiveness of state regulation of the economy. The e-government contributes to the regulation of the information market.

Information market – system of economic, institutional and organizational relations on the exchange of information products on a commercial basis. The specificity of this market is that information resources, products and services can be copied in an unlimited amount. The information market has close institutional links with electronic trading, electronic exchanges, telecommuting, electronic payment systems, etc.

In the modern information economy, instead of the traditional organization and the classical paradigm of labor resources comes a virtual organization and new labor relations of the XXI century, the conceptual filling of which are the principles of telework. On telework, the employer and the employee are geographically distant from each other, transferring and receiving informational results of work and payment with the help of IT. Telework plays an important role in the global expansion of spatial and temporal characteristics of labor resources, the transformation of the concept of management, based on coordination, transformation of hierarchical organizational structures into network of organizations, transfer of the preemptive decision-making right and responsibility from the employer to the employee with the defining role of competencies and IT [Akopyan A.R., 2020].

In addition, telework plays an important role in the construction of cluster infrastructure in the information economy, the interaction of firms network with employees. A special importance of telework was acquired during the spread of coronavirus in 2020 due to the need for quarantine and antiepidemic measures.

In the case of network forms of IT enterprises, companies are allowed to coordinate the types of activities distributed in other geographical regions (for example, Boeing engineers work on one project with suppliers). IT allows to create new relationships in the business, expanding the number of possible industries in which the company can gain competitive advantage.

The function of the organization of production and supply in the information cluster as an element of the infrastructure of the new economy, directed to the satisfaction of individual needs of

a particular consumer, can take on its own structure - a virtual entity. In general, a virtual enterprise can represent an element of the information cluster with a more specific specialization (production exclusively of information products and services). The creation of a similar enterprise implies the integration of an unique experience, production capabilities and new technologies into a series of enterprises for the organization of an IT project, which they can not perform in isolation. The information product is produced and adapted to the needs of the consumer in a short time in any place. An example is the virtual product of the company Toyota, where on the assembly line for 72 hours will be produced one car, the parameters of which correspond to one customer's order.

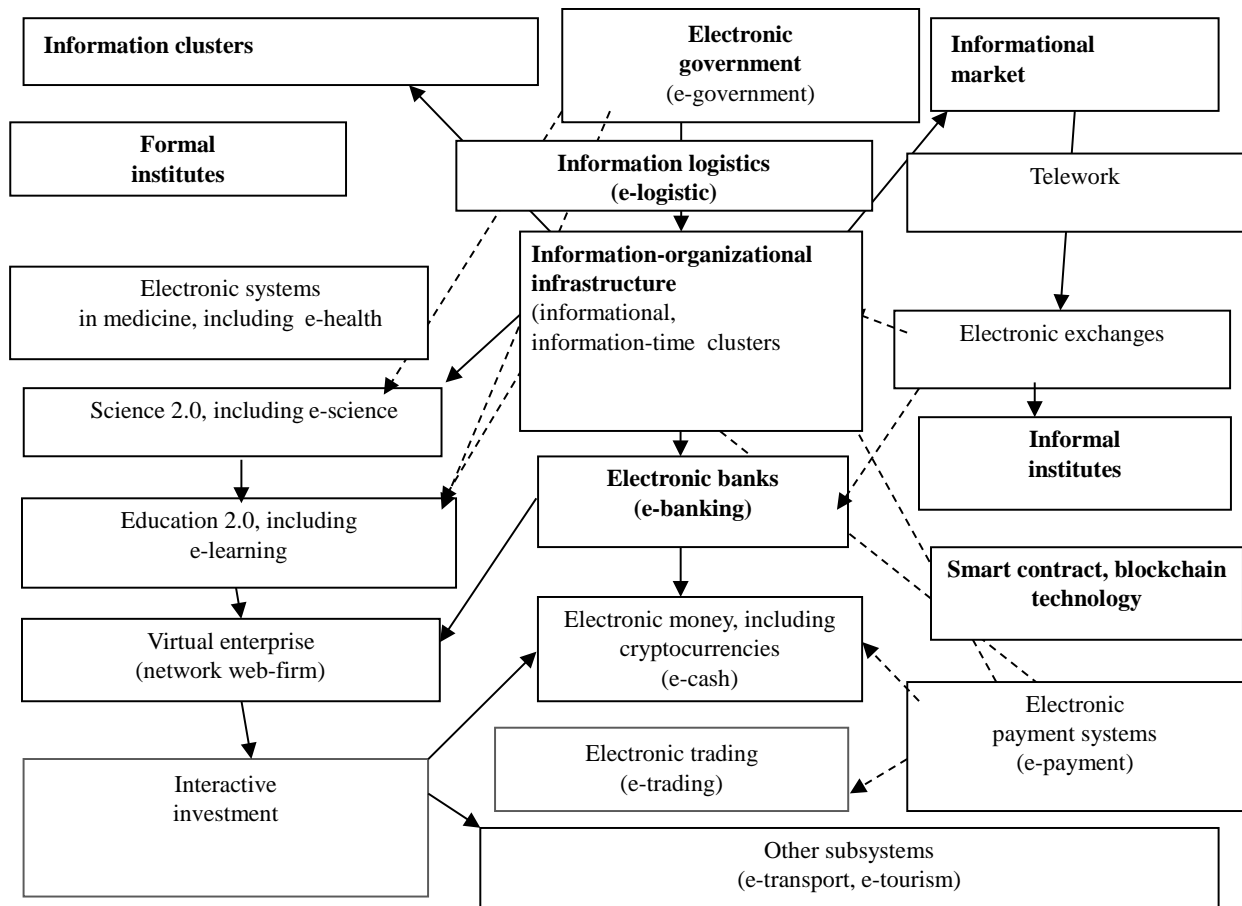


Figure 1: Institutional interrelationships between subsystems of information economy

Dominance of the network form of the organization of economic activity is one of the most significant changes in the traditional institutions under the influence of the information economy. This form, as an institution, appeared in the heyday of the industrial economic system and was due to the transnational nature of production and globalization [Tapscott, Williams, 2020].

However, in the conditions of formation of information economy, the network form of organization has become not just dominant, but transformed under the influence of new institutions in the form of information cluster, which immanent to the process of building of information economy. Within the cluster, the effects of synergy, scale and coverage are revealed. Electronic trading (e-trading) gives access to global markets for small and medium enterprises; the choice of optimal offers is simplified for consumers; costs for distribution and marketing are reduced. Commercial trade operations using the Internet are the most promising and dynamically developing element of the world economy. General official interpretations of electronic trade (according to the European Commission, the Organization of Economic Cooperation and Development, the World

Trade Organization) its essence is included in the organization of the process of commodity exchange with the using of IT [Gorochnaya V., 2021].

As barriers to the wider development of e-commerce, it is possible to distinguish: imperfection of the institutional and legal framework, lack of effective protection of the intellectual property rights of the system of goods, realization; cash security, mistrust, uncertainty conditioned by the existence of a partner company; lack of qualified sales managers, logisticians and marketers; insufficiently high level of IT development; opportunistic behavior of participants in electronic transactions and their exclusion from taxation; low level of communicative competencies of the population.

The development of intellectually capacious IT and the emergence of new ways of providing banking services led to the formation of a system of network financial relations, the participants of which are organizations and private individuals using IT. The key tool for such relations is an electronic bank. It should be noted that electronic technologies of remote banking services can be classified by types of information systems used to carry out operations [Financier S.P., 2019].

### **3. Electronic payment systems (e-payment): theoretical and practical aspects**

Electronic payment systems (e-payment) are systems of settlement between financial, business organizations and Internet users when buying/selling goods with IT, they are similar to ordinary payment systems for bank payment cards, but all transactions in electronic systems go through the Internet [Chepakov D.A., 2019].

Electronic money is an ambiguous term that has its own genesis, is used to denote the system of storage of funds during the transfer of money. At the same time, in connection with the active distribution of cryptocurrencies, from our position, under electronic money should understand the system of storage and transfer of traditional state assets, as well as non-state-owned assets. Non-state payment systems may have quotations in national or foreign currency, but their reliability and liquidity are not guaranteed by any state. According to the position of the European Central Bank, the means of access to a bank account, Internet banking systems and systems for using stationary bank payment cards do not belong to electronic money, but in systems that calculate electronic money, bank accounts are used only when entering and withdrawing money from the system.

When issuing electronic money, traditional money is credited to the consolidated bank account of the issuer. In accordance with the legislation of the European Union, the issuance of electronic money is allowed a new type of monetary institutions - the Institute of Electronic Money (ELMI). In India, Mexico, Nigeria, Singapore, Taiwan the issuance of electronic money can be carried out only by banking structures. In Hong Kong, issuers must obtain a license from a deposit company. In Russia, issuers can be only credit organizations - banks or NGOs, which have a license to operate as an operator of electronic money and money transfers without opening a bank account.

In Russia, until 2015, the SWIFT network was used as an international interbank system for the transfer of information and payment improvements. However, since December 2015 The Central Bank of Russia has launched the Russian analogue system SWIFT - the System of Transfer of Financial Messages of the Bank of Russia (SPFS), and this fact has a huge value for the country and its trading partner under the terms of the sanctions in 2022.

SPFS is an alternative channel of interbank cooperation, which provides a guaranteed and uninterrupted provision of services for the transfer of electronic communications on financial transactions. It also has the purpose of reducing risks, affecting the safety and confidentiality of the services provided by the transfer of financial messages. Providing access to the Bank of Russia SPFS facilitates the exchange of electronic co-communications between settlement participants, thereby speeding them up. SPFS operates on the basis of the information and telecommunication

system of the Bank of Russia. SPFS provides services for the transfer of financial messages. Within the framework of the SPFS it is possible to transfer messages in SWIFT format, as well as transfer messages in the own format of The Central Bank. The order of the Bank of Russia on the transfer of electronic communications on financial transactions to credit institutions and their clients - established by the order of the Bank of Russia dated October 5, 2015. № 3814-U9 [Khomenko E. 2019].

Financial communication services using the Bank of Russia's system (SPFS) are provided on the basis of agreements on the provision of financial services concluded between the Bank of Russia and credit institutions, clients of credit institutions - legal entities supported in accordance with the legislation of the Russian Federation. The number of credit organizations using the services of SPFS is growing steadily. So, with the opening of this system in January 2015 in 2022 the number of credit organizations connected to the SPFS is more than 350.

The electronic exchange is a platform on which it is possible to make deals with various assets and financial instruments with the help of modern IT. The main advantages of electronic exchanges are the possibility of round-the-clock non-stop work, maximum access to the market and the absence of spatial and temporary boundaries, low-tech configuration and transactional pursuits.

Interactive investment implies the actions of the investor (operations with shares, warrants, as well as the direct investment of investments in entrepreneurship) with the use of long-term IT contracts.

From an institutional perspective, interactive investing eliminates the intermediary structures of exchanges and brokers, in fact leaving the latter out of work, primarily because the investment process becomes as simple as buying goods in a store. Most actively, with the help of IT-technologies can be invested a venture capital. Moreover, venture investors automatically become all those who invest their capital in the field of information economy, while it remains an investment risk project, financing projects of the new economy has the same characteristics as traditional form of business [Fayyaz, S., 2019].

Important institutional elements of the new economy are systems of education, health and science, which embody of the socio-informational part of the new information society, contributing to the preservation, reproduction and development of capital.

Within the framework of Science 2.0 electronic science is the means of realization of the final results by co-groups of researchers in the framework of a more open approach, which includes public exchange of non-recurring feasible data. Conceptually, e-Science involves the development of new methods to support scientists in conducting scientific research with the aim of creating new scientific openings by analyzing the vast amount of data available through the Internet. Thus, in 2020, in the framework of the fight against the coronavirus NVIDIA company offered the owner of productive computers to help simulate potentially drug-resistant proteins of SARS-CoV-2 (SARS-CoV-2). The goal was to develop effective methods of coronavirus treatment. The corresponding application of the company unites all computers in a single international network, using distributed computing power to solve similar complex of computational tasks. Nowadays, a lot of attention is paid to e-science in the UK, where the British program of e-Science receives significant budget funding. In the EU, the most notable result of the implementation of the program is the creation and support of the Large Hadron Collider CERN, based on the Grid infrastructure.

Thus, e-Science plays an important role in the activities of virtual enterprises in the framework of technology transfer and openness, as well as lays the scientific and technical basis for the formation of information clusters.

The evolution of the cluster approach involves the transformation of the institutional and legal aspects of the formation of clusters. This process affects both the world economy and the economy of individual countries and regions [Park E., 2021]. For example, the EU has adopted an “Updated

EU Industrial Policy Strategy”, which promotes the recognition of clusters as a powerful tool for economic development to support industrial innovation in the EU regions. New cluster initiatives of European countries related to the transnational orientation of clusters have been implemented as part of the COSME (Competitiveness of Small and Medium Enterprises) support program for small and medium businesses and the Horizon2030 program to support the internationalization of scientific research and innovative developments.

The EU attaches great importance to both intersectoral interaction at the initial stages of cluster formation and coordination of national programs to support them. A network of special organizations has been created in the European Union, the task of which is to provide information, educational and consulting support to emerging clusters (European Cluster Observatory). It is managed by the Center for Strategy and Competitiveness at the Stockholm School of Economics in cooperation with the Basque Institute for Competitiveness. Also within the program "Industry-2030" was formed European Platform for Cluster Interaction (European Cluster Collaboration Platform(ECCP), the purpose of which is to unite leading European companies into virtual and real cooperation networks in order to form clusters, to provide promising companies with the necessary clustering tools. This platform includes about a thousand cluster associations throughout the European Union, covering 8,000 large companies and more than 11,000 university and research centers. A group of experts from the European Cluster Observatory is involved in the development of recommendations for a new generation of joint cluster initiatives under the EU Common Market Clustering Program 2021-2027.

Since 2021, the EU has been implementing new development strategy "Europe 2030", within the framework of which the 9h framework program was adopted for R&D and scientific and technological development, considering clustering as the most important element of economic growth.

European Commission and the European Cluster Observatory contribute to the coordination of cooperation between clusters of different EU countries in the framework of the transnationalization and internationalization of economic processes in European countries. In addition, with EU national cluster programs are being created, the purpose of which is the development of regional clusters that can enhance exports to world markets and the markets of neighboring countries, increase the degree of interethnic integration with manufacturers from other countries.

The main institutional and legal platform regulating the formation of clusters in the EU countries - the program "Transnational Alliance of Clusters Towards Improved Cooperation Support" (TACTICS (Transnational Alliance of Clusters Towards Improved Cooperation Support), which contributes to the coordination and evaluation of the effectiveness of trans-European cluster cooperation; stimulates the development of clusters in new and high-tech sectors of the economy; simplifies financing R&D of promising cluster projects [Park, E, 2021]

*Electronic learning (e-learning)*- this is a system of training, implemented with the help of IT based on the principles of Education 2.0. E-learning is closely linked to the evolution of society and the development of information technology. The process of e-learning is characterized by a high degree of autonomy of students and creative composition, as well as teamwork on tasks and their decisions. The composition of educational elements implemented in the e-learning system differs in its dependence on its purpose. On the basis of the selected elements are implemented short-term training programs, advanced training, modules of higher education programs or MBA, operational consulting. The development of e-learning, reflecting changes in society, allows to review educational content and competencies that modern students and undergraduates should have.

The volume of the market for distance learning in Russia amounted to about 28.9 billion rub, according to forecasts for the period 2022-2023. The growth rates of the market are 17-20% per year. The share of distance learning in the structure of education is 1.1%. In 2022, according to

experts, it will reach 2.6% in Russia. In the United States, Japan in some EU countries, e-learning occupies 20-30% of the education structure. In the implementation of the distance learning program, Belarus was one of the few countries in Europe, where e-learning is poorly developed, although the system provides BSUIR, BSU and some other institutions [Kochetkova, 2021].

Thus, e-learning is not the main, but extremely important element of the new socio-economic system, built on the principles of accumulation of anthropogenic capital of the country. As in the case of telework, under the conditions of the spread of the coronavirus in the world in 2020, a number of countries (China, Italy, the Czech Republic, etc.) practically moved to a distance learning programs [Finanzaira, 2019].

From our position, the state must actively regulate certain areas of development of the information economy, such as electronic medicine, education, science and some other socially significant subsystems. It is necessary to refrain from interference in the system, which is regulated by the global economy and its market mechanisms, such as interactive investment, smart contracts, blockchain technology and others.

The process of building an information economy leads to the replacement of existing institutions and the creation of new ones. The main changes in the traditional institutes caused by the information economy can be attributed to: the formation of network structures, information clusters; evolution of national innovation systems and formation on their basis of digital innovation ecosystems; formation of e-government; increase in trust in electronic financial institutions, increase in compliance with national formal and informal institutions (legislation, norms, traditions, degrees of freedom, level of trust, inclusive in society); increasing the role of informal institutional environment, narrow collaboration of the state, financial institutions, business structures and scientific organizations through the improvement of infrastructure of information cluster interaction.

From our position, the last layer of the information economy is the greater degree of co-ownership of informal institutions, which are transformed into formal ones in terms of the macroeconomic evolution. Thus, in the process of its development, such elements of information economics as telework and electronic training pass the way from the position of informal institutions to formal institutions [Castels, 2020].

At the present time, in the information economy, the spread of the structure, formed under the influence of the Institute of web-behavior, which informally acquires all the signs of public law. Moreover, it shows that the most significant opportunities for the transformation of informal institutions in modern conditions are state management systems and large corporate structures.

*Institutional structure of information economics* (Figure 1) represents its own complex of its organization, which has an ambiguous impact on the dynamics of transactional costs. Criterion for the effectiveness of the functioning of any institute is independent of the place occupied by them in the institutional hierarchy, there is the economy of transactional costs, in the presence of which it exists.

In the modern information economy *minimization of information transactional costs* become a symbol of effective functioning of the economic system, only the process of its transformation is able to reduce the effectiveness of formal, as well as informal institutions. The information system increases the volume of information, the number of transactions, alternative selection, complicates the management of the need to search for relevant information, as a result of which *transactional costs* increases.

#### 4. Evaluation of the economic efficiency of the information economy system

In the classical theory of transaction costs by O. Wiliamson, transaction costs are considered separately from other types. In the opinion of O.Sukharev such rupture gives rise to a number of methodological difficulties of further analysis [O. Sukharev, 2016]. From our position, information is inextricably linked with separate transactions and they can not be considered in isolation from its transactional and informational costs. Transactional costs *associated with information processes* (which we called informational-transactional) include the following elements: *search activities* – costs associated with entropy and/or asymmetry of information and the need for its analysis; *bargaining activities* – coordination and motivational cost, cost of contract making activities, *cost of information monitoring* - control of contract implementation.

Subsystems of information economy in terms of their transactional connections can be integrated into larger blocks, such as *management, information, financial, scientific, educational, organizational-infrastructural, production*.

Let's present indicators of the effectiveness of each of the subsystems of information economics (Table 1).

Table 1 : Evaluation of the economic efficiency of the information economy system

Naming systems, its elements	Indicator effectiveness subsystem development	Subsystem options
<i>Informational</i> Informational market and others	$RI = SI / C$ $RT1 = T / L$ $RT2 = T / Z$ $RT3 = T / Q$ $RT4 = VI / S$	$SI$ – speed of information processes; $C$ – costs for information processing; $T$ – information-transactional costs; $L$ – the number of people employed in the economy; $Q$ – the volume of the product created in the economy, $RT1$ , $RT2$ , $RT3$ , $RT4$ – the magnitudes that determine the dynamics of transactional costs in the system and transactional efficiency
<i>Financial</i> Electronic payment systems (e-payment) Electronic money (e-cash) Electronic banks (e-banking) Interactive investment and others.	$RF = \Delta F / F$ $RPB = P / B$	$\Delta F$ - accumulation of financial capital; $F$ – volume of financial capital; $P$ – fictitious capital and its turnover; $B$ – share of finance, information and industrial sector and metasector of information and anthropogenic services
<i>Scientific</i> Science 2.0, including e-science	$RS = Se / Z$	$Se$ – economic effect of the scientific system, $Z$ – costs for science, scientific capacity
<i>Management</i> Electronic government (e-government)	$RT = RT / AC$	$RT$ – the result of infosocial management; $AC$ – the purpose of public administration, which is modified in specific models of criteria



<i>Production</i> Virtual enterprise (network web-firm) Telework	$RP = Pr / TC$	$Pr$ – profit, $TC$ – cost of production
<i>Educational</i> Education 2.0, e-learning	$RE = Ed / Z$	$Ed$ – economic effect of the educational system, $Z$ – costs for education
<i>Organizational and infrastructural</i> Information clusters, information-time clusters	$Ez = \sum (Si - Ci - (Zi + Pi)) \frac{1}{(1 + r)^{i-ip}}$	$Si$ – cost of evaluation of IT implementation results; $Ci$ – additional operational costs with the introduction of IT in the $i$ – period; $Zi$ – costs for technical support in the $i$ - period; $Pi$ - costs for software in the $i$ period; $N$ - the number of calculated periods; $ip$ – number of the period of receipt of results from the use of IT; $r$ – the calculated interest rate.

In the financial system (Table 2) share of finances will become a key indicator serving the information-industrial sector and metasector of information-anthropogenic services. In scientific and educational systems, the economic effects of innovation are long-lasting and occur with time lags that are minimized when focusing on specific innovative projects within a specific infrastructure system having a cluster organization. The production system is described by standard efficiency parameters. In the information system the key criteria, which determine its effectiveness, will be the speed of information processes and information-transactional costs.

The main way to reduce the amount of information and transaction costs is to improve the company's relationships with the external environment, which is achieved by forming an appropriate information infrastructure, that can be virtual (virtual enterprise), as well as virtual and temporary (information-time clusters). One of the first stages in the formation of virtual firms is the informatization of the activities of the enterprise, the dissemination of publicly available economic information, electronic document management, the formation of a system of protection of information, self-regulation, conduct of research. Introduction of electronic subsystems (e-payment, e-trading, e-banking, telework, etc.) contributes to the reduction of information and transaction costs, the strengthening of innovative activities of the firm, the development of network structures, etc.

In the opinion of a number of researchers, modern information innovations and low-level of transactional costs complement each other, increase competitiveness as macro-, as well as at micro-levels.

The strengthening of the economic role of the state leads to an increase in transaction costs, respectively; state measures are needed to minimize them. At the same time, important problems are the inefficiency of property rights institutions and excessive interference in the regulation of market activity, which does not always lead to an optimal structure of information and transaction costs, which deforms the actions of market forces (for example, the creation of artificial barriers to entry and exit the market). The need for state support in the modern information economy is obvious, and the means of this support should be diverse, including a special product pricing mechanism, a specific lending regime for enterprises in this industry, an acceptable tax regime.

## 5. Conclusion

The state policy in the field of minimizing information and transaction costs in the information economy should be multifaceted. In the field of the development of organizational and information infrastructure, the first step of the state should be the formation of a supporting infrastructure of public and private institutions (trade representative offices, marketing enterprises, information and consulting services, independent organizations for determining the quality of products, etc.), which in the future will serve as fundamental elements of the formation of information clusters. Together with the formation of such an infrastructure, firms will be able to access distribution channels in the context of reducing transaction costs and minimizing information asymmetry. The state should create a favorable innovative and business climate for IT firms, capable of giving impetus to breakthrough innovations and creating a large number of jobs in the country in industries related to the information economy.

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