Increasing of the Technological Cooperation Efficiency in the Context of Digitalization

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Introduction

The problem of technological cooperation is the subject of research by many scientists. The research on the cooperation in the commercialization of innovations is considered in the papers of Aarikka-Stenroos et al. (2014), Abdul Hamid and Abd Rahman (2014), Kim et al. (2022). Many scientists have achieved success in international technology transfer research (Soares et al., 2020; Palaco et al., 2022). Many scientists are studying the international and interfirm cooperation in new conditions. Impact of the digitalization on the cooperation and innovation is revealed by Alcácer et al. (2016), Amit and Han (2017), Gault (2019), Bessonova and Battalov (2021). We also explored the problems of technological cooperation in the new conditions. In previous studies we have identified the factors and risks that arise by the expansion of international technological cooperation. We revealed the factors of international technological cooperation expanding: change in the dynamics of foreign trade as a result of consumption growth in China and other developing countries of produced by them goods as a result of increased interior demand; trend of declining share of intermediate goods and services in international trade; the growing influence of new and emerging technologies on world trade; the necessity of transition to Industry 4.0; an unprecedented degree of concentration in several countries of the most important raw materials required for the current industrialization stage; unprecedented rise of global social inequality (Solodovnikov, 2021,

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p. 124). We also revealed the risks arising from the international technological cooperation expansion in current conditions: the emergence of a new phenomenon—the economy of risks; institutional international, civilizational and cultural differences; increased economic diversity, accompanied by the complication and exacerbation of political and economic relations; overestimated needs expectations of individuals; a decrease in the trust level in society due to a decline of social capital at the society and an increase in interclass and intraclass contradictions; weakening of the state role in the management of social, economic, technical and technological processes in society; the complexity of adaptation of institutions of partnership society-state-business in the context of quick digitalization. These risks largely determine the current forms, mechanisms, and tools of interfirm technological cooperation. At the same time, the dominant factor in this process is the consistent development of a digital society. It is revolutionizing not only the economic system of society (in which the digital economy is developing of outstripping rates), but also almost all socio-cultural relations. In connection with the emergence of new factors and risks of international and interfirm technological cooperation in the context of the digitalization of the economy, the features and effectiveness of technological cooperation are changing. It requires research of new tools for improving of the technological cooperation efficiency in the context of digitalization, which is the purpose of this paper.

Materials and Methods

The subject of the study is the technological cooperation efficiency in the context of digitalization. The purpose of this paper is the design of new technological cooperation efficiency increasing tools in the context of digitalization. The authors, being adherents of the scientific school in the field of studying the modernization of the economy, are united by the methodology of the subject-activity approach. Research works of domestic and foreign scientists-economists, scientific reports, data of the research reports carried out by the authors were used to write this article. The general scientific methods such as system approach, unity of historical and logical, institutional approach were used during the research. The institutional approach let us consider the dialectical contradiction between traditional institutions ensuring the interaction of the object under study and its traditional external environment and the need for the evolution of these institutions in order to adapt to new conditions.

Results

The most gnosiologically useful and methodology correct scientific publications devoted to the phenomenon of digitalization is the article by T.N. Yudina «“Surveillance capitalism” as “digital econom”» and/or “digital society”» (Yudina, 2018).

Let us immediately make a clause. We have chosen this article not because it is the only philosophical and economic work of T.N. Yudina on this topic. On the contrary, we have chosen this article, since this work, first of all, is a quintessence of a whole series of science-intensive dedicated to digitalization publications by T.N. Yudina (Yudina, 2016, 2017, 2019; Geliskhanov et al., 2018; Yudina & Kupchishina, 2019; Yudina & Balashov, 2020). Secondly, this article is the most methodologically suitable for the study of the increasing of technological cooperation efficiency in the context of digitalization.

T. N. Yudina could show the general and specific in the development of modern economics. In essence, this author could develop the concept of «surveillance capitalism» introduced by S. Zuboff (2015) and describe it as «the very essence of the "digital economy" and/or "digital society"» (Yudina, 2018, p. 14). At the same time in our opinion T.N. Yudina discovered the phenomenological nature of modern society and/or the digital economy, including revealing its essence as a noumenon. The noumenon is a philosophical concept that was introduced in Neoplatonism for denoting the world of intelligible entities. I. Kant, proceeding from his transcendental idealism, used the concept of noumenon to designate a sphere that transcends sensory experience. The traditional relationship of essence and phenomenon is replaced by Kant's rigid opposition of the sphere of everyday facts and scientific experience (phenomenon) to the unknowable world of "thing-in-itself". Today a phenomenon is understood as a set of properties of a system and/or a phenomenon that is a result its individual development. According to this methodological approach, the phenomenon is a combination of the general (development principle) and the special (unique).

Let us consider from this point of view the statement of T.N. Yudina: «However, many compatriots, including scientists, don't see the phenomenon of the "digital economy" in general, taking it for a noumenon. The phenomenon of "CE" *(digital economy—authors' note)* contains leaps towards the quantitative development of the economy and, at the same time, essential threats affecting individuals and society as a whole» (Yudina, 2018). If we consider the noumenon in the neo-platonic sense (since it is unlikely that T.N. Yudina believes that many of her compatriots, including scientists, adhere to the methodological and/or ideological positions of Kantian transcendental idealism), then the named noumenon (as a principle of development) doesn't contradict the phenomenological approach, in which all real objects are considered as a combination of general (development principle) and special (unique). The named noumenon is a part of phenomenological approach. At the same time, this methodological clarification doesn't refute the fact that many scientists considering the phenomenon of the digital society and/or the digital economy exaggerate the importance of the external similarity of many economic processes before and after the digital revolution. It is in the content analysis and synthesis of the latter that the scientific contribution of this Russian scientist lies. The scientific contribution of the Russian scientist T.N. Yudina lies precisely in the meaningful analysis and synthesis of these economic processes.

The beginning of the twenty-first century is characterized by the emergence of a new type of economic rent, namely digital rent. Digital rent is appropriated primarily

by Big Tech—Alphabet, Amazon, Apple, Meta as well as Microsoft, «whom belong a new type of capital—big data—in fact, a source of digital rent» (Yudina, 2018, p. 14). But big data isn't the only source of digital rent in current economy. K. Birch and D.T. Cochrane say that «new forms of specifically digital rentiership are emerging as the result of Big Tech. The ecosystems that Big Tech create and control represent a heterogenous assemblage of technical devices and platforms, as well as users and developers, legal contracts and rights, collective standards, etc. These digital ecosystems enable Big Tech to make economic rents in new ways that reinforce their techno-economic power, while undermining the political, social, and economic capacity of others to shape the future» (Birch & Cochrane, 2021, p. 11). T.N. Yudina rightly notes that «the analog, non-digital economy represented and represents real relations between people in the process of production, distribution, exchange and consumption of real goods and services and institutions. The "digital economy" leads to a virtual artificial world, it is "watching capitalism" or "surveillance capitalism" with its institutions and organizations» (Yudina, 2018, pp. 14–15). Considering the problem of interaction between the virtual and analogue economies in the context of design of new technological cooperation efficiency increasing tools in the context of digitalization, it is necessary to understand that the analogue economy provides all the material goods consumed by households. No matter how we develop the digital economy, a person can never do without food, water, clothing and many things in the material world.

In the same way, the digital transformation of industry, initially focusing on the maximum possible digitalization of the industrial complex (according to the criteria of economic feasibility and/or environmental safety and/or humanization and safety of production processes), has generated a new digital reality—a parallel virtual display of production processes. This virtual display allows not only to improve the processes of direct production, including through the widespread use of robots (material and virtual), but also to develop industrial services very quickly. It led to a new industrial revolution and significantly changed the business models in industry. «A firm's business model defines how it delivers (supply model) and profits from (revenue model) the customer value it creates through the effective satisfaction of needs» (Cachon, 2020, p. 15). In the context of digitalization, fundamentally new revenue models are emerging, implying, for example, "payment" for a service by the user with access to his personal data (social networks, video hosting). At the same time with these processes, the accumulation and capitalization of BIG DATA is actively accelerating and, accordingly, the increase in digital rent. All this is changing the main tools for increasing of the technological cooperation efficiency in the context of digitalization, when traditional tools are not only supplemented, but also largely replaced by IT tools, including through the formation of digital platforms business. At the same time, in order to provide a competitive national industrial complex (as a basis for technological cooperation, too) it is necessary to maintenance and develop non-digital (analog) modern technologies in industry.

As a result of the development of the digitalization processes investors became an alternative by investing in digital technologies in industry: to invest in the development of the industry itself and industrial services or in the virtual shell of a digitized

industry (expecting obtaining more revenue through digital rent or for doing business for information security). While «the state policy of the analyzed countries *(Russia and Belarus—author's note)* in the field of digital industrialization <...> is characterized by the continuing self-determination of states in the new economic conditions» (Makarova et al., 2021, p. 164), it seems promising for enterprises of the Republic of Belarus and the Russian Federation to develop technological cooperation not only in the direction of product cooperation and industrial services, but in the direction of accumulation and capitalization of big data generated by the ongoing digitalization of national industrial complexes in order to obtain digital rent. The feasibility of such a strategy is confirmed by the technical and economic nature of the new industrial production based on «cyber-physical systems, which involve the digitization of equipment and industrial products, the creation of their "digital twins" and control of production processes in virtual space in real time using algorithms for automated decision-making» (Mialeshka, 2021). The transition to a new type of industrial production under the influence of digitalization is impossible without robotization proceeding.

The necessity of the robotization of the national industrial complex of the Republic of Belarus and the Russian Federation is today supported by many economists. Current robotization is one of the most promising areas of technical and technological modernization of the national economy, leading to the transformation of social and labor relations. The expansion of the production and use of robots in the economies of the Republic of Belarus and the Russian Federation as a component of modernization will make it possible to make a technological breakthrough, which will entail changes in value chains, in producer-consumer relations, and an increase in the competitiveness of the domestic economy. It should be noted that the potential for a rapid increase in the use of disembodied (intangible) robots in the financial, trade, commercial and law spheres of the economies of the Republic of Belarus and the Russian Federation has largely been exhausted. Accordingly, public and private business begins to move more actively towards the development and use of material (including industrial) robots. All these processes will affect the change in labor relations and the labor market (Bogatyreva et al., 2021, p. 9). The decline of the number of employees engaged in medium and low-skilled mental work in the spheres of the national economy that have undergone accelerated robotization will inevitably have an impact on the labor market and labor relations. The impact of robotization on employment will appear itself in fundamental changes in its structure. At the macro and micro levels, the transformation of the employment structure will be accompanied by social instability and changes in income distribution.

New industrialization in the context of digitalization requires finding long and cheap money both to finance the domestic industry and to develop international technological cooperation. The most important factor in the expansion of international current technological cooperation is «the strengthening of international political-economic competition. The competition is manifested in the increasing frequency of trade conflicts, increased sanctions pressure on individual producers and entire states, and the introduction of new measures of tariff and non-tariff foreign trade regulation» (Solodovnikov et al., 2021). And even if these instruments don't

affect directly belarusian production or export of goods and services, but «the redistribution of markets as a result of the strengthening protectionist measures made by individual countries creates risks of displacement Belarusian products» (Solodovnikov & Sergievich, 2020, p. 67). In addition, as the practice of recent years has shown, restrictive and sanctioning instruments of political and economic competition are often used unilaterally by countries with large economies, while «countries with a small open export-oriented economy, such as Belarus, are usually very limited in the free use of protectionist measures of international trade» (Serhiyevich, 2020, p. 140). That is why the task of strengthening interfirm technological cooperation is being actualized, first of all, in the Union State of Belarus and Russia. The Republic of Belarus and the Russian Federation must have strong state-owned banks. This will provide long and cheap money for financing the development of industry and increasing the technological cooperation efficiency. For example, Romanian scientists analyze the lessons of industrial policy in their country in recent years: «Learning from the experience of the past 27 years, which shows that we cannot expect capital finance and the funding of local industry as long as the Romanian state-owned banks currently hold only 5% of the total banking system assets» (Chivu et al., 2017, p. 168). They also add, that «creating a Romanian-capital bank and/or a Sovereign Investment Fund, for the economic development of Romania, a step that is not only imperative, but it is also a matter of common sense» (Chivu et al., 2017, p. 168). The strong state-owned banks focused on supporting national industry are necessary because of that «digitalization has made the financial market global» (Vardomatskya et al., 2021, p. 6). The globalization of financial markets increases the risks of the technological cooperation efficiency. Thus, the creation of a financing mechanism for industrial modernization is a tool for increasing technological cooperation in the context of digitalization. Thus, the creation of a financing mechanism for industrial modernization is another tool for the technological cooperation efficiency increasing in the context of digitalization. With the development of the digital economy and the emergence of economy of risks, the costs of ensuring the safety of its operation increase. Recall that «external threats, challenges to the country's economic security are often implemented through mechanisms of undermining the competitiveness (economic security) of industrial enterprises» (Solodovnikov, 2020, p. 21), including through the offense of stable relations of technological cooperation. The variety of these mechanisms undermining the competitiveness of industrial enterprises increases with the digitalization of the economy. M. Christen and E. Bangerter describe the fundamental problems that are widely used for explaining why it is seemingly hard to defend IT systems: «asymmetry between defense and offense», «complexity of ICT systems»; «software is inherently insecure today» including software vulnerability; «lack of attribution and consequences for the attacker» (Christen & Bangerter, 2017, pp. 246–247). All these factors, along with «the impact of time pressure on cybersecurity behavior» (Chowdhury et al., 2019), determine the risks of significant vulnerability to the technological and economic security of industrial enterprises. These risks are increasing in the context of technological cooperation, since in the process of inter-firm interaction responsibility for ensuring security is partially

blurred. As a result, such an important tool as providing cybersecurity is required in order to increase the technological cooperation efficiency in the context of digitalization.

Discussion

We began our contribution with a review of the results that we obtained in our research of the topic of technological cooperation in the context of digitalization. We first discuss new factors of international technological cooperation expanding in current conditions and of arising herewith risks. Then we showed that in connection with the emergence of new factors and risks of international and interfirm technological cooperation in the context of the digitalization of the economy, the features and effectiveness of technological cooperation are changing. It requires research of new tools for improving of the technological cooperation efficiency in the context of digitalization. Then we paid attention to the methodological foundations of our research, using the theoretical results of the Russian scientist T.N. Yudina. The following three points are of particular importance: the digital economy should be considered both as a phenomenon and as a noumenon; digitalization has led to the emergence of a new type of economic rent—digital rent, which is formed in connection with the emergence of big tech and big data; digitalization creates new business models through fundamentally new revenue models. All of this is cardinally transforming the main tools for increasing the technological cooperation efficiency in the context of digitalization. Our research made it possible to establish the main technological cooperation efficiency increasing tools in the context of digitalization: firstly, digitalization of industrial and business processes in the national industrial complex; secondly, robotization of industrial processes; third, maintenance and development of analog (non-digital) technological processes in industry; fourth, ensuring the development of industry with long and cheap money; fifth, providing cybersecurity.

There are some limitations to this study, which open possibilities for further studies. Our results are limited by the features of the economic policy of a particular country and are relevant, first of all, for the Republic of Belarus and the Russian Federation. «Any country in the world implements state economic policy. But due to the diversity of its goals, the configuration of tools and priorities in the countries of the world are significantly different, due to the different visions of national elites of key national interests in the economic sphere. Therefore, the formation of the state's economic policy takes place on the basis of critical reflection and use of the experience gained in domestic economic theory and business practices, taking into account global trends in the development of economies in the world» (Vertakova et al., 2020, p. 3). In our contribution, we proceeded from the national priorities of the economies of the Republic of Belarus and the Russian Federation to build a super-industrial economy with a strong industrial complex. Our conclusions can be supplemented with new technological cooperation efficiency increasing tools, taking

into account new challenges in the context of sanctions pressure on the Republic of Belarus and the Russian Federation.

Conclusion

The paper includes the new tools of the increasing of the technological cooperation efficiency in the context of digitalization: digitalization of industrial and business processes in the national industrial complex; robotization of industrial processes; maintenance and development of analog (non-digital) technological processes in industry; ensuring the development of industry with long and cheap money; providing cybersecurity. Further research can be continued in the direction of finding ways to overcome organizational and economic problems arising by technological cooperation and innovation creation.

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