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The Use of Digital Economy Tools in Certain Industries

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Abstract

The development of the modern economy is accompanied not only by the active introduction of innovations but also by digital technologies, which are their separate component. Currently, digital technologies cover all spheres of activity, regardless of the organizational and legal form and way of life. At the same time, very few scientific papers consider in detail the tools by which the digital economy functions. And it is virtually impossible to consider all the tools of the digital economy in a single work. It should be noted that the tools of the digital economy are only a small component of the organizational and economic mechanism of the entire digital economy. Obviously, it is necessary to consider the tools of the digital economy in the context of industries, or according to any scientifically sound classification. This paper attempts to systematize the economic research of individual foreign authors and companies. In addition, reliable statistical data are used. There is data on the quantitative impact of certain digital economy tools on gross value added, certain production indicators, the effectiveness of the use of certain digital technology tools by countries around the world.

Keywords: Information and communication technologies, Digital economy, Digital economy tools, Value added, Innovation.

Introduction

Information and Communication Technologies (ICT) refers to technologies that use microelectronic means to collect, store, process, search, transmit and present data, texts, images and sound. At the same time, no attempts have been made in the modern scientific literature to list the tools of the digital economy. Apparently, this can be explained by the constantly replenishing tools of the digital economy, by which we in our work will understand the specific means, mainly technical and software, involved in the creation of added value in the innovative, digital part of the economy. The tools of the digital economy are one of the components of its organizational and economic mechanism of functioning, which in turn includes all the components that contribute to its effective functioning. It is obvious that, in general, the tools of the digital economy should not only be described, but also systematized. Their impact on the economic performance of business entities must necessarily be assessed. Unfortunately, there are no works describing the methodology for evaluating the effectiveness of digital economy tools in the national scientific literature. This paper makes an attempt, based on foreign and national data, to evaluate the effectiveness of individual economic instruments and the factors affecting them.

Materials And Methods

The work used systematic, comparative, monographic and other research methods. Published works of scientific research institutions of the Russian Academy of Sciences, universities, statistical materials at the federal and regional levels, foreign studies were used as materials.

Results And Discussion

According to the University of Nebraska-Lincoln, which analyzed data from 126 farms with more than 600 hectares of farmland, 98% of farmers use digital agrochemical soil analysis, 94% use high-speed Internet, 80% use electronic yield monitoring, 68% use a differential system of fertilizer, 30% use satellite aerial images for various purposes.

The farmers of the state of Nebraska were subjected to the study. Based on the given material, we can say that precision farming is at a high level here. In general, the implementation of precision technology in the U.S. is at a high level [4].

Another Goldman Sachs study in this area shows that precision farming can increase yields by 70% and is a significant factor in the development of the entire agribusiness [5].

A study by Roland Berger assesses the regional markets for precision agriculture technology. From the researchers' point of view, the U.S. and European markets were named the most attractive markets in it. At the same time, demand for precision technology in other parts of the world will also grow because of the declining cost of technology and the benefits it brings. In particular, they increase yields and profits. The market assessment in the study included evaluation of data management systems, consulting, control systems, automation, data collection, etc. [3].

The assessment of benefits from the introduction of precision farming technologies in the study was reduced to an assessment of their advantages:

1. Resource efficiency (chemicals, fertilizers, water, fuel);
2. Increasing the quantity and quality of products;
3. Increasing the yield of both individual plots of the field and the gross yield as a whole;
4. Minimizing damage to the environment.

Returning to the Goldman Sachs study, in which the added value was calculated solely by increasing yields. The research data indicate that accurate fertilization will contribute to an increase in yield by 18%, and value added from 45 to 200 billion dollars. The use of precision seeding will increase yields by 13% and value added from $45 billion to $145 billion. Minimizing soil compaction would increase yields by 13% and value added from $35 billion to $145 billion. The use of precision irrigation will increase yields by 10% and value added from $35 billion to $115 billion. Field monitoring and data management would increase yields by 12% and value added from $35 billion to $125 billion. Precision crop spraying will increase yields by 4% and value added from $15 billion to $50 billion.

Table 1 Factors for increasing yields in precision farming

№	Components of technology	Increase in yields, %	Increase in value added, $ billion
1	Accurate fertilization	18	155
2	Precision seeding	13	100
3	Minimizing soil compaction	13	110
4	Precision irrigation	10	80
5	Precision crop spraying	4	35
6	Field monitoring and data management	12	85
	Total	70	565

Undoubtedly, the above analytical data testifies are in favor of implementation of precision farming system. Let us consider the main tools of the precision farming system.

Plant health monitoring is usually determined using the NDVI index that is formed using drones or satellite aerial photography. This index is based on a different range of visible and invisible light waves. NDVI technology allows you to determine the overall level of health of the crop culture and problem areas.

Scouting is a kind of collection of operational information in the field using a tablet or phone. The collected data is analyzed using software and results are given based on the results obtained. The NDVI index is also used here. Scouting allows you to track the activity of pests and the spread of weeds.

Yield monitoring and weather forecasting is the collection of information using sensors mounted on agricultural equipment or drones. The sensors used allow collecting information about yield, grain moisture and other indicators. This kind of information allows you to decide when to start or continue harvesting crops.

Diseases, pests and weeds are diagnosed using hyperspectral cameras attached to drones or small satellites [6-12].

Weather, irrigation, and soil quality are monitored using sensors mounted on soil or plants. Sensors record various indicators about soil and water.

Meteorological stations collect weather data to help understand how weather conditions will affect water and soil. There are also many different advanced irrigation technologies, among which drip irrigation using manually or automatically controlled valves and pumps is important [13-16].

Precision seeding is an automated system that optimizes seed flow during seeding, which in turn allows you to control the interval, depth and condition of the root system. This requires the use of accurate data collection technology.

Differential application system is an automated system aimed at the application of herbicides, chemicals and seeds. Such application is achieved through the use of data obtained from sensors, maps and GPS data. This technology also uses multispectral and hyperspectral cameras, satellite images. It allows reducing the costs associated with the application of fertilizers and crop protection products.

Telematics is the presence of communication between machines in precision farming. It is ensured by the use of sensors and cameras. For example, a camera captures a weed, the software recognizes it, and the machine treats it with herbicide [17-20].

GPS navigation is required for autopiloting, high-precision navigation and positioning of the technical fleet and is the software that ensures optimal walking of machines in the field, as well as the application of fertilizers, crop protection products, seed sowing, etc.

Robots are an automated complex aimed at performing one or more specialized tasks. Robots in agriculture are quite rare. In crop production, one of the main tasks of robots is to automate weed control. For example, robots can use cameras to distinguish weeds and decide how to eliminate them.

Storage platforms provide access to a central data repository, where the aggregation of information from different sources creates an overall picture of what is going on in the industry.

Farm management platforms help manage crop production by integrating information from different machines and devices. The resulting data is analyzed and stored by one central platform.

In the world, the rate of adoption of precision agriculture technologies is increasing, especially in the developed world, which is associated with greater financial opportunities than in developing countries, which have limited financial capabilities to purchase technology. The market offers comprehensive solutions for the introduction of precision farming systems that can increase profits from the crops produced. In the Russian Federation, it is necessary to pay special attention to this technology, to support organizations that offer comprehensive implementation of precision farming systems, as well as organizations that use such technologies. It is necessary to implement state support for organizations that comprehensively implement the precision farming system, as well as other tools specific to the digital economy.

Unfortunately, the lack of technological innovation in agriculture is felt very significantly (Table 2).

Table 2 Expenditures on technological innovation of organizations by type of economic activity in 2016-2018

	Expenditures on technological of technological innovations, bln. rub.			**Specific weight of costs for technological innovations in the total volume of shipped goods, performed works and services, %**		
	2016	**2017**	**2018**	**2016**	**2017**	**2018**
Total	**1284.6**	**1405.0**	**1472.8**	**2.5**	**2.4**	**2.1**
among them by type of economic activity:						
cultivation of annual crops	no	8.3	13.3	no	1.5	2.0
cultivation of perennial crops	no	0.1	0.05	no	0.8	0.2
growing seedlings	no	0.01	0.2	no	0.6	5.2
animal husbandry	5.7	6.4	6.4	0.6	0.7	0.6
mixed agriculture	2.9	-	0.7	5.7	-	5.0
auxiliary activities in the field of crop production and post-harvest processing of agricultural products	no	1.0	1.2	no	5.9	6.4

There is a slight increase in spending on technological innovation in 2018 compared to 2017, and this despite the fact that for more than 10 years the Russian government has outlined a course for innovation in various sectors of the economy, including information technology. Clearly, there is a lack of financial resources to purchase comprehensive and innovative solutions. Obviously, there is also a lack of significant state support. It is insignificant compared to the developed countries of the world. Hence, we can conclude that with regard to the implementation of complex innovative solutions, including digital solutions, there is no comprehensive approach that takes into account all the factors and motives for their implementation. The evidence of ineffective innovation, including digital policy is the low share of costs for technological innovation in the total volume of shipped goods, works and services. In the Russian economy as a whole in 2018, this indicator was only 2.1%, and in growing perennial crops only 0.2%, in animal husbandry 0.6%, in growing annual crops 2.0%. Unfortunately, it is impossible to trace any trends in the above indicators due to the fact that statistical observation has been carried out since 2017.

The lack of significant state support and effective organizational and economic mechanisms for the application of integrated digital solutions, including in agriculture, does not contribute to the significant growth of innovative products, and therefore does not contribute to the production of innovative products, and therefore the innovative economy.

In 2018, the volume of innovative goods, works and services in the Russian economy as a whole increased from 4167.0 to 4516.3 billion rubles, or by 8.4% (Table 3).

Table 3 Volume of innovative goods, works, services of organizations by types of economic activity 2017-2018

	Volume of innovative goods, works, and services, billion rubles		**As a percentage of the total volume of shipped goods, works, done works, services**	
	2017	**2018**	**2017**	**2018**
Total	**4167.0**	**4516.3**	**7.2**	**6.5**
among them by type of economic types of economic activity:				
cultivation of annual crops	10.6	10.3	1.9	1.5
cultivation of perennial crops	0.4	0.5	3.1	2.4
growing seedlings	0.5	0.5	21.4	11.4
animal husbandry	16.6	21.7	1.7	2.1
mixed agriculture	-	0.2	-	1.4
auxiliary activities in the field of crop production and postharvest handling of agricultural products	0.3	0.7	1.8	3.5

At the same time, in the economy as a whole, this indicator in the volume of shipped goods, works and services decreased from 7.2% to 6.5%. In this case, if we talk about agriculture, the maximum amount of innovative goods in 2018 was produced in livestock - 21.7 billion rubles, then comes the cultivation of annual crops - 10.3 billion rubles, then auxiliary activities - 0.7 billion rubles. In other words, the volume of production of innovative goods, including those produced with the help of digital technology in Russia is very insignificant. Of course, this situation must be urgently corrected. One of the factors of this situation is the high cost of imported technologies and the lack of domestic technologies demanded by production. This applies to all technologies, including digital technologies. If we analyze trade in technologies with foreign countries, there is an ambiguous, unstable situation (Table 4). In the Russian economy as a whole, export of technologies exceeds import of technologies. However, payments on acquired technologies considerably exceed payments on exported technologies, which may indicate the undervaluation of domestic technologies, including digital ones, in the world market of technologies. If we talk about agriculture, then here the export of technology is growing insignificantly.

Table 4 Technology trade with foreign countries in the area of the subject of the agreement in 2016-2018

	Export			**Import**		
	Number of agreements	**The value of the subject of the agreement, million US dollars**	**Income for the year, million US dollars**	**Number of agreements**	**The value of the subject of the agreement, million US dollars**	**Payments for the year, million US dollars**
		2016				
Total	**2182**	**27981**	**1277**	**3449**	**14147**	**2499**
including agriculture, forestry, hunting, fishing and fish farming	7	1.7	1.4	25	3.1	2.5
		2017				
Total	2757	26416	1181	4358	17676	3305
including agriculture, forestry, hunting, fishing and fish farming	3	1.8	1.8	39	13.8	1.1
		2018				
Total	3033	32369	1405	4914	16471	3065
including agriculture, forestry, hunting, fishing and fish farming	12	2.3	2.4	47	12.1	3.4

Import of technologies in the agricultural sector exceeds export several times. This indicates the demand for foreign technologies in agricultural production in Russia. This also indicates a crisis of scientific and technological policy in the agricultural sector of the economy. It is obvious that all the transformations that have taken place at all levels of the creation of scientific and technical products for the agro-industrial complex have not been beneficial. Here, the state needs to think about measures to support leading scientific organizations, grant policy, in general, the effectiveness of organizational and economic measures to stimulate and create new scientific and technical products.

That our conclusions are not unsubstantiated is confirmed by data from the Higher School of Economics. The most intensively used digital technology in the world is broadband Internet (Table 5). In the developed countries of the world, 95-100% of business sector organizations use this technology. The most frequent purposes for the use of this technology in the business sector organizations are: the use of e-mail and the implementation of financial transactions. The second most important digital technology for organizations are cloud services[6].

Table 5 The intensity of the use of digital technologies in some countries of the world, 2017, (the share of organizations using digital technologies in the total number of organizations in the business sector, %) [1, 7]

Country	Business Digitalization Index	Broadband Internet	Cloud services	RFID-technologies	ERP-systems	Electronic sales
Russia	28	82	23	6	19	12
Great Britain	35	95	35	8	19	20
Germany	38	95	16	16	38	24
Denmark	46	100	51	9	40	29
Netherlands	43	100	35	18	48	16
South Korea	45	99	…	42	28	11
Japan	46	95	47	18	…	24
Finland	50	100	66	23	39	21
France	36	99	17	11	38	17
Sweden	43	97	48	12	31	29

From 17 to 66% of business sector organizations use such services. The third most important digital technology in the world is ERP systems. This type of technology is associated with the management of the organization, processing and storage of information, planning and forecasting. The share of organizations using such technologies is 19-48%. Electronic sales is on the fourth place by prevalence. The share of organizations using these technologies is from 16 to 29%.

It is obvious that the future of the use of such technologies belongs to commerce. The world leader in the use of such services is China, where it is quite common to order food at home, as well as to buy goods over the Internet. 45% of business organizations in China use this type of digital technology. The use of RFID technology in manufacturing and services is on the fifth place. From 8 to 42% of business sector organizations in some developed countries of the world use this technology. And it can be used in security, circulation, and has recently been used quite often in manufacturing, for example, in monitoring the use of resources.

Unfortunately, there are no similar statistics on agriculture. However, based on the above analysis, it is clear that digitalization in this sector of the economy in Russia is delayed for a number of reasons. It is obvious that the active digitalization of the agricultural economy requires a reliable organizational and economic platform, including deficit-free, highly effective measures of state support.

At the current stage of economic development, digitalization in agriculture provides an opportunity to create complex automated production and logistics chains, covering retailers, wholesalers, logistics, agricultural producers and their suppliers in a single process with adaptive management. In turn, the digitalization of commodity flows and production makes possible the systematic accumulation of trade lots for the export of agro-industrial products. On the other hand, the purchasing power of Russian organizations in this regard is limited, which is one of the factors constraining the implementation of digital economy tools. This can be seen from the data in Table 6. The profits of agricultural organizations do not tend to grow. Moreover, it fluctuates from year to year, which negatively affects the reproduction process in agriculture.

Table 6 The net financial result for the Russian economy and agriculture, million rubles

	2017	**2018**	**2019**
Net financial result (profit minus loss) – total	9036848	12400336	15758426
including by type of economic activity:			
agriculture, forestry, hunting, fishing and fish farming	246946	301979	298182
including:			
crop and animal husbandry, hunting and provision of related services in these areas	171489	206171	160318

Conclusions

Today's digital economy is represented by a variety of tools with which value-added is generated. There are many complex solutions on the market that can significantly reduce labor costs, increase labor productivity, improve product quality, and increase profitability of production. However, the insignificant amount of profit received by Russian organizations in almost all spheres of the economy does not allow large-scale implementation of digital economy tools. On the one hand, the state should actively engage in subsidizing purchased technology and equipment in this situation. On the other hand, to motivate the creation of domestic analog technologies and equipment that will significantly reduce their cost. In this direction, it is necessary to place state orders in priority areas of development of the digital economy.

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