

# The Specifics of the Digital Transformation of Agriculture

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**Abstract**—At the present stage of the formation of the theoretical and methodological basis of the digital economy, insufficient attention is paid to the issues of digitization of certain branches of national economy, including agriculture. The effectiveness of introducing digital technologies largely depends on the level of technological and information development of industries and fields of activity. Digital technologies themselves do not generate economic effect, they only allow to enhance it. And if the industry or field of activity has a low level of technical and technological development, their digital transformation will require, first of all, solving the problem of eliminating their technological backwardness. It should be accepted that a full-scale transition to the digital economy cannot be made in the near and even medium term. We need realistic understanding of the modern level of informatization of various aspects of public life, the quality of the existing scientific and technical groundwork, and practical significance of certain digital technologies for the social development. The principles of the formation of digital agriculture are demonstrated as components of the methodology. The range of basic information management tasks is substantiated without solving which the transfer of agriculture to digital technologies is impossible.

**Keywords**—*digital economy, digital transformation, digital technologies, agriculture, information management tasks*

## I. INTRODUCTION

At present, within the framework of the neo-industrial development paradigm, information and digital technologies begin to dominate as a key factor in the development of socio-economic systems at various levels. Understanding of the global nature of the upcoming technical and technological transformations led to the introduction of the term “digital economy” into academic use. At the present stage of the formation of the theoretical and methodological basis of the digital economy clearly insufficient attention is paid to the issues of digitalization of individual sectors of national economy. Agriculture is among the sectors where the digitalization strategy is still absent at the national level.

## II. RESEARCH OBJECTIVE AND TOOLS

The objective is to study the specifics of the organization of transformation processes in agriculture. The research is based on the consideration and synthesis of scientific approaches to the study of the digital transformation of economic sectors, taking into account their features.

## III. RESEARCH RESULTS

When forming the theoretical and methodological basis of the digital economy, it is of fundamental importance to understand the mechanism of transition to the digital economy from the traditional one and to work out criteria that allow determining the moment of this transition. These issues are still undeveloped, but without an answer to them, without a scientifically based system of criteria that allow a comprehensive assessment of the digitalization result and match it with the target parameters of the digital economy development program, it is impossible to ensure the effectiveness of digitalization process management. It is particularly important to understand the mechanisms of transition to the digital economy at the level of specific fields of activity and sectors of national economy. Obviously, in the trade digitalization mechanisms will differ significantly, for example, from the digitalization mechanisms of agricultural production, and in the banking sector – for example, from government, but the effectiveness of interrelations among economic agents of various spheres and industries can be ensured only when all of them achieved the minimum level of digital interaction and integration into the united digital.

The digital economy is represented as a kind of add-on, providing large-scale penetration of digital technologies in the industries and sectors of the traditional economy and fundamentally changing the system of interaction between economic agents by means for formation of digital ecosystems (ecosystems in the theory of digital economics are understood as a complex system providing interaction between heterogeneous agents which may be people, robots, software systems, and other subjects of the digital economy). This means that the digital economy does not cancel the traditional economy, but only expands its capacities, while significantly affecting its structure and determining the pace of development of individual industries and sectors.

The overwhelming majority of researchers refer to the process of transition of various-level economic systems to the digital economy model as a digital transformation that defines the goals and ideology of this transition, priority areas and objects of digitalization [1-14]. But, as a rule, the emphasis is on digital transformation of business and relatively large business structures, while systemic problems

of digital transformation of individual branches of the national economy remain beyond the scope of research.

It should also be recognized that the effectiveness of digital technology introduction largely depends on the level of technological and information development of the industries and sectors. Digital technologies themselves do not generate economic effect, they only allow to enhance it. And if the industry or field of activity has a low level of technical and technological development, their digital transformation will require, first of all, solving the problem of eliminating their technological backwardness. The Program *Digital Economy of the Russian Federation* dated 2017, unfortunately, does not reflect the government's position on this issue, but it does allow to form certain technological groundwork, based on which it will be possible to further digitize certain industries and sectors.

It should be accepted that a full-scale transition to the digital economy cannot be made in the near and even medium term. We need realistic understanding of the modern level of informatization of various aspects of public life, the quality of the existing scientific and technical groundwork, and practical significance of certain digital technologies for the social development. It is no coincidence that there are more and more supporters of the opinion that the idea of the digital economy arose as a response to the need of large corporations to form new global markets for electronic products, that is, by and large, digital technologies are not created as a result of the demand for them, but the demand for digital technologies is formed by their manufacturers, based on their own interests.

Digital transformation of the economy cannot be fragmented; it should cover all phases (stages) of the reproductive process. At the stage of economic benefit production, the main task of digital transformation is associated with the robotization of workflows, the massive introduction of hardware and software systems for their automation, the transition to fundamentally new production technologies (for example, 3D printing), which significantly increase productivity, ensure the flexibility of production lines, and their rapid adaptation to changing societal and individual needs. At the distribution stage, the basic task is to develop the institutions for the distribution of resources and goods produced among the subjects of economic relations, taking into account changes in the structure of social production, positions held by subjects in digital ecosystems, and the level of development of network interactions. At the exchange stage, digital technologies and means of communication allow for a multiple reduction in distribution costs, minimizing the length of supply chains by establishing direct contacts between producers and final consumers of economic benefits. E-commerce and e-money technologies create prerequisites for a drastic reduction in the level of logistical costs and speeding up of the circulation of goods. At the consumption stage, it becomes possible to form and implement individual models of consumer preferences, changing as a result of the emerging opportunities to generate new types of economic benefits or changes in consumer properties of the existing goods and services. The interests of the end user become the key reference point for the subjects producing economic benefits, and the consumer consumption model is replaced by an individualized consumption model, oriented at the living standard improvement for the population and self-development of

individuals. The interrelation between the stages of the reproduction process is built on the basis of a set of digital services that also ensure the integration of individual subjects of economic relations into digital ecosystems and the global information space.

Realizing the need for digital transformation, business entities of the agrarian sector are trying to intensify the processes of informatization of their activities, while maintaining the existing business model, which allows them to significantly increase productivity and management quality, but does not provide the conditions for the formation of a digital platform adequate to the requirements of the digital economy. For example, the introduced technologies of precision farming, involving collection and use of large volumes of information obtained using various sensors, actually are not integrated with the corporate information systems widely used in business practice; the fragmented nature of the information fund does not allow to ensure the integrity of solving cross-cutting management tasks; the low level of development of e-commerce platforms significantly limits the efficiency of supply and sales activities, etc.

Certain restrictions on the realization of the digitization potential in agriculture are imposed by the existing structure of the agrarian sector of the Russian Federation, characterized by high proportion of consumer-type farms or by low level of marketability, described by low level of innovation-investment potential and information development.

Obviously, under the modern conditions, the massive transition of agriculture to the digital economy is impossible both due to the low level of informatization of agricultural production and due to the lagging level of development of information infrastructure in rural areas and IT training of a significant part of managers and specialists of the agricultural sector. That is why it is necessary to design some state strategy for overcoming the informational backwardness of the agricultural sector and the formation of basic conditions for the start of digital transformation of the most technologically developed economic entities of the agricultural sector and the industry as a whole.

Currently, we can talk about the three main ways of informatization of agriculture: spontaneous self-organization of individual subjects, centralized governmental control of informatization processes, and directed informatization, involving the stimulation of the processes of using information technologies and creation of the conditions for activation of digital transformation processes. While the first two paths can be considered self-defeating [15], the implementation of several ideologies for the development of digital platforms, adapted to the sector-specific nature of the business entities of the agricultural sector, is possible within the third framework. The first type ideology is based on borrowing digital platforms developed by foreign companies and adapting them to the needs of domestic agricultural producers and agricultural production management bodies. Borrowing of the technologies of precision farming and herd management can be used as an example. The second type ideology implies domestic development of digital platforms, the design of which is carried out on the basis of system-wide requirements formulated by agricultural authorities at all levels, while within the framework of the third type ideology the design of digital platforms is based on the existing and potential needs of agricultural producers. But

the implementation of each of these ideologies requires a nationwide digitalization strategy for agriculture, ensuring the formation of efficient digital ecosystems and the intra- and inter-sectoral interaction of digital platforms at various levels.

One of the components of the methodology for the formation of digital agriculture is a set of principles reflecting the main provisions of this process. We suggest including the following ones in the core of this set:

- The principle of information priority (it assumes that information acquires the status of the key production factor ensuring the possibility of effective use of the other resources);
- The principle of information relevance (it assumes that the available information should completely meet the information needs of the users but not be redundant);
- The principle of increasing efficiency (it is associated with reducing the time of search for information, its collection, systematization, processing and providing to the user);
- The principle of data recorders development (it ensures improvement in information objectivity and opportunity to obtain it in real-time mode);
- The principle of material and technical base adequacy (it requires provision of the adequacy between the level of technical, technological, and informational development and the complexity of the implemented informational tasks);
- The principle of informational integration (it stipulates the need for integration of all subjects of the digital economy into multidimensional information space of the systems of various levels);
- The principle of information interaction optimization (it is associated with creation of the conditions for formation of digital ecosystems of various levels);
- The principle of integrity (it is oriented at overcoming of the fragmented nature of the information provision systems and using of cross-sectional digital platforms);
- The principle of procedural unity (it defines the general procedural approaches to formation of digital platforms and digital ecosystems ensuring their efficient interaction);
- The principle of transparency (it guarantees the possibility of modernization of the digital platforms and ecosystems in accordance with the digital technology development);
- The principle of the balanced development (it assumes implementation of systemic measures for prevention of technological backwardness of any industries and sectors);
- The principle of availability (it ensures availability of digital technologies for all business units in agriculture and of the benefits generated within the digital economy – for all rural population), etc.

One of the basic ideas of the digital economy is maximum integration of production with final consumption, that is, the orientation of production systems to the needs of specific individuals. Agriculture in this context occupies a specific niche, being mainly a supplier of raw materials for food production (in its original form, according to various estimates, only 4-8% of agricultural products are consumed), which determines the specifics of the digital transformation model of the agricultural sector.

#### IV. SUGGESTIONS

Converting agriculture to digital technologies requires solving such basic information management tasks as:

- Setting the complete list of management tasks solved based on the information technology use and of the information required and sufficient for this solution;
- Analysis of the intensity and cyclical nature of information flows and the identification of the information needs of management subjects;
- Provision of controlled access to the network information resources reflecting the condition and development trends of the external environment operation;
- Regulation of operations for the collection, systematization, transfer, storage, processing of information and its presentation in accordance with the information needs of the users;
- Optimization of informational interaction of business units in the agrarian sector among themselves, with authorities and other economic entities of various levels;
- Integration of agricultural producers into united information space of the higher-level systems based on the principles of interaction within digital ecosystems;
- Overcoming the lag in the development of information infrastructure and the possibility of using information and communication technologies;
- Formation of the base of economic and mathematical models, allowing to explore alternative development options for economic entities and higher-level economic systems;
- Ensuring information security of business entities and protection of the information against unauthorized access (including personal data);
- Integration of various information technologies and systems within a single digital platform or the transition to the use of standard digital platforms, etc.

Only if these problems are solved, it will be possible to argue about the prospects for the transfer of Russian agriculture to the rails of the digital economy, but it is necessary to start forming the theoretical and methodological basis of digital agriculture right now.

#### V. CONCLUSION

It is suggested to view the following as the key directions of the digital transformation of agriculture:

- Digitalization of technological and production processes associated with the development of the Internet to things (equipping machines and equipment with microprocessor devices and various kinds of sensors), robotics and automation of production, etc.;
- Design of digital platforms that ensure the integrity of solving production and managerial tasks and the integration of subjects of agricultural production into the multidimensional space of digital ecosystems;
- Modernization of the information management system for agriculture by optimizing the composition and structure of information resources, providing open access to them, and developing tools that ensure the implementation of a set of tasks for system management of agricultural production;
- Development of information infrastructure, increase of the reliability of communication channels and the speed of information transfer, availability of information and communication technologies and electronic services;
- Optimization of information interaction with resource and service suppliers and finished product consumers together with extensive use of digital commerce technologies.

The model of targeted digitalization is proposed as a promising model of digital transformation of agriculture, which suggests active regulatory impact of the government on the design and development processes of sectoral digital platforms and ecosystems and the formation of macroeconomic conditions for creating and introducing digital technologies into economic practice.

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