Formation of a digital agricultural development system

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Abstract. Within the framework of the presented study, the scientific indicators of agriculture were analyzed, which indicate a reduction in the corresponding specialists capable of ensuring a high-quality transition of agriculture to digital technologies. The analyzed indicators for specialists in the field of information and communication technologies, involved in various fields of activity, reflected that only 0.5% of all relevant specialists are employed in agriculture, while indicators of the use of digital technologies by highly qualified agricultural specialists are at a low level. Based on the findings, the paper proposed a model for digital transformation of agriculture, which should be based on factor management, and an analysis of the readiness or unpreparedness of agriculture to ensure a high-quality transition to digital technologies.

1. Introduction

Modern conditions for the development of various fields of activity are associated with the emergence of new trends and new requirements for its development. In the last decade, new directions of development have been formed in Russia, which are associated with the transition to innovative and digital technologies [1-3]. An innovative transition is ensured in order to increase the functioning efficiency of various fields of activity, reduce production costs, eliminate manual labor and introduce resource-saving and energy-efficient technologies. Such a transition has not been fully implemented in Russia, but the following agenda has been formed related to the transition to digital technologies in all areas of the state’s activities [4].

The digital transformation of various fields of activity consists in creating a system of autonomous control of objects, and sometimes using an artificial intelligence system, making operational decisions, developing a system for collecting, accumulating, processing and storing information data, creating digital doubles of large industrial facilities and complexes, etc [5-6]. At the same time, most industries and manufacturing gradually began to introduce such technologies into the production process, but agriculture, which, as a rule, involves the use of manual labor or mechanized equipment, cannot indicate a significant breakthrough in innovative and digital development [7].
At the same time, it is worth noting that any field of activity can ensure a gradual transition to innovative and digital technologies only through the formation of the necessary scientific and practical base in which the transition methodology, mechanisms for implementing the goals and program provisions for achieving the goals will be presented [8]. In this regard, we believe that it is necessary to assess the level of readiness of science in the field of agriculture for a possible transition to digital technologies and the general level of development of this science in comparison with other areas of scientific activity.

2. Materials and methods
As part of the study, a goal was set related to the formation of recommendations for ensuring a high-quality transition of agriculture to digital technologies. Based on this goal, the following tasks are proposed:

- Assess the level of scientific potential in agriculture;
- Propose a model for digital transformation of agriculture.

The study used statistics published in open sources. The work was based on the use of scientific approaches and methods, which made it possible to reveal the goal of the study.

3. Results
The development of any areas of activity is associated with the creation of a system that ensures the transition to new technologies, the use of better raw materials and materials, advanced training of workers, improvement, modernization and updating of equipment and other areas of development that can only be carried out with proper planning and development of program actions. Of course, in all areas of activity, scientific personnel are engaged in this, which have the necessary competence in shaping the conditions for the development of activities [9-10].

Agriculture began to develop in ancient times, when a person used his knowledge, skills, and manual labor to obtain agricultural products. Since then, scientific and technological progress in agriculture has been observed, but no significant results have been achieved, since man mainly controls any processes and he is the main link in the production activities of agricultural enterprises [11].

The creation of new development systems cannot be imagined without the use of the corresponding knowledge and skills that have been formed over a long period. Scientific personnel in the corresponding areas of knowledge possess similar competencies, in this regard, in order to ensure a qualitative transition to digital agricultural technologies; it is advisable to consider the number of researchers in agriculture (figure 1) [12].

Despite the fact that agriculture faces new challenges and it is necessary to solve more and more tasks that the field of activity has not encountered before, there has been a decrease in the number of researchers over 18 years by 35%, while the number of researchers of doctors of sciences is increasing by 10%, and candidates of science is reduced by 20%. Thus, it is clear that the number of scientists who directly develop a methodology for innovative and digital development of agriculture is declining, which indicates a decrease in the effectiveness of the scientific sphere of agriculture and a negative impact on the transition to innovative and digital technologies.

Of course, in order to ensure a qualitative transition to a new path of agricultural development, there must be specialists who will ensure the technical fulfillment of the goals for the transition to the digital agriculture. In this regard, it seems necessary to compare the number of specialists in the field of information and communication technologies by type of activity (figure 2) [12].
Figure 1. The number of researchers in agriculture, people.

Figure 2. Specialists in the field of information and communication technologies by type of activity in 2017 (as a percentage of the total number of specialists in the field of information and communication technologies).

The figure shows that the sphere of activity “information and communication” accounts for a third of all specialists in the field of information and communication technologies, about a seventh of all specialists account for “manufacturing”, and agriculture accounts for only 0.5% of the total number of relevant specialists. Of course, this situation indicates the absence of the necessary number of specialists who will ensure a high-quality transition of agriculture to digital technologies.

Further, it is advisable to consider the percentage of highly qualified scientific specialists in the field of agricultural sciences who use advanced digital technologies in their activities (figure 3) [12].

The presented figure shows that highly qualified scientific personnel in agricultural sciences do not fully use possible digital technologies in their activities. This situation first indicates a lack of understanding about the possible benefits of the use of digital technologies by scientists who determine the development trends of the corresponding field of activity. At the same time, we need to talk about...
the possible unpreparedness of agriculture to switch to digital technologies in directly production activities, for example, in those processes where the process of growing raw materials takes place. In this regard, for agriculture, it is necessary to develop a factor model for ensuring the digital transformation of agriculture [13-14].

Figure 3. The use of advanced digital technologies by highly qualified scientific personnel in agricultural sciences (as a percentage of the number of candidates and doctors of sciences in the relevant industries of science).

4. Discussion
In our opinion, such a model can be presented in the form of a causal relationship diagram that will reflect the conditions for achieving the digital transition of agriculture and indicators that need to be evaluated and managed to achieve the goal. Among the main factors affecting the introduction of digital technologies in agriculture should be production factors, which today it is advisable to transform into the production chain and form the conditions for the development of this field of activity. Imagine a model for digital transformation of agriculture (figure 4) [15-18].

Figure 4. A model for digital transformation of agriculture.
Thus, the presented model indicates that the digital transformation of agriculture can be achieved by managing these factors. Management of these factors should be built at the state level, that is, through the formation of state policy in the field of digitalization. Factor management should be provided at the expense of human capital, which has the necessary knowledge and skills in the field of development of areas of activity, while the necessary investments in agriculture should be attracted, the appropriate infrastructure should be created, and industrial production should be established to create the necessary digital technologies for rural households.

5. Conclusion
This study was aimed at studying and shaping policies in the field of digital agricultural development. The study analyzed indicators reflecting the scientific potential of agriculture, which, in recent years, has been declining. The analyzed information about the specialists in the field of information and communication technologies working in agriculture showed that their number does not exceed 0.5% of all specialists in the information sphere. In turn, highly qualified specialists in the field of agriculture do not fully use digital technologies in their activities. The paper concludes that to ensure digital transformation, it is necessary to propose a model due to which factor management will be ensured, as well as the readiness or unpreparedness of agriculture for a high-quality transition to digital technologies.

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