Impact of digitalization on the effectiveness of management in the field of agricultural development

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Abstract. Purpose of research was to analyze the impact of digitalization on the effectiveness of management in the field of agricultural development. The analytic investigation of foreign and domestic management experience in the field of agricultural development was done on the base of own date and references sources. A number of highly promising modern trends in the development of agriculture in the world have been described in the article. In our days, the centralized management model in the development of rural areas and agribusiness still dominates in European countries, with all this the modern general approach of the policy of the EU and other European countries outside this union in regional development consists, first of all, in transferring as much management functions as possible to the regional level. This approach is also characteristic of the Russian model of agricultural development policy. The most important and effective tool of modernization of any of the known control systems in the modern world is their digitalization. Digitalization of management in the agricultural sector at all levels from the state to the subject of small agribusiness is not be an exception. Further digital transformation of management in domestic agriculture represents a higher level of digital integration, which affects the most complex organizational changes in government structures and agribusiness. The results of the implementation of these tasks can dramatically affect the growth of profits in the agricultural business and the competitiveness of products will allow the agricultural industry to reach modern world technological frontiers.

1 Introduction

A detailed research of the foreign and domestic experience of territorial government in the field of agriculture clearly indicates that for most developed countries, the multilevel nature of management is typical. It in itself implies the distribution of various powers and functions between different levels of government, but not in a hierarchical order, namely in

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a logical order based on the dependence between different levels and subjects of relations in which each participant brings his share of specific resources and knowledge [1, 2].

The broadest long-term management experience in the agricultural sector of various countries definitely shows that there are numerous difficulties and hindrances in creating a specific and optimally effective multi-level coordination [3, 4].

For a clear and in-depth understanding of multilevel management, it is first important to identify the levels involved and also outline the circle of key participants (subjects) involved in direct participation in these management processes [5].

Purpose of research was to analyze the impact of digitalization on the effectiveness of management in the field of agricultural development.

2 Materials and methods

The analytic investigation of foreign and domestic management experience in the field of agricultural development such as history, current state, the impact of digitalization was done on the base of own date and references sources [6].

3 Results and discussion

At this stage it is possible to identify and distinguish at least four basic levels of management (Table 1).

<table>
<thead>
<tr>
<th>No.</th>
<th>Management level</th>
<th>A brief description of the concept of the management level under consideration</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>National (country)</td>
<td>This level coincides with the concept of the State level or in specific cases, it may be the level of the Federal State</td>
</tr>
<tr>
<td>2.</td>
<td>Regional or in a Federal State</td>
<td>At this level, the management concept, as well as the scale (size) of the region (republic, state, canton, etc.) can be very different in terms of international comparison, which as a result creates serious problems of cross-country comparison and comparison</td>
</tr>
<tr>
<td>3.</td>
<td>Sub-regional or intermediate</td>
<td>This level often plays a significant role in those systems where the degree of decentralization is very high and/or in large regions. In fact, here we are talking about the level between the regional (land, cantonal, republican, etc.) and the local level, which can be very important for those countries where there may be some diversity in the territorial division</td>
</tr>
<tr>
<td>4.</td>
<td>Local</td>
<td>Of course, this level is most suitable for local self-government, for subjects of public and private forms, for civil society, in fact for everyone who promotes such development projects at the local level</td>
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</table>

Let us briefly look at the intermediate (sub-regional) level, it is most often identified with a specific administrative division unit established in the territory under consideration, but at the same time the local level is not necessarily closely related or even related to the administrative entity.

The following term "local" level is more likely to have the meaning of "local significance; limited, local character or influence on something". In fact, the term "local" becomes practically synonymous with such terms applied to administrative divisions as "provincial, municipal, district, village, etc. (for example, districts in the UK)". If we move
away from this logic of administrative division, then these are, as a rule, territories limited in size, within which specific, special and even unique agencies (associations, organizations, institutions, representative offices, etc.) that are interested in cooperation. And also those agencies that are already implementing various projects for the development of rural areas, environmental projects and other initiatives, plans and programs concerning the widest development of the agricultural sector. In this variant, the term "local" can already mean a certain set of both private and public participants (subjects) of relations to promote the most diverse and broad types of partnerships.

<table>
<thead>
<tr>
<th>Management</th>
<th>The main subjects involved in the management processes</th>
</tr>
</thead>
<tbody>
<tr>
<td>National (country)</td>
<td>Ministries of Agriculture, Ministries of Rural Affairs, other ministries and departments</td>
</tr>
<tr>
<td></td>
<td>Other organizations and associations (consumers, environmentalists, etc.)</td>
</tr>
<tr>
<td>Regional</td>
<td>Regional departments of Agriculture</td>
</tr>
<tr>
<td></td>
<td>Other departments involved in the agricultural sector</td>
</tr>
<tr>
<td></td>
<td>Regional professional organizations</td>
</tr>
<tr>
<td></td>
<td>Other organizations and associations</td>
</tr>
<tr>
<td>Sub-regional or</td>
<td>Sub-regional authorities (departments, provinces, districts, etc.)</td>
</tr>
<tr>
<td></td>
<td>Regional development agencies</td>
</tr>
<tr>
<td>Local</td>
<td>Local authorities, local institutions (communes, local agencies</td>
</tr>
<tr>
<td></td>
<td>Local partnerships (private and/or public)</td>
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<td></td>
<td>Local organizations/associations</td>
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<tr>
<td></td>
<td>Non-profit and voluntary organizations</td>
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</tbody>
</table>

**Fig. 1.** The structure of multilevel management in the field of agricultural development (based on foreign experience)

Each of the four levels of governance listed above has its own rather specific participants (subjects) and not only from an institutional (officially established) point of
view, but also other participants, such as various associations, social and economic representations, non-profit and voluntary organizations and others (Fig.).

The specifics and significance of each of the management levels presented in the figure will vary depending on the institutional order (structure) separately considered country. In those States where the national level clearly prevails, there is a powerful centralized management system, and on the contrary. In the States where decentralized management prevails and is most important, these are as a rule countries with a regional and sub-regional (intermediate) level.

Now, the centralized management model still dominant in Europe in the development of rural areas and agribusiness is becoming increasingly popular in some new European Union and individual development programs by country. At the same time, interest in the centralized model in Western European initiatives and rural development programs was quite low 20-30 years ago.

However, the current general policy approach of the EU and other European countries outside this union in regional development consists primarily in transferring as much management functions as possible to the regional level.

In fact, currently in the countries of Western Europe the policy of rural development and its management models are very different. From our point of view it is important to pay more attention to two European countries: Italy and Germany. In the models of agricultural development management, there are the most difficult moments and features compared to other countries of Western and Eastern Europe, because they are very characterized by a fairly strong territorial division, both of a number of functions and powers in management. If in Germany its federal structure is manifested because of the federal system of the entire state structure of the country and indeed a very large independence of all its 16 lands, in Italy is initially a unitary state where separate but defining elements of federalism are clearly present. It is this form of state territorial structure that is very often called "regional". There are only 20 regions in the country, which are divided into provinces. However, at the same time, 5 regions of Italy have a special status, namely the widest autonomy. Otherwise, there are many common points between Germany and Italy in terms of governance [7]:

1. In both countries deep decentralization has been carried out, based on the importance of regions and the transfer of more important management functions to the regional level, both administrative and legislative (in Italy in 20 regions and especially in 5 of them, which have broad autonomy; in Germany in all 16 lands).

2. The main impetus for reforms and decentralization of governance in these states as it is commonly believed today, was the influence of certain results obtained in the world order after the end of World War II.

3. The reforms on the decentralization of governance progressed in several stages and became particularly active in Germany and Italy in the period between the 70s and 90s of the last century, i.e. until the unification of the two German states (Federal Republic of Germany and German Democratic Republic).

4. All interrelations and relations between different levels of government in these countries are based precisely on the principles of comprehensive and broad cooperation, i.e. on a multipolar management system. It is important to highlight the characteristic distinguishing features inherent in this model [8]:

a) all management functions in this cooperative model are subdivided precisely in such a way that in solving the same problem, whether it is state aid or participation (grants, programs, works, quotas, etc.), social services, a number of environmental problems, other environmental issues, etc., all participating have different levels and the authorities perform any specific function of their own;
b) any movements and actions in the development of the agrarian sphere begin and are further implemented only with the obligatory observance of territorial interests, which are represented and formed with the direct participation of several levels of government in these territories;

c) based on the previous indisputable condition, in a cooperative management model, it is quite possible to duplicate some management functions and use certain tools that can solve a variety of problems that can naturally arise with this duplication. In such circumstances, the most important mechanism in resolving emerging problems will be careful coordination between the state and the regions of the main steps in solving these issues and tasks, and mandatory work is also carried out with local authorities;

d) the further formation and direction of the state policy in the field of rural development is always based on democratic and constructive agreements between different levels of government.

For example, in the United States, the Department of Agriculture (USDA) plays a primary role at the level of the federal body, which is the main conductor of the state agrarian policy at all levels of management in the country's agriculture. The USDA also plays a major role in coordinating the interests of agricultural producers (farmers) with the interests of other agribusiness entities, and at the same time the interests of end consumers of agricultural products and other various agricultural services with national interests are taken into account.

A significant role in the realization of the mutual interests of all participants in this process lies on Public-Private Partnerships (PPPs), which with the accumulation of efforts and scientific and technical potential of the private and public sectors of the economy in close cooperation, ultimately gives a huge synergistic effect in development.

So, regarding the global processes taking place in world agriculture, and, of course, in the US agricultural sector many authoritative world experts today define and reduce to a single concept, which has received the generalized name Agriculture 4.0 or Farming 4.0. Thus, the European Agricultural Machinery Industry Association defining in detail the essence of the entire concept of Agriculture 4.0, currently identifies two fundamental trends (directions) of further development in it [9, 10]:

- Precision Farming;
- Digital Agriculture.

Regarding the first direction, the following definition can often be found in the scientific literature and other sources - Precision Farming is a complex high-tech agricultural management system that includes global positioning technologies (GPS, GLONASS), geographic information systems (GIS), Yield Monitor Technologies, Variable Rate Technology and Technologies of Remote Sensing of the Earth.

The second main direction is Digital Agriculture, which makes extensive use of intelligent networks and data management tools. The goal in Digital Agriculture is to use all available information and accumulated experience to automate processes in crop production, i.e. digital agriculture means going beyond the simple availability and accessibility of data and creating a really effective artificial intelligence and significant added value of such data [9, 10].

New high-tech trends make it possible to establish a clear relationship in the innovation chain of the US agricultural sector: agricultural science – new agricultural technologies – the activity of the Extension Service system or service - the development of the latest technologies by agricultural producers (farms) and other business entities of agribusiness [11, 12].

At the same time, there is an active use of broad integration opportunities through the system of public-private partnership in the implementation of modern models of rural development and, in particular, Precision Farming and Digital Agriculture as an agricultural
management system. Thus, from all of the above, it is the issues and problems related to management in the agricultural sector that are coming to the fore now.

It should be noted that the nationwide cooperative system or Extension Service in the US agriculture was created in accordance with the Smith-Lever Act of May 8, 1914. The Extension Service unites various agricultural organizations, institutions of the USA and represents a kind of foundation for the strategy of economically and environmentally sustainable functioning of the modern agricultural sector of the country. The built-up Extension Service system is essentially the central link in solving all issues, tasks and problems arising in the US agriculture.

Over the years, the system has made it possible to form and develop a truly effective mechanism where fundamental research is clearly coordinated, bringing scientific developments to practical use, introducing them into specific agricultural technologies, testing in practice, as well as disseminating information about innovations and effective technologies used in agriculture [13].

The study of the extensive experience of various foreign agricultural consulting services and, in particular, the American Extension Service, as well as the practical application and implementation of some elements of foreign agricultural consulting services will be extremely useful for the agro-industrial complex of the Russian Federation especially in today's preparatory conditions during the transition to the active phase of a serious digital transformation in the agricultural sphere.

At the moment, a highly integrated agro-industrial production of an intersectoral type has been definitely and accurately formed in the United States with a balance of all its constituent elements, under conditions of sufficiently high development of industrial and economic ties and the necessary infrastructure. At the same time, mechanisms of public-private partnership, venture financing are used along with program-targeted stimulation of science and research by Federal and State-level departments, which creates a special favoring regime for knowledge-intensive areas, which, when implemented, ultimately give a really high result.

For today, the most important effective tool of modernization of any of the known and really existing control systems in the modern world is their digitalization. Digitalization of management in the agricultural sector at all levels from the state to the subject of small agribusiness will not be an exception [14, 15].

Further digital transformation of management in Russian agriculture represents a higher level of digital integration, which affects the most complex organizational changes in government structures and agribusiness, the results of the implementation of these tasks can dramatically affect the growth of profits in the agricultural business, the competitiveness of products and will allow the agricultural industry as a whole to reach modern world technological frontiers.

It is important to note that today the comprehensive large-scale digitalization of domestic agriculture is a requirement of the time and the most important is simply a necessary condition for increasing its competitiveness and reaching acceptable profitability both for processing agricultural products with its subsequent sale, and initially for agricultural production itself, the profitability of which remains low [16, 17].

For example, in Russia, in accordance with the National Program "Digital Economy of the Russian Federation", the Ministry of Agriculture of the Russian Federation is actively creating and forming an Information System of Digital Services of the Agro-industrial Complex (ISDS AIC), which since 2021 had been put into pilot operation in certain pilot regions of the country. The key objective of this project is to improve the mechanism of providing state support to farmers, to make it easier and more transparent. It is planned that the Agro-industrial Complex will be closely integrated with public services.
Thus, subsidies, grants, preferential loans, preferential leasing all these support measures can be obtained electronically. The information system will allow not only submitting applications electronically, but also to learn about their status, receive funding and subsequently report on its use. It is expected that more than 100 thousand agricultural producers, as well as employees of regional agribusiness management bodies and local self-government bodies will become users.

The purpose of the ISDS AIC is to translate into electronic form, and accelerate the processes of obtaining state support measures in the field of agriculture, increasing their efficiency, as well as reducing the costs of agricultural producers for reporting. The main thing is that the information system as a module of the national agribusiness platform will improve the efficiency of the administration of the industry, the speed of bringing funds to farmers and the transparency of the processes of providing state support measures [18].

The key purposes and objectives in modern management based on the development and introduction of new technologies into management processes under the conditions of the Russian Federation today include [19]:

a) abandoning paper and switching to complete electronic document management and translation after thorough and high-quality reengineering of many processes into digital form.

b) Maximum minimization of the negative influence of the human factor through the active introduction of automated decision-making technologies at various management levels.

c) Achieving a high speed of making changes to management processes.

d) Creating a digital ecosystem that allows citizens and businesses to quickly and effectively interact with government agencies in multichannel mode using various devices.

e) Continuous improvement of the digital ecosystem processes based on the introduction of a feedback system regarding the degree of user satisfaction with the quality of services provided.

f) Increasing the level of transparency of decision-making in the public administration system due to the maximum permissible disclosure of data and the introduction of automated technologies and decision-making systems [19].

4 Conclusions

Further digital transformation of management in Russian agriculture represents a higher level of digital integration, which affects the most complex organizational changes in government structures and agribusiness. The results of the implementation of these tasks can dramatically affect the growth of profits in the agricultural business and the competitiveness of products will allow the agricultural industry to reach modern world technological frontiers.

References

