Directions and prospects of sustainable development of the national accounting and analytical system of agricultural formations

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Abstract. In the course of the research, the concept of an accounting and analytical system and its structure are considered. The trends and parameters of the sustainable development of individual elements of the accounting and analytical system are highlighted. The analysis of the current state and assessment of trends in the development of agricultural formations is carried out. It is established that the key direction of the development of agricultural formations, affecting their accounting and analytical system, is associated with the digitalization of production and economic processes. The influence of certain types of technologies on the accounting and analytical system is described. The directions and prospects of sustainable development of the national accounting and analytical system of agricultural formations in terms of information, accounting, analytical and control subsystem are highlighted.

1. Introduction
In the last decade, there has been an active transition to the so-called "information society" and "digital economy", which has affected all sectors and spheres of public activity, including agriculture. Interest in the phenomenon of the digital economy is intensified by numerous conferences, symposiums, seminars, open lectures, both on the international and on the national platform. The transformation fever has not spared the accounting and analytical system with its separate elements of accounting, analysis and control, has affected the methodological aspects of the organization and the directions of its sustainable development. In addition, the accounting and analytical system of agricultural formations has certain features associated with accounting of biological assets, significant influence of natural factors on it, and long production cycle. Many authors focus on individual questions about how digital accounting technologies can affect accounting and control or analytical processes in agriculture, which certainly characterizes the relevance of this study.

2. Materials and methods of research
When setting goals and solving tasks, general scientific methods of research, analysis, modeling and analogy were used. The main problem of the study can be formulated as the search for directions and
the allocation of parameters of sustainable development of the national accounting and analytical system of agricultural formations.

3. Results and discussion

3.1. Accounting and analytical system and parameters of its sustainable development

The accounting and analytical system should be understood as the process of collecting, processing, evaluating and analyzing all types of economic information generated to justify the most effective options for management decisions. Combining accounting and analytical operations in one continuous process, performing operational analysis, ensuring continuity of this process, as well as the formation of recommendations for making managerial decisions based on it, determine the essence of the accounting and analytical system [1]. At the same time, the general methodology and regulations of accounting and analysis are being improved for rational use in a single accounting and analytical system.

The elements of the accounting and analytical system are the following: special technique (technology) for the formation of information and records that objectively reflect the fait accompli of the economic life of the organization, which allows them to be combined into a single model: accounting - analysis - audit; analytical indicators and methods of analysis; audit evidence and methods of conducting control and audit procedures [2].

There are approaches in the literature according to which the structure of the accounting and analytical system is determined by four interrelated subsystems, namely: information, accounting, analytical and control (audit). At the same time, the key place is given to the accounting subsystem, since it further allows to properly build and conduct an analysis of the organization's activities, as well as control and audit [3].

Some authors, for example, O.A. Zubareva, believe that the accounting and analytical system of individual organizations is unique, and is determined by the needs of the management and owners of the organization for information; the current regulatory framework in the field of accounting, tax, analysis, local and industry regulations; the number of structural levels of formation of information (for example, the agricultural entity as a whole, its individual business units and segments) [4].

The entire accounting and analytical system will work effectively with the development of each of its individual components, and if one of them changes, a further transformation of all the others will follow. That is, any accounting and analytical system is subject to the process of its development following changes in technology, development of agriculture and economic trends. The development of the accounting and analytical system assumes a cyclical transition from one state to another, changing the system each time at a different qualitative level. Thus, the development of the accounting and analytical system can be understood as a cyclical process of its change, characterized by the continuity of changes, the balance of information, accounting, analytical and audit components in the transformation of its qualitative characteristics and the tools used.

From the point of view of the progressive steady development of the entire system, the definition of "sustainability" should be laid in its basis. Sustainability is a complex category reflecting the ability of the system to function effectively and withstand the inevitable external and internal influences. The sustainable development of the accounting and analytical system is the constant development and improvement of the information, accounting, analytical and control mechanism, allowing to improve the quality of information, facilitate the process of its collection and systematization, new methods of its processing and control, providing competitive advantages to an economic entity, industry, region. Thus, the concept of "sustainable development" encourages the search for directions or parameters that characterize the improvement of the entire accounting and analytical system (Table 1).

3.2. The current state and trends in the development of agricultural formations

Agriculture has not been considered attractive for investment for a long time due to the long production cycle, difficulties in automation of biological processes, high degree of exposure to natural
and climatic factors, as well as the risks of large losses at various stages of the production cycle and implementation, difficulties in introducing innovations and other factors.

Information technologies in the agricultural sector initially consisted in the use of technical means and software for the effective management of the company's cash flows and control over the implementation of other commercial transactions. With the development of large agro-formations, IT began to be used for monitoring crops, animals, information systems and technologies began to be used at various stages of the production process of agricultural organizations [5]. Agriculture is one of the industries where large-scale digitalization can give the fastest and most noticeable economic effect. According to Goldman Sachs forecasts, the use of robotic complexes and the use of new generation technologies can increase the productivity of world agriculture by 70% by 2050. According to calculations of the Internet Initiatives Development Fund, transformation of the economic data analysis system using the Internet of Things alone allows saving up to 20% of the organization's annual expenses [6].

The total economic effect of digitalization and the use of IT technologies in the agro-industrial complex is estimated at 4.8 trillion rubles per year or 5.6% of GDP growth of Russia [5]. At the same time, only in agriculture the expected growth in IT consumption can reach 22% [7].

Table 1. Trends and parameters of sustainable development of the accounting and analytical system.

| System element | Information subsystem | Accounting subsystem | Analytical subsystem | Control subsystem |
|----------------|-----------------------|----------------------|---------------------|------------------|
| Content of the system element | Sources of information, principles and methods of their evaluation; Ways and methods of collecting information; Ways and methods of information systematization and storage; Ways and methods of information transfer; Technical means used to receive and process information. | Principles and methods of accounting; Accounting documentation; Accounting system and records; Reporting system; Technical means used for accounting. | Principles and methods of analysis; Information sampling and analysis scaling; Methods of information verification and primary analytical processing; Ways and methods of analysis; Technical means used for analysis. | Principles and methods of control (audit); Control environment; Control procedures; Risk assessment; Monitoring; Technical means used for control (audit). |
| Trends in system element development | Increasing the sources of information, accelerating the processes of its accumulation, automatic methods of its search and collection, increasing the volume and quality of the information received, shortening the time | Moving away from paper forms of documentation, more extensive use of technical means for accounting, automatic transmission and formation of accounting records, reducing the influence of the human factor. | The analysis focuses on forecasting future trends and identifying potential risk factors, developing methods for analyzing large amounts of data, increasing the role of probabilistic methods of | Technical methods and means of control are distributed, part of the control functions are transferred to specialized programs. |
of its search.

### Parameters of the sustainable development of the system element

- Increment of information volumes; Increasing the number of devices and tolls for information collection; Increasing the volume and degree of involvement in Internet technologies; Increasing the level of digitalization of activities.
- Reducing the time of analytical procedures and speeding up the decision-making process; Strengthening the digitalization of analytical procedures; Extension of the technical means used for analysis.
- Increasing the level of automation of accounting procedures and the process of forming accounting documentation; Electronic document management.
- Increasing the frequency of automatic control procedures and monitoring; Reduction of errors due to the influence of the human factor; Increasing the scale of the control environment.

**Source:** compiled by the authors based on the results of a study of sources [8; 9; 10]

Therefore, today in Russia, a course has been taken towards digitalization and robotization of agricultural formations, which affects not only individual processes in economic entity, but also general economic processes as a whole, and also determines the development strategy of the agricultural sector and the accounting and analytical system at the national level. Digitalization and automation of the largest number of processes taking place in the organization are at the heart of the development of the largest companies in the global agricultural sector [5;11].

The long chain of value creation of agricultural products and many unsolved problems in the industry that can be solved with the help of automation and IT technologies is a decisive argument in favor of the increasing investment attractiveness of agricultural formations. Back in 2010, there were no more than 20 high-tech companies in the agricultural sector around the world, and already today the national state program for the development of agriculture in Russia for 2013-2020 provides for an annual increase in investments in the agro-industrial complex (AIC) in the amount of 4.5% [12]. The global volume of investments in fixed assets of agriculture by 2020 increased 6.5 times compared to 2012 (Figure 1) [13].
The budget of Russia for 2020 and for the period 2021-2022 provides for financing of the program for the development of the agro-industrial complex in the amount of more than 300 billion rubles annually. Many large agro-formations (about 70%) carry out technological innovations by attracting third-party investors, which is due to a lack of funding and the almost complete absence of their own research base [14].

Currently, the Russian Federation is on the 15th place in the world in terms of digitalization of the agricultural sector, and the volume of IT technologies in the agricultural sector, according to experts, is about 360 billion rubles. According to the Ministry of Agriculture of the Russian Federation, as of 2018, about 95% of information technologies in the field of agriculture are foreign developments. But the increase in investments in agriculture will ensure the development of IT technologies, including through the support of agro-startups [5; 12].

Against the background of attracting investment, there are positive trends in the growth of domestic agricultural products, in particular, from 2010 to 2019, the increase was 2.40 times, and the volume of livestock production, the total volume of production doubled and crop production almost tripled. High growth rates are observed in pork and wheat exports, but in general, the performance indicators of the Russian agricultural market lag behind other major world economies. The positions of Russian agricultural companies relative to foreign ones in terms of the level of innovation activity are significantly lagging behind. The leaders in terms of agricultural IT technologies are China, the USA, the EU, Canada, Israel and India. Relative to European countries, as of 2016, the volume of information and computer support for companies was 3.4%, while Norway - 59.8%; the Netherlands - 48.3%; Denmark - 40.8%; Spain - 8.6% [14].
Thus, the agricultural sector becomes a segment with a very intensive flow of information. Technologies are developed and modern large agro formations learned quickly to share experience and data via seamless communication channels, and with the participation of the government, investors, partners to monitor the production cycle of the agricultural organizations through smart devices, transmitting and processing parameters of the object and its environment in real-time (hardware and sensors that measure parameters of plants, climate, soil, and animal performance). Robotization of the largest possible number of agricultural processes using a virtual (digital) model of the agricultural production cycle and interconnected links of the value chain is possible due to the merger of economic processes into a single network, the exchange and management of Big-data, the growth of the productive capacity of computers, the development of cloud services and software. All this makes it possible to plan business operations with mathematical accuracy, react urgently to prevent losses in case of threat detection, to determine planned productivity, yield, cost, revenue, and profit [15].

Within the framework of the departmental project "Digital Agriculture" 2019 - 2024, with the introduction of digital technologies and platform solutions that provide a technological breakthrough in the agro-industrial complex, it is expected that labor productivity in "digital" agricultural organizations will increase by 2 times by 2021 (Table 2). The project also plans the formation of a common accounting system for agricultural land [16; 17].

| Target indicators                                      | 2018 | 2019 | 2020 | 2021 |
|--------------------------------------------------------|------|------|------|------|
| Share of resources in Big Data, %:                      | -    | 75   | 100  | 100  |
| land                                                   |      |      |      |      |
| cattle                                                 | 1    | 25   | 100  | 100  |
| equipment                                              | 50   | 75   | 100  | 100  |
| Share of SMART-contracts with subsidy recipients, %    | 0    | 10   | 50   | 100  |
| Cost reduction ratio, %                                 | 0    | 5    | 15   | 20   |
| Share of material costs in product cost, %             | 65   | 60   | 55   | 50   |
| Labor productivity growth, %                           | 100  | 105  | 125  | 150  |
| Share of investments in Digital Technologies (including made in Russia), % | 0.5 (0.1) | 1 (0.5) | 3 (1.5) | 7 (5) |

Source: Rosinformagrotech [15; 16]

Thus, the basic direction of the development of agricultural formations that affect their accounting and analytical system is associated with the digitalization of agriculture and includes the following basic technologies:
- Internet of Things;
- Robotics and drones;
- Large data processing systems;
- Development of neural networks and artificial intelligence, platform solutions.

The information comes from various devices that are located in fields, on farm animals, machines, from sensors and agro-drones, meteorological stations, satellites, external and partner platforms, contractors. The general data collected in one place from different participants of the production chain allows to obtain new quality information, find hidden patterns, create added value for all involved participants, apply modern methods of information processing (data science) and make informed management decisions based on them, leveling economic risks and increasing business efficiency [15; 18].
Large data processing systems (machine learning, artificial intelligence, Data Science), allow to automatically collect data and monitor all accounting objects online, as well as use network solutions, management systems, platforms and applications. RFID technologies (Radio Frequency Identification) in agriculture help to automate many processes of accounting, control, analysis and optimization of crop and livestock complexes, which significantly reduces labor costs, reduces the possibility of errors caused by the human factor, accelerates information processing even in large agricultural enterprises. All this makes it possible to significantly increase the profitability and competitiveness of national agricultural organizations in the world market.

Mobile or online applications become available to owners, managers, and employees of agricultural formations, which, when downloading data about their field, provide accurate operations, accounting documents, account balances, both within their farm and in the external environment, combining information obtained from agricultural machinery, sensors, agro-drones, satellites, and other external applications. Now programs help to store a large array of data, predict, and analyze in comparison with past indicators [5].

The prospective accounting and analytical system of agricultural formations will function on the principle of predictive management of inventory, procurement, logistics, finance, personnel. Management of the organization through the automatic exchange of information between participants in the supply chain with minimal use of its own infrastructure, reducing the role of wholesale intermediaries [19].

It should also be noted that in Russia, the formation of the Agro IoT ecosystem is in the initial stage of development. Basically, its elements are formed in large agro-formations with private capital and state support. At the same time, solutions for small farms and individuals are developing in the world. This creates broad prerequisites for the formation of a new type of accounting and analytical system [16].

3.3. Directions and prospects of sustainable development of the national accounting and analytical system of agricultural formations

The noted trends in the development of agricultural formations towards digitalization, robotization will fundamentally affect the accounting and analytical system. Technologies have evolved and spread to such a level that, for the first time in the history of the industry, it became possible to obtain data about each agricultural object and its surroundings. The basic trend of digital development is to calculate the algorithm of actions and the slightest deviations quickly and mathematically accurately, to predict the result and to act pointwise, minimizing costs.

The accounting and analytical system of agricultural formations, unlike other branches of the economy, has its own characteristics associated with the need to consider biological assets (animals, plants), land. Thus, the crop industry is characterized by keeping records of land as an object of fixed assets, high dependence on natural and climatic factors and seasonality of labor, the division of costs by production cycles, since there is only a partial coincidence of the working period with the production process (for example, the costs of previous years are laid for the current year's harvest, and the costs of the current year - for the harvest of future years). In the livestock industry, it is necessary to highlight features in the analysis of livestock production related to the diversity of animal species and the inability to compare and summarize the livestock of different groups of animals, therefore, the calculation of the herd structure must be carried out in conditional heads [1]. The specifics of the activities of agricultural formations are also reflected in the accounting statements, where it is necessary to reflect and evaluate biological assets [20]. The analytical subsystem of agricultural formations is characterized by the presence of numerous specific indicators, and due to the assessment of climatic factors, the widespread use of probabilistic and statistical methods of analysis. The noted features should be considered when determining the development trajectories of the accounting and analytical system of agricultural formations.

The tasks of the accounting and analytical system are resource management and optimization, reduction of losses, maximum automation of all stages of the production cycle to improve business
efficiency. Further robotization represents a higher level of digital integration of the received data with various intelligent IT applications that process them in real time. A revolutionary shift in managerial decision-making is being implemented, based on the results of big data analysis, assessing the impact of many factors at once and justifying subsequent actions [5].

In the information subsystem, the transformation begins with the transition to electronic document management and the large-scale introduction of the Internet of Things, which will enable the automatic generation and receipt of primary documents, their storage on a server or in a "cloud storage" and automatic reflection. Data from fields and farms will be available to managers online and on any device that supports an Internet connection. As a result, the time for collecting and processing information will be reduced, and the decision-making process will be accelerated.

In the accounting subsystem, due to the absence of the need for manual data entry from primary documents into an automated system, the function of accounting registers as documents that reflect the systematization and grouping of facts of economic life loses its primary importance. Automatic grouping of information from primary documents in accounting will facilitate and speed up the reporting process.

In the analytical subsystem, in the future, with the support of digital platforms, it is advisable to work on integrating an external data array into an internal operational analysis system to reduce the time for making managerial decisions. Econometric methods of big data research and qualitative methods of analytical information processing are becoming increasingly developed. Thus, a predictive analytical model helps to determine that a change in one factor will contribute to a whole chain of events related to it. For example, an increase in soil moisture by 5% contributes to the decomposition of individual organic substances, which in turn violates the nutrition regime of plants that accumulate harmful substances and during processing will worsen the quality of plant feeds. There is modeling of effective conditions, as well as management of production factors, control of natural factors, which allows managers of agricultural formations to make management decisions in a timely manner based on the constructed forecasts with mathematical accuracy and without unnecessary expenditure of resources [5].

The development of intelligent analysis based on neural networks that allow optimizing management decisions is also promising. Due to the specificity of various agricultural formations, it will be characteristic to deepen the sectoral analysis, its binding and adaptation to each specific economic entity, which will allow developing individual trajectories of their development that determine the security boundaries of individual organizations. Considering the duration of the crop and animal husbandry cycle, systems of proactive analysis of expanded production indicators are being developed and implemented, which will reduce the costs of owners through the implementation of preventive protection measures [5].

The control subsystem also becomes digital and moves into the Internet space. The most urgent in the near future will be the transition to continuous control (audit) technologies. This approach dramatically reduces not only the time of control procedures, but also increases the reliability and accuracy of the conclusions formed. At the same time, the expansion of audit parameters and remote internal control over the reliability of data through special technologies dictates the need for a more complete identification of links between individual parameters of accounting financial statements.

The mentioned directions of development of the accounting and analytical system will affect the demand for individual specialists. Thus, the number of vacancies for specialists in the field of Internet technologies, Big Data analysis, Data Science, mathematics, analytics, robotics will increase. The role and burden on accounting staff is reduced, their functions are increasingly reduced to analytical and control.

4. Conclusions
The accounting and analytical system consists of several interconnected subsystems, each of which undergoes objective changes caused by economic and technological development. Trends and parameters of sustainable development of elements of the accounting and analytical system of
agricultural formations are associated with digitalization and large-scale introduction of IT technologies into agriculture, increased investment in this industry and opportunities for its growth.

The sustainable development of each of the elements of the accounting and analytical system based on the principles of digitalization allows managers of agricultural formations to see negative business trends at an early stage, quickly assess various scenarios for its growth and expansion, take proactive measures in time, rationally allocate and spend resources, plan the activities of departments considering optimal development parameters and necessary financial results.

It is advisable to develop the accounting and analytical system of agricultural formations in the following promising areas: the development of the Internet of Things, electronic document management, predictive analytics, big data analysis, deepening of industry analysis, development of continuous control (audit) technologies.

The effect of implementing the directions of sustainable development of the accounting and analytical system of agricultural formations will be manifested in increasing the speed of data reception and processing, reducing the likelihood of errors caused by the human factor, expanding the capabilities of big data analysis and switching to a preventive business management policy.

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