Artificial intelligence for digitalization of management accounting of agricultural organizations

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Abstract. In Russia, much attention is paid to the development of the digital economy and artificial intelligence technologies. Agricultural organizations need artificial intelligence. Artificial intelligence creates new opportunities for substantiating management decisions, including in the field of management accounting. The aim of the study is to develop directions for using artificial intelligence in the management accounting of agricultural organizations. The methodology of management accounting has been supplemented with new provisions that show the use of artificial intelligence in the management system of agricultural organizations. Interpretations of the elements of the management accounting methodology are proposed: the object (historical, current and prospective information on the costs and results of financial and economic activities in different sections and details), the subject (financial and production activities of agricultural organizations and their structural elements), methods (general and specific). It is proposed to expand the statement of the goal of management accounting (strengthening the efficiency, reliability and completeness of information provided to management) and tasks (identification and measurement of activity parameters; increasing the efficiency of information collection; operational preparation and processing of information with a given degree of detail and depth of time lag; strengthening the quality of management analysis, control, planning and forecasting). It is proposed to supplement the methodological characteristics of the principles and functions of management accounting with new analytical and organizational capabilities. It is concluded that artificial intelligence can become an applied management accounting tool, expanding its traditional capabilities.

1. Introduction
The digital economy provides ample opportunities and various new technologies for the development of industries. Not all industries are equally geared towards embracing digital innovation. In Russian scientific research it is customary to divide the industries into digital and non-digital (analog) [1]. In Russia, agriculture is commonly referred to as non-digital industries. Agricultural organizations mainly use only mechanized and automated equipment, but use little digital technology.

In Russia and in the world, there is an accelerated development of artificial intelligence technologies. Russia has developed a National Strategy for the Development of Artificial Intelligence for the period up to 2030. The strategy is very important, since the development of artificial intelligence and other digital technologies is a priority for the state. The Ministry of Digital...
Development of Russia believes that the market for projects in the field of artificial intelligence should increase from 2 billion RUB to 160 billion RUB (or in 80 times).

According to experts, thanks to artificial intelligence, the growth of the world economy in 2024 may reach at least 1 trillion US dollars. Oracle data shows that globally 50% of firms workforce already use some form of artificial intelligence, up from 32% a year ago.

In the management accounting of agricultural organizations, artificial intelligence creates new opportunities for informed management decision-making. There is a symbiosis of digital IT innovations and traditional accounting techniques and methods. As a result, the transformation of traditional management systems is required [2].

The purpose of the work is to develop directions for using artificial intelligence in the management accounting of agricultural organizations.

2. Materials and methods

In the scientific literature, differences are noted in the interpretation of the content, methods and techniques of management accounting. Accounting, acting as a management function, adapts its own methods, methods, tools for solving current problems. The tasks of the modern Russian economy are advanced competitive development that can be achieved thanks to digital technologies. In fact, in the field of management accounting and other economic sciences, a situation is emerging today when the development of practice is ahead of the existing theoretical postulates and they turn out to be inoperative in the new conditions. Management accounting theory needs updating. The relevance of interdisciplinary research of management accounting with information and communication technologies is increasing [3]. But in theory, the adaptation of digital technologies (artificial intelligence, cloud computing, quantum computing, big data, etc.) to practical problems of management and management accounting remains poorly studied.

Management problems in national economies were studied by Akimova OE, Volkov SK, Kabanov VA, Ketko NV and Kuzlaeva I. [4], Elmquist M, Gawar A, and Le Masson P [5], Idris M [6], Morozova IA, Popkova EG and Litvinova TN [7], Skokov R Yu [8], et al. Issues of the digital economy and digital innovation were studied by Babkin AV, Burkal'tseva DD, Betskov AV, Kilyashkanov H Sh, Tyulin AS and Kur'ianova IV [9]. Jacobides M, Cennamo C and Gawar A [10-11], Masiukiewicz Piotr and Dec Paweł [12], Sukhodolov AP, Popkova EG and Kuzlaeva IM [13], Sviridov O Yu and Nekrasova IV [14] et al. Agriculture as analogue and as digital the sphere was considered by Popova L, Korobeynikov D, Korobeynikova O and Panov A [15], Sazonov S, Kharlamova E, Ezangina I, Kovazhenkov M, Polyanskaya E and Gorshkova N [16], etc.

At the same time, the applied adaptation of digital technologies (artificial intelligence, cloud computing, big data and other related technologies) to the practical problems of analysis and synthesis of information in management accounting remains poorly studied. And since management accounting is unregulated at the state level, it uses an individual set of techniques and methods.

The study uses a systematic approach and theoretical methods for generalizing and comparing data, a structured description of management accounting, its general and specific elements of the methodology.

The research was carried out on the basis of the following principles. The applied principle of the unity of theory and practice is to study the mechanisms of application of practical technologies of artificial intelligence to the methodology of management accounting of agricultural organizations, taking into account their industry specifics. The principle of objectivity lies in the study of fundamental scientific works in the problem area. The principle of complexity manifested itself in a combination and comprehensive study of various aspects of the management accounting methodology and changing the interpretation of its elements when using artificial intelligence. The principle of consistency manifested itself in the study of the field of management accounting as a complex, multi-level economic system of an open type. The openness of the system determines its susceptibility to innovations in the digital economy and the use of artificial intelligence.
3. Results

3.1. The actual state of the development of artificial intelligence in the management activities of Russian enterprises in various industries

Agriculture in Russia is a traditional sector of the economy. Compared to other industries, the level of production automation is lower, the share of intellectual labor is low. At the same time, management accounting in agriculture needs to process and analyze information using artificial intelligence, since it has a pronounced specificity:

- The use of biological assets with multiple individual characteristics.
- High probability of various difficult-to-predict risks.
- Specific composition and nature of costs.
- Length of the production cycle.
- The use of a large amount of resources: land, material, labor, financial.
- And other features.

There are some successful practices among state corporations, subjects of large industrial business [17], technology companies, banks [18] on the joint application of artificial intelligence and cloud technologies, but these examples mainly relate to industrial megaprocesses. Thus, Gazprom Neft was the first Russian company to create and implement in the regional sales directorate a complex analytical data management platform “smart data lake”. The platform was developed by the company's specialists, without the involvement of external contractors. The platform is a complex analytical data management platform (“smart data lake”), including components for processing, storing and analyzing data - Datalake and data warehouse, the advanced analytics laboratory Datascience. The platform is successfully used in the regional sales department. The tasks of processing transactions of the Gazprom Neft filling station network, calculating segments for client analytics, analyzing customer feedback are being solved. For this, artificial intelligence is used. The platform integrates data from the St. Petersburg Commodity Exchange, websites of the Bank of Russia and Central Banks of the CIS countries, geographic and meteorological resources, metrics and reviews from Google, AppStore, Yandex, open data from social networks, various partner data and information about competitors, mobile data applications. The platform made it possible to implement about 50% of all analytical projects and initiatives of the Gazprom Neft company within the “smart data lake”. It is planned that by the end of 2020 the share of digital projects in Gazprom Neft will be at least 75%.

The first automated systems that appeared in Russia were expert systems. They described an algorithm of actions for choosing the optimal solution in specific conditions. These conditions were described by a set of quantifiable factors. In the field of accounting in agriculture, automated systems for summarizing information and reporting in accordance with national standards and taking into account industry specifics were used. Expert systems have improved thanks to machine learning technologies. Innovative technologies have made it possible to automatically set rules for information systems, identify patterns and make decisions. The advent of machine learning capabilities actually means the emergence of artificial intelligence. However, artificial intelligence and other technological innovations have not received the expected mass development in Russia, despite the clearly expressed trends in the introduction of digitalization.

3.2. Impact of artificial intelligence on the development of management accounting

In the process of using artificial intelligence in the production processes of agricultural organizations, arrays of information are created that require processing by means and methods of management accounting. The use of artificial intelligence in the field of management accounting for the generalization and analysis of the data set obtained in the standard procedures of system accounting is a logical continuation of the digital innovation of agricultural organizations.

In Russian practice, the following paradox is observed: the accounting system in a broad sense (including financial, managerial, tax, statistical accounting) was among the first processes to be
automated with the advent of computer technology and information software technologies. But the process of digitalization of accounting began with a certain delay (compared to other management areas). Automation made it possible to reduce the labor intensity of accounting, expanded the practice of using methodological tools, formalized the processes of external (primarily counterparty and reporting relations) and internal (in terms of management accounting) communications. To meet the needs of digital control, accounting automation must evolve into digitalization [19]. By digitalization, in this case, we mean the use of digital innovations in the automated management accounting system (both technological - artificial intelligence, cloud technologies, blockchain, etc., and product - QR, biometric identification, etc.).

In the system of management functions of an agricultural organization, management accounting provides a generalization of information in sections necessary for making specific management decisions. With the development of digital technologies, management accounting receives new tools and new content for its content.

Currently, a fundamental process of dividing the post-industrial economy into digital and exponential economies is taking place. Exponential economics implies the use of exponential technologies, such as artificial intelligence, cloud and quantum computing, process robotics, distributed ledgers [20], etc., allowing businesses to significantly increase the efficiency of their activities. Management accounting is a key area for digital exponential innovation alongside process technology. An exponential effect is observed in management accounting due to exponential technologies. That is, there is an increase in the efficiency of accounting and management processes, which can lead to an acceleration of the dynamics of competitive growth of an agricultural organization.

The possibilities of using artificial intelligence in management accounting are due to the following factors:

- the end-to-end nature of the application of applied technological solutions developed on the basis of artificial intelligence.
- the impact of technological solutions developed on the basis of artificial intelligence on the effectiveness of management accounting.
- wide availability of tools for the development of management accounting technologies based on artificial intelligence (including open source computer programs).
- the need to process large amounts of data generated by both the organization's personnel and technical devices.

Artificial intelligence is an applied management accounting tool along with other digital innovations. It is capable of imitating the cognitive functions of an accountant (including self-learning and finding solutions without a predetermined algorithm) and obtain, when performing specific tasks, results comparable, at least, to the results of the intellectual activity of the accountant himself.

3.3. Elements of the methodology for management accounting of agricultural organizations, taking into account the impact of artificial intelligence technologies

Let's consider some elements of the methodology of management accounting as a scientific field, which are changing due to the use of artificial intelligence (table 1).

The use of artificial intelligence technologies in management accounting affects the content of the elements of its methodology. This influence is manifested in the following.

Artificial intelligence allows you to process big data accumulated over the entire period of the organization's existence and for the financial year as a whole. This is important for agricultural organizations, since the accounting period is one year, and not a month, as for enterprises in other industries. Therefore, in the composition of the object of management accounting, we include historical, current and prospective information on the costs and results of financial and economic activities in different sections and levels of detail.
New opportunities appear in the use of specific (accounting) methods - accounts and double entry, inventory and documentation, valuation, calculation, budgeting, grouping and summarizing in reconciliation accounts, balance sheet summarizing and reporting. Thus, management accounting accounts can be detailed by multi-level analytical positions without losing their information value. After that, the resulting big data can be analyzed using artificial intelligence. The possibilities of inventory are expanding, which is an effective method of confirming the actual presence of assets and liabilities. To assess assets and liabilities, it becomes possible to use multivariate models and multivariate models. In forecasting and business planning, artificial intelligence allows you to move from two-dimensional calculations, which are most often performed in Excel tables, to multidimensional mathematical models. For example, Oracle has launched the Oracle Hyperion Planning project on the market, which allows building multidimensional forecasts of financial indicators, long-term development scenarios. When using calculation and budgeting methods, you can achieve high planning accuracy and make point adjustments to calculations based on alternative estimates.

Table 1. Management accounting methodology for agricultural organizations and the impact of artificial intelligence.

| Elements of the methodology | Characteristics of elements |
|-----------------------------|-----------------------------|
| Object                      | Historical, current and prospective management information in different sections and details |
| Science subject             | Financial and production activities of an agricultural organization and their structural elements |
| Methods                     | 1. General: elementary mathematics, statistical econometric mathematical programming |
|                             | 2. Specific (accounting): accounts and double entry, inventory and documentation, valuation, calculation, budgeting, grouping and summarizing in reconciliation accounts, balance summarizing and reporting |
| Aim                         | Strengthening the efficiency, reliability and completeness of management accounting information |
| Problem                     | 1. Identification and measurement of performance parameters |
|                             | 2. Increasing the efficiency of information collection |
|                             | 3. Operational preparation and processing of information with a given level of detail and depth of time lag |
|                             | 4. Strengthening the quality of management analysis, control, planning and forecasting |
| Result                      | Reaching the set aim |

The purpose of management accounting - to provide information to management - is deepened by increasing the efficiency, reliability and completeness of information processing. On the basis of artificial intelligence technologies, the tasks of management accounting are solved: to identify and measure the parameters of the activities of the subjects of management accounting, to increase the efficiency of information collection, to promptly prepare and process information with a given degree of detail and the depth of the time lag, to enhance the quality (information content) of management analysis, control, planning and forecasting, etc. The result of solving these problems is the achievement of the goal in accordance with the methodological principles of management accounting.

The principles of management accounting are also supplemented with new substantive characteristics. The principle of business continuity is confirmed by the new possibilities of cloud storage of information and its generalization by means of artificial intelligence for the accumulated time period of activity. The principle of uniformity of measurement and meters can be considered in a broader sense as a comparable multivariance of measurement and meters. Wide variability is characteristic of another principle - performance measurement. With the use of artificial intelligence, the principles of assessment, continuity and reuse of information can become more significant for the organization of management accounting. With the help of cloud computing and big data processing, it is possible to conduct an alternative assessment of accounting methods at a large time lag (including forecast), to reliably confirm the chosen option or its change when external or internal conditions change. Artificial intelligence provides such a technical opportunity. The principle of periodicity means that the analytical function of management accounting can be implemented not discretely, but
permanently. In turn, this will enhance the practical effect of the principle of controllability of each business transaction. The principle of economy characterizes both a direct effect, expressed in the optimization of management accounting functions, and an indirect effect, expressed in an increase in the resulting indicators of management activities, for example, labor productivity, financial results, cash flow generation, improving the quality of budgeting, etc.

With the use of artificial intelligence technologies, the importance, priority and completeness of management accounting functions change. The predictive function becomes one of the main ones. It is supplemented by a provision on expanding the horizon and depth of planning and forecasting in relation to the subject of management accounting. The information function is to provide the management of an economic entity with complete, reliable and timely information in the required forms and quality. The analytical function is complemented by the possibilities of using artificial intelligence methods to substantiate the reserves for the growth of financial results, optimize the financial condition, develop financing options, investment, etc. The control function will be enhanced by increasing the importance of logical control methods, using new algorithms for reconciling balances and turnovers on accounts, intensifying inventories using artificial intelligence methods, etc. The organizational (communication) function combines all the innovations that artificial intelligence brings to the management accounting system. As a result, the intensity of information exchange between the participants in management activities increases, procedures for analyzing information flows are intensified, coordination of actions of structural elements is facilitated, reasonable and productive mechanisms for stimulating personnel are created, etc.

4. Conclusions

Thus, management accounting in agriculture needs processing and analysis of information using artificial intelligence, since it has a pronounced specificity. In the production and financial activities of agricultural organizations, large amounts of specific information are created. This information requires processing by means and methods of management accounting using artificial intelligence. Artificial intelligence, along with other digital innovations, should become an applied management accounting tool. With the development of digital technologies, management accounting not only receives new tools, but also new content in its content. The interpretation of goals, objectives, object, subject, methods and principles of management accounting are changing. New interpretations of the elements of the management accounting methodology are proposed: an object (historical, current and prospective information on the costs and results of financial and economic activities in different sections and details), a subject (financial and production activities of agricultural organizations and their structural elements), methods (general and specific). It is proposed to expand the statement of the goal of management accounting (increasing the efficiency, reliability and completeness of information provided to the management) and tasks (determining and measuring performance parameters; improving the efficiency of information collection; operational preparation and processing of information. With a given degree of detail and depth of time lag; improving the quality of management analysis, control, planning and forecasting). It is proposed to supplement the methodological characteristics of the principles and functions of management accounting with new analytical and organizational capabilities.

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