

LEASECON 2021
Conference on Land Economy and Rural Studies Essentials**CORPORATE INFORMATION SYSTEMS IN AGRICULTURAL
INFORMATIZATION**

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Abstract

The paper presents a generalization of current views on the structure and standards for building corporate information systems. The need to use corporate solutions of a flexible cloud-based architecture based on formalized ERP II (Enterprise Resource Planning) management standards and the concept of EBC (Enterprise Business Capabilities) is noted. A corporate information system is considered as a set of independent applications operating through a service bus with the process platform core allowing for integration and providing access to corporate data. As subsystems of the corporate information system, it is possible to use data processing systems and information management systems at the operational and functional levels and decision support systems at the strategic level of organization management. When choosing typical corporate information systems, as well as independent applications as separate corporate information system subsystems for an agricultural organization, it is recommended that the developer has industry solutions, the possibility of cloud work, the territorial proximity of the representative office of the developer company to provide maintenance of the software product, and the possibility of remote service, which is especially important for the new economic conditions in and after the pandemic. An important criterion is the possibility of a phased acquisition of information systems. In addition, the need for low-code technology is emphasized, which provides a minimum amount of programming on the software product technological platform. Domestic corporate information systems that have been implemented taking into account current requirements are offered as components of the AgroSolution module of the Digital Agriculture project.

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Keywords: Corporate information system, digital agriculture, Enterprise Resource Planning, Enterprise Business Capabilities, informatization



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1. Introduction

The “Digital Agriculture” departmental project contains the concept of upgrading the industry through the use of up-to-date information systems and technologies that ensure a twofold increase in labor productivity in agriculture by 2024, as well as a decrease in the share of material costs in the structure of the unit cost of agricultural products from 65% in 2018 up to 43% in 2024, which will also contribute to improving the efficiency of agricultural production (Gordeev et al., 2019).

It is envisaged to create a digital platform for an agricultural organization as an integrated information system that includes the AgroSolution module (Gordeev et al., 2019). However, there are no offers in this module that are related to filling the functional subsystems of this module and to using corporate information systems in order to automate business processes of managing an agricultural organization. This requires further improvement and refinement.

2. Problem Statement

The digital platform of an agricultural organization based on the AgroSolutions module to be proposed by the Digital Agriculture departmental project includes the already developed subsystems of this module such as Electronic Trading Platform and Personal Account of the Agricultural Producer. These subsystems make it possible to sell products using the Internet, carry out electronic document flow in an organization, and perform financial modeling and forecasting business activities. However, the subsystems mentioned above do not cover the entire spectrum of enterprise business process management. The document does not indicate typical software products designed to automate all levels of management; there is no description of their functional modules or subsystems and selection criteria for an agricultural organization taking into account the existing software, specialization, etc.

3. Research Questions

To solve the above-mentioned problem, the following research questions are highlighted in the paper: generalization and systematization of current scientific views on corporate information systems as possible components of the AgroSolutions module and on standards and concepts of their construction; analysis of current practices of using information systems and technologies in agricultural organizations; development of proposals for the use of corporate information systems based on current standards as components of the AgroSolution module.

4. Purpose of the Study

The purpose of the study is to systematize formalized organization management standards on which corporate information systems are built; development of recommendations for the use of corporate information systems having a flexible architecture and low-code technology as components of the AgroSolution module for an agricultural organization.

5. Research Methods

The study has been performed based on data obtained from the Ministry of Agriculture of the Russian Federation, Federal State Statistics Service, regulatory documents, reference materials, and personal observations of the authors using the main provisions of the systematic approach. Thus, the abstract-logical research method has been used to solve the problem of using corporate information systems as components of the AgroSolution module. The method of expert assessments and methods of analysis and synthesis have been used to analyze the available software products in an agricultural organization.

6. Findings

Corporate information systems (CoIS) are integrated information systems that provide automation of management of all business processes of an organization. These software products cover all areas of the enterprise, such as production, finance, trade, logistics, etc., and also use a single information space. CoIS was based on the following formalized organization management standards: MRP I, II (Material Requirements Planning: planning of material requirements), later on ERP I, II (Enterprise Resource Planning) including CRM standards (Customer Relationship Management) and SRM (Supplier Relationship Management).

In recent years, the need for flexibility in the architecture of corporate information systems, the use of required applications from various vendors rather than the use of a static set of modules, and work with hybrid cloud and on-premises deployments have been emphasized. Gartner, the originator of the ERP term, has even proposed the special Postmodern ERP name to describe this process. Currently, according to the experts of the same company, the fourth era of flexible, open, platform, cloud ERP-systems is coming. This era is based on the use of the EBC (Enterprise Business Capabilities) standard. Business capabilities and business potential of an enterprise are considered as a broad abstract concept that includes factors of production, organizational structure, business processes, information infrastructure of an enterprise, etc. necessary for the implementation of basic functions. The new era of ERP systems, i.e. business capabilities of the enterprise, is seen as the future of applications. Moreover, applications should be designed to combine composite business capabilities. In order to provide for the interconnection of various applications, a so-called core is required that is surrounded by a special customizable technological platform that allows new software solutions to seamlessly integrate and access data in the system of corporate applications (Guay, 2020). That is why the new era of ERP is called flexible, open, platform and cloud.

Another modern trend in the use of corporate information systems is the use of low-code technology. The implementation of this technology in information systems provides for a minimum amount of programming on a special business processes automation platform.

In the EU countries, corporate information systems are widely used in various industries including agriculture. Moreover, dedicated solutions are used. However, some difficulties arise with the adaptation of typical software products to the conditions of a particular organization. For example, when using ERP systems in Dutch gardening, significant efforts were required to adapt the system to an agricultural

organization and harmonize with its requirements and specifics. However, it is noted that this problem can be solved. About 62% of the surveyed respondents positively assess the compliance of a typical ERP solution with the organization's business processes (Verdouw et al., 2015). Further difficulties associated with the use of ERP systems in agriculture are not only the difficulties of implementation associated with the scale of systems that automate and integrate the main business processes of the organization, but their high cost for small and medium-sized agricultural enterprises. Foreign scientists propose the development of integrated information systems such as ERP designed for small and medium-sized enterprises taking into account their specifics, requests and financial capabilities (Rus, 2012).

The main Russian agriculture innovation area has recently been the use of technological innovations associated with improving the production process. The Agriculture 4.0 project of the future is considered as a new stage in the technological development of the industry associated with the use of the Internet of things, blockchain technologies, big data including that coming from remote sensors, satellites and drones, and technologies and methods of artificial intelligence. The Agriculture 4.0 implementation is designed to solve the problem of food security in the country (Romanova & Levina, 2020). However, there is a low activity of enterprises in the development of organizational innovations. Thus, according to an expert survey conducted by employees of the Institute of Agrarian Research of the National Research University Higher School of Economics in February-March 2020 among top managers or business owners, the main obstacles to the innovative transformation of the agricultural sector are the imperfection of the legislative framework with an emphasis on the bureaucratic aspect (91% of respondents); lack of the necessary dialogue between business and science (82%); low efficiency of the technology transfer support system (73%) (Orlova et al., 2020). In addition, barriers are also such objective factors as a lack of specialists (Karpuzova et al., 2021), funding problems, a low level of equipment of research institutes, as well as subjective factors associated with conservatism, apathy of individual managers, and unwillingness to make changes in their work. This also applies to the use of up-to-date information systems and technologies in the management process. Meanwhile, 73% of the surveyed experts consider it necessary to introduce ERP- and CRM-systems in the industry (Orlova et al., 2020).

Most agricultural organizations have a low level of informatization. Only every second agricultural organization had a local area network and only every fourth had its own website in 2019. Only 9.4% of organizations use cloud services to provide customer relationships, use computing power to run their own software, use cloud services as a computing service, and host e-mail, which is one of the lowest values in comparison with other types of economic activity. Dedicated software is represented by accounting systems, mainly by 1C and its franchisees, as well as by programs for veterinary medicine and appraisal accounting of animals from 1C and BARS Group. The so-called island or patchwork automation takes place, when software products are not interconnected with each other and a single information space of the organization is not formed. Processing organizations and large agricultural holdings that also have processing facilities have experience in the implementation and use of corporate information systems in integration with the management enterprise systems (MES). These are the projects of such companies as Chernozemye INTECO, 1C: Rarus, Galaxy Corporation, etc. Agricultural organizations almost do not use corporate information systems (Federal State Statistics Service, 2020).

The national platform for digital public administration of agriculture, the concept of which is outlined in the Digital Agriculture departmental project, includes a digital sub-platform of agricultural producers, i.e. the Agro Solutions module. The project specifies the already implemented subsystems of this module, such as Electronic trading platform and Personal account of an agricultural producer. The trading platform is designed to provide an opportunity for agricultural producers to sell their products using the Internet. Personal account allows performing financial modeling, forecasting business activities, accomplishing electronic document management and executing some other applications. In addition, the project stipulates that “functional and technical requirements for the AgroSolutions module have been developed”, however, specific functional modules or subsystems are not described.

In our opinion, it is possible to use corporate information systems operating according to formalized ERP and EBC management standards as functional subsystems of the AgroSolution module for an agricultural organization. These should be domestic developments included in the unified register of Russian software for computers and databases (Decree No. 1236, 2015). The Digital Agriculture departmental project also emphasizes the need to use domestic software. So, if, in 2018, the share of investments for the purchase of domestic projects was one fifth of the total investment for the purchase and implementation of digital technologies, then it should increase to 80% by 2024 (Gordeev et al., 2019). These can be domestic ERP class software products from 1C and its partners, such as 1C: Enterprise 8. ERP Agroindustrial Complex 2, 1C: ERP Enterprise Management, as well as projects from other domestic manufacturers (Galaktika ERP from Galaxy Corporation, Compass from Compass, etc.). When choosing software, it is necessary to take into account, apart from the cost, the fact that the developer has industry solutions, an opportunity of cloud work, and a built-in development environment with low-code technology, which allows the user who is not a professional programmer to make the required changes. It is also required to take into account the territorial location of the developer's representative office to provide maintenance of the software product and the possibility of remote maintenance, which is especially important for the new economic conditions in and after the pandemic. In addition, an important criterion is an opportunity of a phased acquisition of the information system.

Due to the fact that the new era of using ERP systems is flexible, open, platform and cloud one, it is possible to use composite systems obtained by combining various software products. A corporate information system can be built as a combination of business applications that use their own databases. But the presence of a database integration mechanism eliminates the problems associated with various sources of information. Information systems and technologies used at different levels of organization management can be combined. Transactional data processing systems and information management systems working with a database and implementing On-Line Transaction Processing (OLTP) can be used at the operational and tactical levels of management. Decision support systems or information and analytical systems operating with data storage and On-Line Analytical Processing (OLAP) and technologies for finding hidden patterns in Data Mining can be a means of automating business management processes at a strategic level.

The integration of applications from different manufacturers is provided by a special software application, i.e. the Enterprise Service Bus (ESB). The use of an ESB will allow removing the problems of patchwork automation and ensuring the construction of composite corporate information systems. The

integration bus can also be used for interaction of the proposed corporate information systems or their individual components with the already developed applications of the AgroSolutions module, Smart Field, Smart Farm, etc.

7. Conclusion

Current corporate information systems are built according to ERP management standards and the EBC concept (Enterprise Business Capabilities). The system has a flexible and a customizable cloud architecture that includes a core and a technological platform that allows individual applications to integrate into the system and access data. Currently, corporate information systems in agricultural organizations are practically not used. They are used in large agricultural holding structures having processing facilities. The author's suggestions consist in recommendations for the use of corporate information systems as components of the AgroSolution module. At the same time, based on the up-to-date architecture of corporate information systems, it is possible to combine various applications including those for different management levels along with integration through the enterprise service bus between themselves and with the developed subsystems of the AgroSolutions module of the Digital Agriculture departmental project. The purpose of the project, as mentioned, is to increase labor productivity in agriculture and reduce the cost of agricultural products, which contributes to ensuring the country's food security.

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