



## The Use of Digital Technologies to Improve the Information Support of Agricultural Enterprises

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**Abstract.** The use of digital technologies affects all stages of agricultural production, transforming and improving business processes, models, and structures. In this regard, the efficiency of implementing the digital platform in the strategic development of an agricultural enterprise is an urgent scientific task. The purpose of this research is to develop practical recommendations for improving the information support of agricultural enterprises in conditions of digitalization based on the elaboration of the digital platform for the agro-industrial complex. The research is methodologically based on a systematic approach, methods of analysis and ITIL-based modeling. As part of the research, an organizational and economic mechanism has been developed to improve the information support of an agricultural enterprise in conditions of digitalization, the main components of which are the ITIL methodology and the ITSM-based management approach, material and technical, personnel, scientific and information consulting, and financial and economic support. Application of the organizational and economic mechanism developed will significantly facilitate the elaboration of similar projects. The authors have developed the model of the digital platform for the agroindustrial complex of the Komi Republic, which includes the necessary modules, with the prospect of subsequent strategic development based on the introduction of Digital Twins Technology. Operation of the digital platform proposed will make it possible to proactively use best practices, optimize the resources used in production, expand the agricultural producers' access to information on markets and prices, enhance the authorities' interaction with various economic entities, and ensure digital literacy among industry workers.

**Keywords:** Agriculture; Digitalization; Digital technologies; Digital platforms; Information support

### 1. Introduction

Agriculture, industry, services, and innovations using digital technologies are key factors determining global economic growth. Currently, agriculture is seen as an integral part of the value chains underlying the economy, providing inestimable services to society, ensuring food supply security, stability, and strengthening the economies of all countries. Leading economists note in their studies that agricultural efficiency growth is focused on the development of economic, environmental, and social sustainability and its management systems, which meet the requirements of improving the population's level and quality of

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life (Zaytsev et al., 2021). Advances in technology have changed the modern way of life, eating habits, perception, and awareness of some environmental problems, so agriculture today should be directly related to the issues of digitalization. There are several reasons why it will be very important for agriculture to be digital in the future, since by transforming, it ensures not only the sustainability of the agricultural business individually, but also the agroindustrial complex (AIC) as a whole (Adzhiyan et al., 2021). It is necessary to agree with the studies conducted, which note that, for the purpose of effectively solving these problems, introducing digital technologies is recommended to increase productivity and reduce food safety risks (Nasirahmadi & Hensel, 2022; Shkarupa, 2020). In terms of long-term development, digitalization of the agroindustrial complex is the process of introducing digital transmission systems at the primary network level and switching and control facilities at the secondary network level that ensure the transmission and distribution of information flows in digital form. The main objective of the digitalization program is to create an ecosystem for the digital development of agriculture. Researching the key foundations of forming the ecosystem is carried out on the materials of the Komi Republic. The purpose of this research is to develop practical recommendations for improving the information support of agricultural enterprises in conditions of digitalization based on the elaboration of the digital platform for the agroindustrial complex.

To achieve this objective, the following tasks were solved in the course of the research:

- To form the organizational and economic mechanism for improving the information support of an agricultural enterprise in conditions of digital transformation.
- To develop the model of the digital platform for the agroindustrial complex of the Komi Republic, applying the ITIL methodology and the ITSM-based management approach.
- To consider the prospects of using the digital twin for implementing the innovative sustainable business model of manufacturing and selling agricultural products in the Komi Republic.

The scientific novelty of the research lies in the systematization of existing digital technologies for improving the information support of agricultural enterprises by developing the digital platform for the agroindustrial complex, based on application of the ITIL methodology and the integrated approach to ITSM-based management. The object of the research is organizations engaged in agricultural activities and authorities in charge of the agroindustrial complex in the Komi Republic. The subject of the research is the process of modeling the digital platform of the agroindustrial complex, based the application of the ITIL methodology and an integrated approach to ITSM-based management.

## 2. Literary Review

The scientific community and government agencies agree that further economic innovation is needed to prepare the country for the new technological paradigm. In most studies, the authors note that it is not possible to transit to the subsequent technological paradigm and implementation of progressive technologies with morally and physically worn-out equipment (Zhumaxanova et al., 2019). It should be noted, however, that a number of issues related to the development and implementation of integrated approaches to solving the problems of digital transformation of the agroindustrial complex and assessing the prospects for applying various digital technologies remain in the stage of developing rational management mechanisms aimed at overcoming digital development constraints and providing appropriate information support for agricultural enterprises. (Egorov et al., 2021).

Meanwhile, a number of provisions related to evaluating the conditions for initiating application of information and communication technologies, and understanding the

prospects for digitalization of agriculture remain incomplete, are debatable, and need additional research (Adzhiyan et al., 2021; Zhilenkova et al., 2019). Thus, with all the variety of studies on the innovative development of agriculture, the published works lack a comprehensive approach to substantiating specific areas for elaborating the information support for agricultural enterprises in conditions of modern transition to the digital economy based on the application of digital technologies (Kukharev et al., 2021; Marcu & Vulpe, 2020). The scientific foundation of the research is areas of agricultural technological re-equipment in transition to digital development (Nasirahmadi & Hensel, 2022), which will not only develop the agroindustrial complex on modern innovative and digital foundations but also ensure the appropriate level of food safety in the country's difficult economic situation.

At the moment, a fairly large number of ITSM systems are on the market, including: 1. ITSM 365 is a product line that provides tools for automating various information support services. By 2020, ITSM 365 had been integrated with the applications for Remote Desktop AnyDesk, TeamViewer; integration with Telegram and Viber messengers appeared; integration with Zoom appeared; and automatic subscription to an application from a letter appeared. The functionality of the ITSM system includes knowledge bases, response templates, E-mail integration, file attachments, ticket priorities, ticket statuses, access control, comments, self-service portal, surveys, reporting and performance analytics, problem management, configuration management, IT management – assets (Barafort et al., 2002). 2. Service creation. Service Creatio is a comprehensive solution for managing internal and external services, speeding up the service process, and increasing customer satisfaction (Amalia et al., 2022). 3. Naumen Service Desk. Web-based system for IT infrastructure management. Supports 15 ITIL processes. Flexible customization options for the user interface and business processes. There is a SaaS version. 4. IntraService. IntraService is a system for accounting applications with a web interface. IntraService is great for ticket processing, general task setting, a full-fledged service desk, or outsourced services. 5. Itilium. Itilium is a service desk class system, designed to automate support processes and provide IT services in accordance with the process model for IT organization best practices. 6. vsDesk. vsDesk is a service desk (help desk) system for automating the work of both an internal IT department and an external Technical Support Service. 7. ServiceNow. SaaS service for managing IT infrastructure for medium and large businesses. There is a Russian interface and documentation (Moudoubah et al., 2021). There are partners in Russia. 8. InfraManager. The InfraManager software solution, created in 1999, is still a multifunctional platform for automating ITSM processes: from the Service Desk to managing and monitoring IT infrastructure (Barafort et al., 2002). Based on the results of comparisons of the pros and cons of systems, we have two candidates: IntraService comes first; in second place is Itilium. Next, a vote was held, a customer survey was conducted within one working day, and it was found that the most attractive of the two systems is the IntraService ITSM system, since it has more advantages compared to competitors, is more popular according to the popularity graph given in the system overview, and appearance has become an important factor in comparing systems. Due to the fact that not all client companies actively use 1C, the interface of this ITSM system is not simple and understandable for all users. This indicates the need for developing methodological tools, selecting priority areas of information support for agricultural enterprises based on achievements of scientific and technological progress, and application of integrated digital platforms, to increase their efficiency, which determined the relevance of the research theme.

### 3. Methods and Materials

The methodological basis of the research was the systematic approach that provided the opportunity for targeted and comprehensive studies of the main types of existing digital platforms in agriculture.

In the course of the research, the following methods were applied:

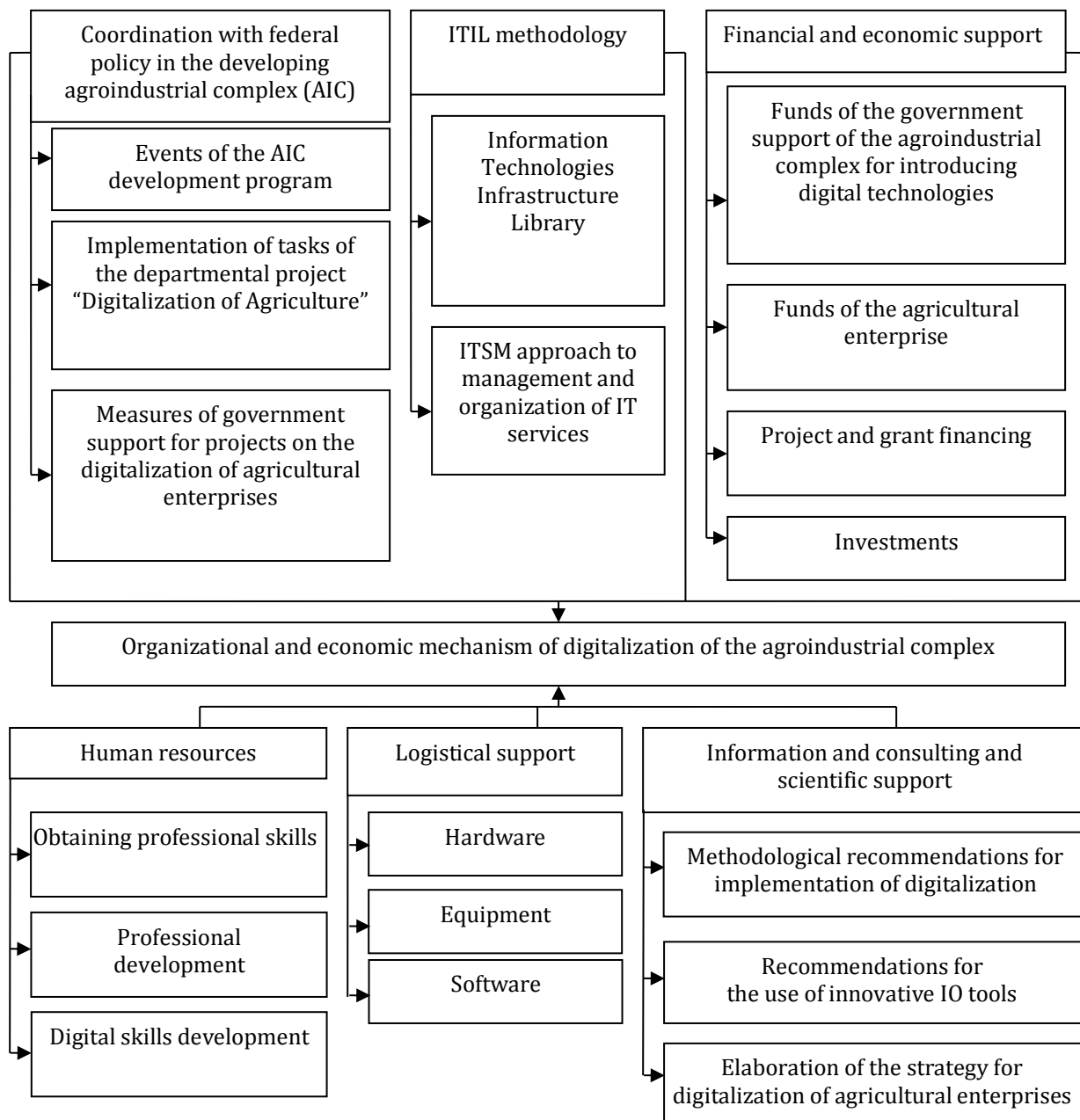
- analysis, in which the studied process of modeling the agroindustrial complex's digital platform was considered on the basis of promising, subsequent application of Digital Twins Technology, and allocation of its key blocks for consideration.

- the ITIL modeling method, which describes processes, procedures, tasks, and checklists that are not specific to an agricultural organization but can be used to integrate with the organization's value-added strategy and maintain a minimum level of competence. The basis comprises practice-oriented studies, in which ITIL is used for demonstrating compliance, and measuring improvement (Anisimov et al., 2022). This process will be implemented by applying the information technology infrastructure library, which is a set of detailed practices for managing digital services (ITSM or IT Service Management), with its focus on harmonizing digital services with the needs of agricultural enterprises.

The practical novelty lies in the use of the IntraService software product for agricultural organizations. Stages of implementing an ITSM system based on this software product: 1. Deployment of the system on the server of the company "Optimal Service"; 2. Transferring data from the current database to the new ITSM system; 3. Domain setting; 4. Debugging network access to a resource; 5. Appearance customization; 6. Setting permissions; 7. Alert settings; 8. Integration with mobile devices; 9. Integration and configuration of telephony; 10. Training; 11. Transfer system to offline mode. The data of the Federal State Statistics Service, the Ministry of Agriculture and Food of the Komi Republic served as the information and empirical base of the research.

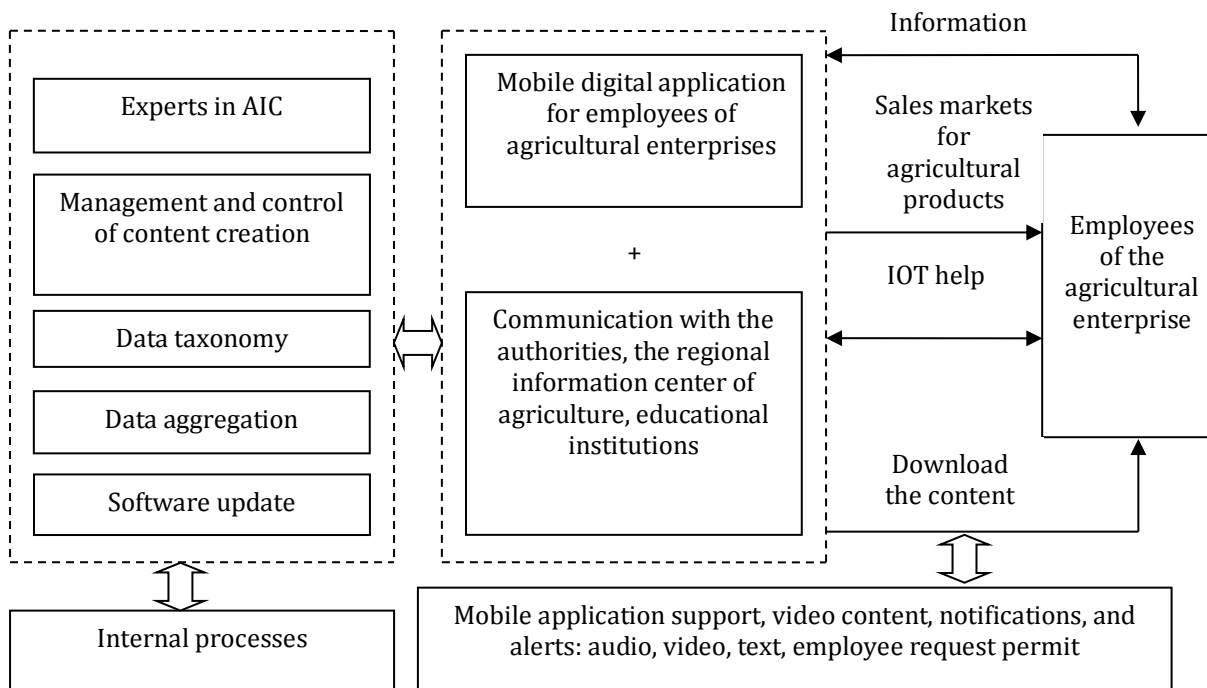
### 4. Results

The digitalization of the agroindustrial complex is focused on improving production efficiency. It is known that the digital economy is based on information resources responsible for the smooth interaction of all elements of the market and its functioning under the influence of external and internal factors (Amirova et al., 2021; Golubev, 2021; Ivanov, 2019). However, it is necessary to note the slow process of digitalization in agriculture; according to most scientific experts, it is associated with the turning period in agricultural development (1998), which reduced the government's influence in this area (Karpushova et al., 2022; Abramov et al., 2021). The digitalization of the agroindustrial complex should be based on the elaboration of the multi-level single digital platform (SDP), and integrated with the state management platform for developing the agroindustrial complex and ensuring the country's food security (Lisina et al., 2022; Zaytsev et al., 2021). For increasing the efficiency of digitalization of agricultural enterprises in the Komi Republic, the organizational and economic mechanisms for developing agricultural enterprises by introducing digital technologies were proposed (Figure 1). This application will allow for establishing two-way communication with personnel of agroindustrial enterprises. Figure 2 shows the developed model of the digital platform of the agroindustrial complex in the Komi Republic. The mobile digital application block includes two clusters: solving production issues; ensuring communication with management bodies and organizations providing information, consulting, and educational services.



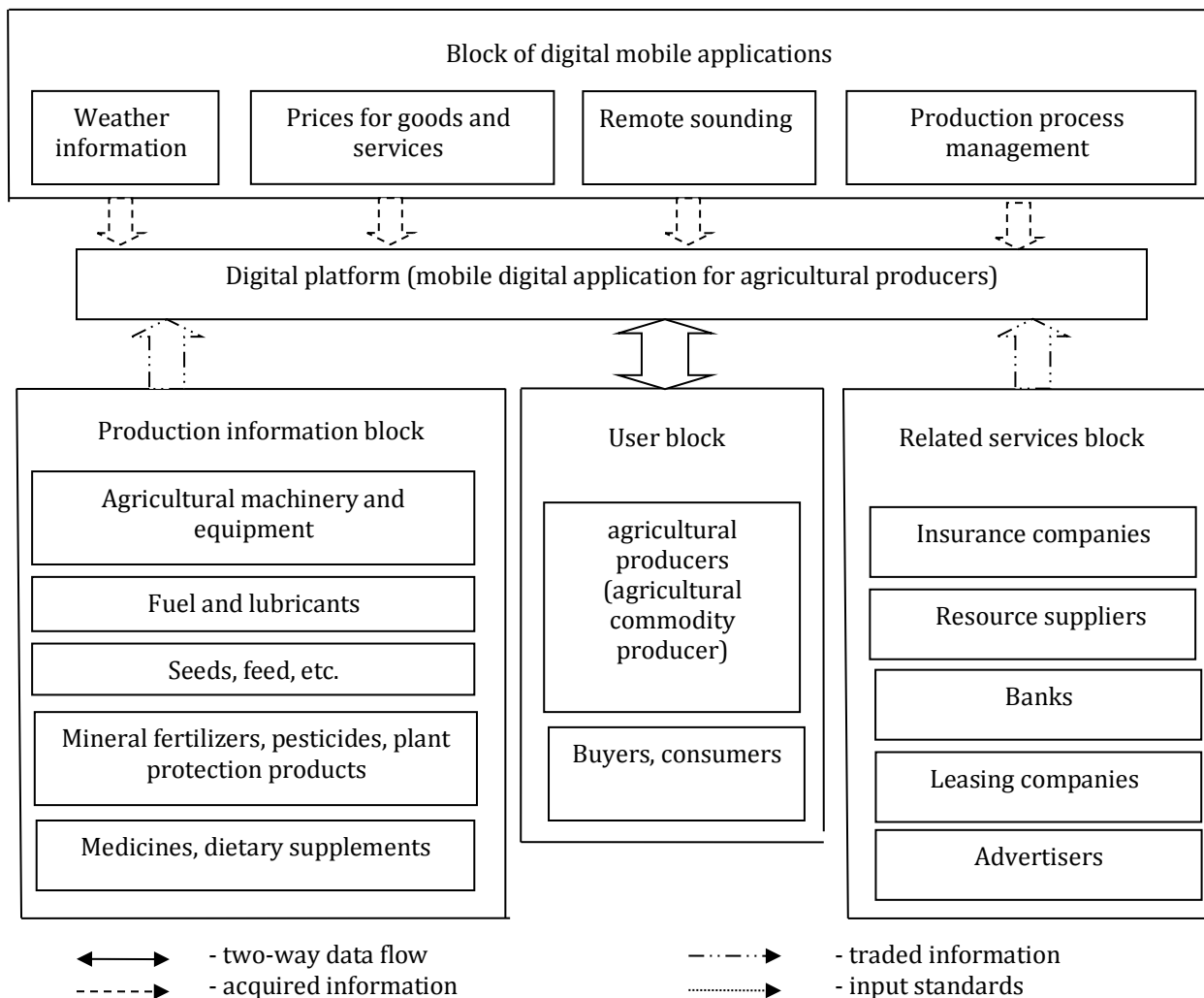
**Figure 1** Organizational and economic mechanisms for improving the information support of an agricultural enterprise in conditions of digitalization

Figure 3 shows the diagram of such a platform with possible data flows. It can be seen from the presented scheme that an increase in the number of participants from different fields of activity, using digital platforms, will allow collecting large arrays of structured and aggregated information, which will contribute to improving the quality of management decisions made and forecasts compiled. The large block of the proposed digital platform of the agroindustrial complex of the Komi Republic is the application responsible for communication with regional authorities, the regional agricultural information center, and educational organizations (Figure 4).



**Figure 2** The scheme of the digital platform of the agroindustrial complex of the Komi Republic

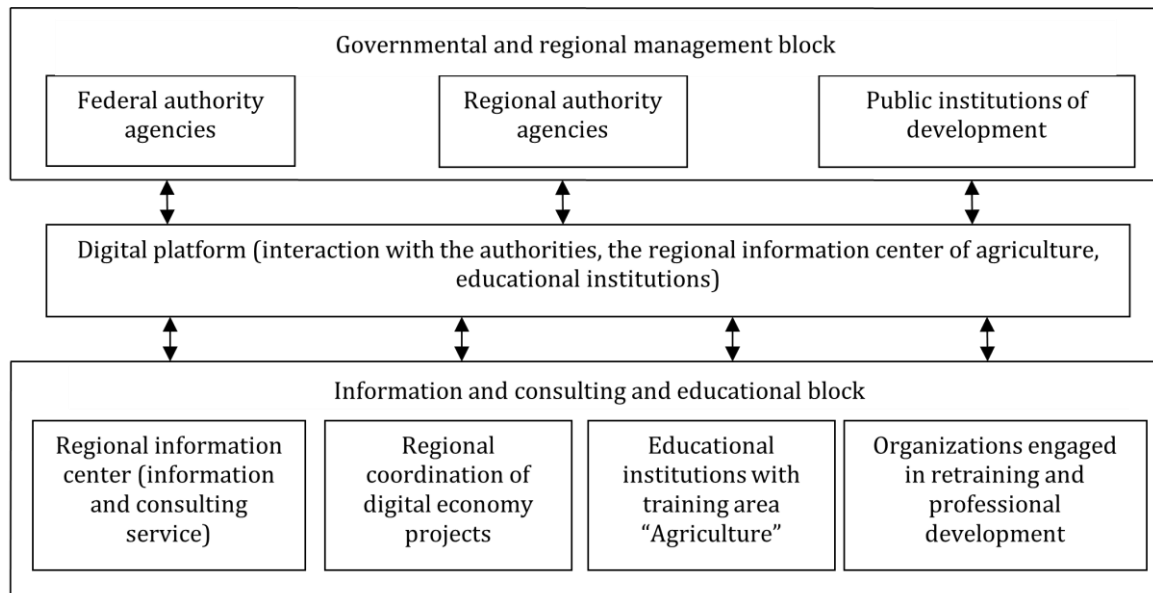
User requirements will be summarized by the cloud-based digital platform. In the mode of real-time interaction with the authorities, the regional information center for agriculture, and educational organizations, the decision will be formed through competition, and then partners on the platform will provide appropriate resources for the implementation of agricultural production. During this period, users can see the entire production process. Communication between platforms and information resources sharing allows saving much work and material resources, as well as giving new public and environmental benefits. In combination with the level of sustainable business models, we see the link between the network of platforms and the sustainable development of the region. The digital platform of the agroindustrial complex of the Komi Republic is focused on public interaction and undermines traditional e-commerce, seeking to create an Internet of Things platform that unites agricultural commodity producers, solutions for relevant state and regional authorities. This technology begins with the most basic sensors, which are placed in various, remote locations, and converts any impact (physical or otherwise) into digital signals. The data is then routed through networks (wireless and wired), protocols, and interference and superimposition of electromagnetic waves until it reaches the Internet. From the Internet, these data (data packets) are transmitted to cloud storage or to the data processing center via different channels. The resulting digital platform simulates sequences of states, then their specifications, then functional relations between states during operation, and finally simulates the change of states by calculating functional dependencies. The presented development for regional practice under changing conditions should allow proceeding to the synthesis of the information actions specifications, when functioning in changing conditions of agricultural development. The elements of this conception are concepts and principles that allow setting meta-models for forming the outcomes of various types of actions, including informational actions, transitional actions from one functioning to another, implemented by using informational actions.



**Figure 3** The scheme of the mobile digital application for agricultural commodity producers and data flows going through it

Thus, digitalization leads to changing (improving) organizational functioning and, further, should lead to improving the operational properties of information technology applications. When data is used in this manner, it is used to implement new activities that have not previously been implemented (to increase involvement in activities, make changes to activities that have already been implemented or are currently being implemented, and implement repeatable activities. Thus, the target result of the data use is the alternation of activities and the involvement of new objects and subjects in the activities, or the expansion of agricultural commodity producers' activities. To calculate the economic efficiency of the implementation project, it is necessary to evaluate the initial investment in the project. SRR, or a simple rate of return, shows how much additional profit each ruble of investment costs for the implementation, development of a digital platform brings.  $NP1 = (832900 - 274300 - 62400) \times 12 = 5954400$  (net profit before implementation);  $NP2 = (888701 - 218499 - 6599) \times 12 = 7963236$  (net profit after implementation);  $SSR = (7963236 - 5954400) / 477500 = 4.02$  rubles/year. Thus, each ruble of investment costs, invested in the project for the implementation of the ITSM system brings 4.02 additional profit per year. PP - simple payback period shows how much planning intervals will pay off implementation.  $PP = 477500 / (7963236 - 5954400) = 0.2$  year.





**Figure 4** The scheme of the digital platform of the agroindustrial complex of the Komi Republic (block “Communication with authorities, the regional information center of agriculture, educational organizations”)

This digital platform can be considered cost-effective, since the payback period is only 2.4 months, after which it will begin to generate net profit. Due to the detection of hidden connections and data processing, they can increase the efficiency of the equipment's use. To strengthen the design of raw material costs and the schedule of agricultural output. The digital business process is a process, the results of which are largely determined by digital technologies.

## 5. Discussion

In the course of the research conducted, the following results were obtained:

- the organizational and economic mechanism for improving the information support of an agricultural enterprise in conditions of digitalization, which is fundamentally different from the one previously proposed by other authors (Inshakova et al., 2022; Babkin et al., 2021), has been formed. We have identified as main components the ITIL methodology and the ITSM-based management approach, logistical, personnel, scientific, information, and consulting support, financial and economic support.

- The model of the digital platform for the agroindustrial complex of the Komi Republic, which includes necessary blocks, has been developed. The first block provides internal processes and includes subsystems related to expertise, management and control of content creation, data systematization and aggregation, and software improvement. The second block consists of applications responsible for production processes, communication with management bodies, information and consulting enterprises, and educational institutions. Our approach to the elaboration of the digital platform for the agroindustrial complex of the Komi Republic, based on the ITIL methodology and the ITSM-based management approach, makes it possible to significantly facilitate development of similar projects. In contrast to the studies conducted (Valiyev et al., 2022), this original elaboration assumes in its composition necessary innovative solutions that will optimize resources used in production, expand the access of agricultural commodity producers to the data on markets, prices, government policy, increase the level of interaction with authorities and various economic entities.



## 6. Conclusions

The functioning of the proposed digital platform will make it possible to actively use best practices, optimize resources used in production, expand access for agricultural commodity producers to data on markets, prices, and government policy, increase the level of interaction with authorities, suppliers, and consumers, ensure digital literacy among industry workers, etc. According to the calculations of developers of digital technologies and expert assessments, digitalization of the agroindustrial complex will help reduce the amount of operating costs in production of certain types of agricultural products by 20-40%, increase crop yields and animal productivity by 15-25%, and increase labour productivity by 1.5-2.0 times. Based on the network of digital twin platforms, agricultural enterprises can carry out intelligent modernization of equipment, create intelligent production lines, as well as decision-making systems in workshops and intelligent supply chains, for the purpose of ensuring efficiency and reliability in planning and managing the production system in the agroindustrial complex.

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## References

- Abramov, Y.V., Zemskov, Y.V., Kochetkova, E.V., 2020. Prospects for Legal Regulation of the Digitalization Development Program of the Agriculture and Food Industry in the Russian Federation. *International Journal of Psychosocial Rehabilitation*. Volume 24(6), pp. 5051–5060
- Adzhiyan, P.S., Ilicheva, O.V., Kuchin, S. V., Adzhiyan, P.S., 2021. Evaluating the Effectiveness of Digitalization in Agriculture. *Studies in Systems, Decision and Control*, Volume 283, pp. 559–565
- Amalia, A., Fajrillah, N., Lubis, M., Syam, I., 2022. Organizational Architecture and Service Delivery Re-Alignment based on ITIL and TOGAF: Case Study of the Provincial Development Bank. *International Journal of Advanced Computer Science and Applications*, Volume 13(4), pp. 496–508
- Amirova, E.F., Gavriilyeva, N.K., Grigoriev, A.V., Sorgutov, I.V., 2021. Digitalization in Agriculture: Problems of Implementation. *Siberian Journal of Life Sciences and Agriculture*, Volume 13(6), pp. 144–155
- Anisimov, A.P., Inshakova, A.O., Ryzhenkov, A.J., 2020. On the Development of Digital Technologies in Agriculture of the Russian Federation Federations: Legal aspect. *Lecture Notes in Networks and Systems*, Volume 110, pp. 375–381
- Babkin, A., Glukhov, V., Shkarupeta, E., Kharitonova, N., Barabaner, H., 2021. Methodology for Assessing Industrial Ecosystem Maturity in the Framework of Digital Technology Implementation. *International Journal of Technology*. Volume 12(7), pp. 1397–1406
- Barafort, B., Renzo B. Di, Merlan O., 2002. Benefits Resulting from the Combined Use of ISO/IEC 15504 with the Information Technology Infrastructure Library (ITIL). *Lecture Notes in Computer Science*, Volume 2559, pp. 314–325
- Egorov, N., Babkin, A., Babkin, I., Yarygina, A., 2021. Innovative Development in Northern Russia Assessed by Triple Helix Model. *International Journal of Technology*. Volume 12(7), pp. 1387–1396

- Golubev, A.V., 2021. The Perception of Digital Technologies by Agrarians as a Condition for Innovative Development of the Agriculture. *Lecture Notes in Networks and Systems*, Volume 280, pp. 30–38
- Inshakova, A.O., Ryzhenkov, A.Y., Pon'ka, V.F., Davudov, D.A., 2022. Current Issues of Agriculture Digitalization in the Russian Federation. *Smart Innovation, Systems and Technologies*, Volume 288. pp. 125–135
- Ivanov, A.L., 2019. Scientific-Technological Development of Land Use on the Basis of Digital Technologies in Agriculture. *Herald of the Russian Academy of Sciences*, Volume 89(2), pp. 199–200
- Karpushova, S.E., Bazieva, A.M., Fomenko, N.M., Akopova, E.S., 2022. Benefits of Circular Agriculture for the Environment: International Experience of Using Digitalization and Higher Education Development. *Environmental Footprints and Eco-Design of Products and Processes*. Springer, Singapore
- Kukharev, O., Fudina E., 2021. Formation and Implementation of the Agriculture Sustainable Development Strategy Under Economy Digitalization Conditions. *Scientific Papers-Series E-Land Reclamation Earth Observation & Surveying Environmental Engineering*, Volumr 10, pp. 89–93
- Lisina, L.M., Giyazov, A.T., Dubova, Y.I., 2022. Agriculture in Developing Countries: Cultural Differences, Vectors of Sustainable Development, Digitalization, and International Experience. *Environmental Footprints and Eco-Design of Products and Processes*. Springer, Singapore
- Marcu, I.A., Vulpe, A.M., 2020. Arrowhead technology for digitalization and automation solution: Smart Cities and Smart Agriculture. *Sensors*, Volume 20(5) p. 1464
- Moudoubah, L., Yamami, A.E, Mansouri, Qbadou, K.M. 2021. From IT Service Management to IT Service Governance: An Ontological Approach for Integrated use of ITIL and COBIT Frameworks. *International Journal of Electrical and Computer Engineering*, Volume 11(6), pp. 5292–5300
- Nasirahmadi, A., Hensel, O., 2022. Toward the Next Generation of Digitalization in Agriculture Based on Digital Twin Paradigm. *Sensors*, Volume 22(2), p. 498
- Shkarupa, E.A., 2020. The Transformation of Agriculture in the Context of the Economy Digitalization in Order Ensure the Competitiveness of Modern Russia. *Lecture Notes in Networks and Systems*, Volume 110, pp. 173–182
- Valiyev, A., Rustamov, F.V.O., Huseynova, R.A., Orujova, M.S., Musayeva, S.N., 2022. The Digitalization Effectiveness as an Innovative Factor Development of the Agriculture in Azerbaijan. *Journal of Eastern European and Central Asian Research*, Volume 9(2), pp. 194–205
- Zaytsev, A., Dmitriev, N., Rodionov, D., Magradze, T., 2021. Assessment of the Innovative Potential of Alternative Energy in the Context of the Transition to the Circular Economy. *International Journal of Technology*. Volume 12(7), pp. 1328–1338
- Zhilenkova, E., Budanova, M., Bulkhov, N., Rodionov, D., 2019. Reproduction of Intellectual Capital in Innovative-Digital Economy Environment. *IOP Conference Series: Materials Science and Engineering*, Volume 497(1), p. 01206
- Zhumaxanova, K.M., Yessymkhanova, Z.K., Yessenzhigitova, R.G., Kaydarova A.T., 2019. The Current State of Agriculture Digitalization: Problems and Ways of Solution. *Central Asian Economic Review*, Volume 5(128), pp. 144–155