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DIGITAL MODEL OF MATERIAL RESOURCES MANAGEMENT IN AGRICULTURE IN BELARUS

Problem statement. The accelerated development of the digital economy involves making proactive decisions to minimize the risks and threats of the new business format to the efficiency of the agricultural industry. *Purpose of article.* Specify key directions of development of digital technologies in the management of material resources and financial flows, to justify the risks and threats when implementing a digital control models, identify key factors in the transition moving to digital. *The object of research* is the management of material resources in the context of the development of the digital economy. *Methods used in research.* The theoretical and methodological basis for research was the work of scientists on the development of the digital economy and the management of material resources in agriculture. In the course of research, the following methods were used: monographic, abstract-logical, synthesis and system analysis, etc. *The hypothesis of the study.* The development of electronic and digital systems and models of material resource management in comparison with traditional ones has a wide range of features, barriers and opportunities. *Presentation of the main material.* The development of digital technologies in agriculture is fragmented. The implementation of effective digital systems for managing material resources involves responding to and anticipating risks and barriers at the stage of transition from traditional to electronic models. *Originality and practical value.* The scientific novelty of the research is to systematize and supplement the scientific basis for the development of digital models of material resource management in agriculture, which subsequently contributes to the development of the concept of "Intellectualization of agribusiness in the Republic of Belarus" in terms of material resource management. *Conclusions.* The implementation of an effective system for managing material resources in agriculture in Belarus in the context of the digital economy is possible by drawing up road maps for parallel digitalization of all sectors of the national economy, which contains opportunities, risks, and barriers to implementing electronic business models.

Key word:
agriculture, digital economy, management, material resources, efficiency.

ЦИФРОВА МОДЕЛЬ УПРАВЛІННЯ МАТЕРІАЛЬНИМИ РЕСУРСАМИ В СІЛЬСЬКОМУ ГОСПОДАРСТВІ БІЛОРУСІ

Постановка проблеми. Прискорений розвиток цифрової економіки передбачає прийняття проактивних рішень, що дозволяють мінімізувати ризики і загрози нового формату ведення бізнесу на ефективність аграрної галузі. *Мета статті.* Конкретизувати ключові напрямки освоєння цифрових агротехнологій при управлінні матеріальними ресурсами і фінансовими потоками, обґрунтувати ризики і загрози при впровадженні цифрових моделей управління, виявити ключові чинники переходу електронної моделі в цифрову. *Об'єкт дослідження* – управління матеріальними ресурсами в умовах розвитку цифрової економіки. *Методи, використані в дослідженнях.* Теоретичною і методичною основою для досліджень послужили праці вчених з питань розвитку цифрової економіки та управління матеріальними ресурсами в сільському господарстві. У процесі досліджень застосовувались такі методи: монографічний, абстрактно-логічний, синтезу і системного аналізу та ін. *Гіпотеза дослідження.* Освоєння електронних і цифрових систем і моделей управління матеріальними ресурсами в порівнянні з традиційними має широкий перелік особливостей, бар'єрів і можливостей. *Виклад основного матеріалу.* Освоєння цифрових технологій в сільському господарстві носить фрагментарний характер. Реалізація ефективних цифрових систем управління матеріальними ресурсами передбачає реагування та попередження ризиків і бар'єрів на стадії переходу від традиційних до електронних моделям. *Оригінальність і практичне значення дослідження.* Наукова новизна дослідження полягає в систематизації та доповнення наукових основ освоєння цифрових моделей

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управління матеріальними ресурсами в сільському господарстві, що в подальшому сприяє вироб-ленню концепції «Інтелектуалізація агробізнесу в Республіці Білорусь» в частині управління ма-теріальними ресурсами. *Висновки та перспективи подальших досліджень.* Реалізація ефективної системи управління матеріальними ресурсами в сільському господарстві Білорусі в умовах розвитку цифрової економіки можлива шляхом створення дорожніх карт паралельної цифровізації всіх сек-торів національної економіки, в яких закладені можливості, ризики, бар'єри реалізації електронних моделей ведення бізнесу.

Ключові слова:
сільське господарство, цифрова економіка, управління, матеріальні ресурси, ефективність.

ЦИФРОВАЯ МОДЕЛЬ УПРАВЛЕНИЯ МАТЕРИАЛЬНЫМИ РЕСУРСАМИ В СЕЛЬСКОМ ХОЗЯЙСТВЕ БЕЛАРУСИ

Постановка проблемы. Ускоренное развитие цифровой экономики предполагает принятия проактивных решений, позволяющих минимизировать риски и угрозы нового формата ведения биз-неса на эффективность аграрной отрасли. *Цель статьи.* Конкретизировать ключевые направления освоения цифровых агротехнологий при управлении материальными ресурсами и финансовыми по-токами, обосновать риски и угрозы при внедрении цифровых моделей управления, выявить ключе-вые факторы перехода электронной модели в цифровую. *Объект исследования* – управление мате-риальными ресурсами в условиях развития цифровой экономики. *Методы, используемые в исследо-ваниях.* Теоретической и методической основой для исследований послужили труды ученых по во-просам развитию цифровой экономики и управления материальными ресурсами в сельском хозяй-стве. В процессе исследований применялись следующие методы: монографический, абстрактно-логический, синтеза и системного анализа и др. *Гипотеза исследования.* Освоение электронных и цифровых систем и моделей управления материальными ресурсами по сравнению с традиционными имеет широкий перечень особенностей, барьеров и возможностей. *Изложение основного материа-ла.* Освоение цифровых технологий в сельском хозяйстве носит фрагментарный характер. Реализа-ция эффективных цифровых систем управления материальными ресурсами предполагает реагирова-ние и упреждение рисков и барьеров на стадии перехода от традиционных к электронным моделям. *Оригинальность и практическое значение.* Научная новизна исследования заключается в системати-зации и дополнении научных основ освоения цифровых моделей управления материальными ресур-сами в сельском хозяйстве, что в последующем способствует выработке концепции «Интеллектуа-лизация агробизнеса в Республике Беларусь» в части управления материальными ресурсами. *Выво-ды.* Реализация эффективной системы управления материальными ресурсами в сельском хозяйстве Беларуси в условиях развития цифровой экономики возможна путем составления дорожных карт параллельной цифровизации всех секторов национальной экономики, в которых заложены возмож-ности, риски, барьеры реализации электронных моделей ведения бизнеса.

Ключевые слова:
сельское хозяйство, цифровая экономика, управление, материальные ресурсы, эффективность.

Formulation of the problem. Studies show that digital technologies have been widely introduced abroad and have been actively mas-tered over the course of several years: global po-sitioning systems (GPS, GLONASS, GALILEO), geographic information systems (GIS), yield as-sessment technologies (Yield Monitor Technol-ogies), variable rate technology (Variable Rate Technology), systems for identifying farm ani-mals using RFID tags, a system of electronic veterinary certification, systems for automatic regulation of microclimate and control of harm-ful gases, data analysis systems, decision-making assistant applications, insurance system, banking services, etc. Scaling of these technolo-gies in the Republic Belarus, with a focus on creating digital mechanisms for managing mate-rial resources, financial flows, requires a deep study of the issues of determining the features and identifying the risks of their development, which predetermines the relevance of research.

Analysis of the latest trends and publi-cations. The theoretical and methodological ba-sis for the research was the works of scientists on the management of material resources in ag-riculture (V. Gusakov, V. Belsky, K. Shebeko, V. Buts, A. Shpak, M. Zhudro, S. Konstantinov, I. Lenkov, V. Belsky, Y. Brechko, A. Gorbatovsky and others) and the development of digital tech-nologies (S. Ablameiko, M. Batura, T. Belyat-skaya, V. Budanov, G. Golovenchik, V. Gusakov, R. Grigyanets, M. Kaluzhsky, A. Keshelava, M. Kovalev, B. Panshin, S. Plugo-tarenko, V. Rumyantsev, I. Sokolov, A. Tuzikov,

A. Engovatova and others). The information base for the research was the normative legal acts of the Republic of Belarus, individual data of farms.

It has been established that the current stage of economic development of the Republic of Belarus is characterized by the accelerated introduction of TI-technologies into production and management processes in all spheres of the economy, and in the agro-industrial complex. IT innovations are actively supported at the state level: adopted and implemented: State program for the development of the digital economy and information society for 2016–2020; subprogram VII "Technical re-equipment and informatization of the agro-industrial complex" of the State program for the development of agricultural business in the Republic of Belarus for 2016–2020; Decree of the President of the Republic of Belarus dated December 21, 2017 No. 8 "On the development of the digital economy", Decree of the President of the Republic of Belarus dated June 18, 2018 No. 239 "On measures to implement Decree No. 8"; developed and adopted national statistical indicators of the development of the digital economy in the Republic of Belarus, which are monitored by the National Statistical Committee of the Republic of Belarus; the State information system for identification, registration and traceability of animals and products of animal origin (GIS "AITS") and functional complexes (subsystems) "AITS-Traceability" and "AITS-Vetsecurity" and others have been introduced. the enterprise "Design Institute Belgiprozem", the State Committee for Property of the Republic of Belarus; scientists from RUE Institute of Soil Science and Agrochemistry, RUE Institute of Melioration, employees of OneSoil showed themselves directly in agriculture. The effective implementation of these areas in the short term creates a favorable competitive environment due to the hybridization of the IT industry and all sectors of the national economy.

Purpose of the article. Specify the key areas of mastering digital technologies in agriculture in the management of material resources and financial flows, substantiate the risks and threats in the implementation of digital management models, identify the key factors in the transition of electronic to digital model of material resources management in agriculture through "smart" management models.

Presentation of the main research material. The agro-industrial complex of the country is becoming more and more knowledge-intensive, its informatization contributes to an increase in the scale of integration of activities [1-7]. In the near future, within the framework of the implementation of priority areas of scientific research and (or) scientific and technical activities, scientists of the National Academy of Sciences of Belarus will implement the subprograms "Mechanization of agro-processes and" precision "agriculture", "Soil fertility and plant protection", in which significant the impact will be on the development of digital technologies and geographic information systems. At the same time, the agro-economic direction, including the comprehensive digitalization of accounting and accounting systems, has not yet received due attention, which is justified by the role of the functional approach (implementation of the production process itself) in comparison with the process-functional approach (conducting agribusiness in the system of the national economy). At this stage, the introduction of a digital structure is significant, which lays down new standards for resource management in agribusiness, expanding its boundaries. It is assumed that the electronic resource management system with a harmonious connection with other elements of the electronic system (in this case, we have identified the following promising electronic systems and / or subsystems: a logistics system in the agro-industrial complex; an integration subsystem of quality using CALS technology and taking into account the expansion of environmental standards, including within the framework of the joint environmental information system (SEIS); electronic settlement systems, state support for the agro-industrial complex, etc.) will become part of the economic digital system for managing the national economy and business based on the principles of the process approach and hybridization. The practical implementation of this scheme in the agriculture of the Republic of Belarus implies substantiation of the features of material resource management in agriculture in the context of the development of the digital economy (Table 1).

A feature of material resource management in the context of the formation of a digital economy is the mandatory presence of a "temporary" electronic model, which makes it possible to build a system of mutual interfunctional relationships between different agribusiness entities (agricultural producers, financial institutions, food industry organizations, trade, logistics centers, transport companies, etc.) and departmental structures at the level of the national economy.

T a b l e 1

**Features of the implementation of the digital model of material resources management
in agriculture in the short term**

Distinctive Features	Opportunities	Threats
1	2	3
in the global aspect: 1) lack of real opportunity for domestic producers of agricultural products, who have already achieved high results of efficiency and competitiveness (or attaining them) in single or multiple, ele- mental or complex choice of digital organizational and economic mechanisms, platforms and systems of interaction (priority directions were formed by Western agrarians); 2) a global reorientation of the management system, taking into account the need to comply with the requirements and standards of work in the digital business mode, including all business entities and management of the agro-industrial complex; 3) an increase in non-production costs associated with the retraining of personnel, information protection, the purchase of licensed software and technical equipment; 4) reduction of transaction costs; 5) customer-oriented approaches (from the standpoint of both processing organizations and trade structures and the regional market situation in general) to the use of material resources (customer centric); 6) high coordination and consistency on the general trends in the development of the market of material resources and agricultural products; *in the local aspect:* 1) continuous training of agribusiness workers and increasing human resources, taking into account the reorientation of managerial and production work in accordance with the principles of digital systems; 2) strengthening the requirements for discip	• formation and management of large amounts of data in terms of material resources, including their fast and high-quality processing with the specified parameters of analysis, search, correction, etc; • automation of managerial decision making; • adjusting the goals and objectives of long-term and short-term program and target documents at all levels of management in accordance with the results of monitoring material costs, factors and their predetermining conditions; • multivariance of the calculated positions for the use of resources in the sub-complexes of the agro-industrial complex according to several scenarios: adjustment of prices and tariffs for resources; balancing supply and demand for agricultural products and raw materials; application of innovative technologies; climate change in the regions of the country; • structuring data sets in terms of production, availability, trade, use of material resources; • minimization of personal motives and benefits of management personnel when making decisions (for example, in terms of purchasing resources); • efficient pricing for material resources due to the possibility of optimizing the costs of storage, transportation based on the identification of real demand and supply, taking into account the uniqueness of resources; • reducing the time to find the necessary resources in a certain quantity and quality; • expansion of the territorial boundaries of the search for	• complete dependence on the market of Internet resources, its infrastructure, providers, cost of services; • the need for constant updating and synchronization of software and special applications; • significant investment and technological risks in the acquisition, development and operation of software products (for example, failures in the electronic system can completely paralyze primary, accounting, management accounting; purchase of material resources; obtaining government support for the acquisition of certain types of resources, etc.); • the unwillingness of many agricultural specialists to work in the digital economy and the transition to automation of operations and processes within the framework of management functions, including their retraining; • insufficiently wide list of educational, educational-methodical educational complexes and programs for training specialists of digital profile for agriculture; • incomplete substantiation of the categories of new professions that will be in demand in the context of the development of the digital economy; • the need to re-profile the personnel in the agro-industrial complex; • lack of confidence in electronic data storage systems; • low level of information security and the growth of cyber attacks; • work within the strict framework of uniform time and regulatory requirements that do not allow quick adjustment of software tools, taking into account the administrative-territorial, regional and organizational-economic characteristics of the formation of material costs in the sub-complexes of the agro-industrial complex; • high dependence on developers of software tools and tools, even in terms of eliminating the simplest data entry errors; • inability to eliminate input errors, made on the principles of blockchain technology, data on material costs and resources; • the possibility of forming numerous digital platforms of an agricultural profile, which do not allow in the long term to synchronize data on material resources in the context of both states, international regional integration formations, and regions of the country; • laboriousness of development of regulatory and legal documentation, allowing to take into account all force-majeure circumstances associated with the functioning of the material resources management system in the digital mode, especially in terms of the implementation of management functions requiring multi-subject coordination; • the impossibility of adapting certain functions of resource management (due to their chemical, biological

1	2	3
line and order, especially when working with information flows in terms of material resources management; 3) the development of new forms of remuneration, stimulating the rational and careful use of material resources, taking into account the adjustment of labor duties and working conditions, taking into account the eliminated errors when working with data at different stages of their identification; 4) development of digital trade in material resources for agriculture; 5) expanding the list of intermediary services; 6) co-use of information resources and software	partners for the supply and directly suppliers of material resources; • formation of a reliable portrait of the supplier of resources and the distinctive characteristics of its products, taking into account the opinions of actual consumers in the regions of both our country and other countries; • tracking resources, potential for secondary use; • expanding investment opportunities and attracting investors, including by means of crowdfunding, to acquire original assortment positions of material resources and innovative resource-saving technologies; • approval of the internal virtual currency in the agro-industrial complex for mutual settlements; • remote financial support and provision of operations for the acquisition of material resources; • high speed of implementation of management processes with material resources	and physical characteristics and technical and technological features of obtaining agricultural products, especially in the crop production industry) under a single regulation, taking into account the planned intensity and sequence of consumption of material resources by type; • "loss" of narrow specialists in the agrarian profile in terms of in-depth production and economic analysis; • orientation of middle-level management personnel only to automate decision-making; • the lack of the possibility of identifying the subject in the electronic acquisition of material resources: the difficulty with a sufficient degree of reliability in establishing the identity of the partner and the authenticity of electronic documents; labor intensity in comparison with the negotiation process of agreeing the terms of "non-standard" contracts when exchanging electronic documents; • different systems for assessing the qualitative and quantitative characteristics of material resources imported from different countries, using e-commerce tools and the lack of the possibility of their visual assessment; • the difference between the real and the nominal value of an international contract for the acquisition of material resources due to exchange rate differences at the time (the duration may take from several hours to several days) the buyer's money is written off and credited to the seller; • lack of quick tracking of the crediting of funds for the purchased resources due to the large number of purchases through electronic commerce; • high dependence on the development of the digital banking sector of the economy

Source: developed by the author based on [1-7]

It should be noted that the place of the state in the digital system of material resources management is predetermined by the peculiarities of regulating the relationship of business entities when performing transactions on the principles of achieving national security, food independence, import substitution policy, etc. The functions of the state will be: 1) creating conditions for the development of the digital economy (legal base, proper infrastructure in the form of ubiquitous high-speed Internet); 2) maintaining conditions for stable, crisis-free development of the economic system; 3) detection and prevention of threats, implementation of cyber security; 4) elimination of contradictions between the interests of different subjects of the agro-industrial complex.

Analysis of foreign and domestic scientific publications regarding the functioning of electronic and digital control models shows that at the stage of formation of conceptual scientific and practical provisions, it is important to identify and substantiate the factors that restrain (hinder) and stimulate effective management of material resources through the functioning of "smart" models in relation to certain the conditions of their application, in this case to agriculture. Taking into account the problems of the functioning of the agro-industrial complex in the country, the adopted individual regulatory decisions, we have identified the factors of infrastructure, performance, obstacles and threats for the short-term development of the agro-industrial complex.

Subsequently, the factors will predetermine the indicators for assessing the effectiveness of the implementation of the digital model of material resources management (or its individual elements), which will make it possible to develop a methodology for determining the digi-

talization index of the management system (the existing NRI and GII indices allow us to judge only the general directions of the digitalization of the economy).

Conclusions and prospects for further research.

1. It has been established that digital mechanisms of interaction between business entities in the context of socio-economic transformations of society's behavior in relation to agriculture are focused on the implementation of digital models for managing production processes, however, synchronization points with digital systems of other sectors of the economy have not yet been noted (banking, transport -logistic activities, outsourcing activities, processing activities, etc.).

2. The scheme of transformation of the material resources management system in agriculture in the context of the development of the digital economy is presented, including distinctive characteristics, opportunities, threats.

3. A list of factors influencing the formation of a digital model of material resources management for the short-term development of the agro-industrial complex was determined, for which the area of influence on the control system and the direction of strengthening or smoothing their influence on the effective development of digital technologies was determined

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