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БАЯНДАМАЛАРЫ

ДОКЛАДЫ

НАЦИОНАЛЬНОЙ АКАДЕМИИ НАУК
РЕСПУБЛИКИ КАЗАХСТАН

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DIGITAL TRANSFORMATION OF AGRICULTURE IN THE REPUBLIC OF KAZAKHSTAN

Abstract. Currently, in many countries, digitalization is a strategic development priority. According to the forecasts of the world's leading experts, by 2020 25% of the world economy will be digital, and the introduction of digitalization technologies for the economy, allowing the state, business and society to interact effectively, is becoming an increasingly large-scale and dynamic process.

Agriculture in the world is turning from a traditional into a high-tech industry, which is able to create new markets for innovative developments that did not exist before. The time has come when intelligent digital solutions should help the country's agriculture to cope with the problems of increasing productivity and sustainable development.

The agricultural sector is the most vulnerable sector of the economy, largely dependent on the vagaries of nature. And the impact of climate change on food security in the world will only increase. Intensity, seasonality and rainfall will become increasingly unpredictable, which will significantly reduce the ability of the agrarian business to adapt to such changes.

Digitization of the agro-industrial complex will reduce these risks, adapt to climate change, increase crop yields and animal productivity, and plan field work in a timely manner.

The agricultural sector of Kazakhstan is of great importance and should continue to develop rapidly. However, due to the natural conditions in the country, that is, due to the harsh continental climate, this is not easy, but because of the large territory, this industry has great potential. Kazakhstan could make an important contribution to the global food supply in the future.

Reducing the cost of growing products, improving their quality and competitiveness based on the efficient use of resources and scientifically based approaches is the main task of digitization of agriculture. Providing the necessary information to rural producers will reduce transaction costs for the purchase and sale, simplify the supply chain of products from the field to the consumer, reduce the deficit in skilled labor.

Key words: digitalization, agriculture, industry, development, effectiveness, digitalization technology, foreign experience, product, cost.

Introduction. Industrially developed countries continue to successfully modernize their economies. They are rapidly implementing innovative technologies based on automation, computerization, and digital platforms. The day is probably not far off when artificial intelligence will control production.

Global spending on scientific and technological development today amounts to about $ 2 trillion with an average annual increase of 4%.

The world has already entered the era of digital globalization, defined by data flows that contain information, ideas and innovations. According to experts, by 2022, 25% of the world economy will switch to the introduction of digitalization technologies that allow the state, business and society to function effectively.

Digital technologies in Kazakhstan are also considered as the main way to diversify the national economy, its reorientation from a raw material to an industrial-service model.

Areas that have already become traditional for agriculture, such as plant breeding or cloning in animal husbandry, which were associated with mass production and consumption to the detriment of the environment, are now losing their former significance. They are being replaced by "smart" agricultural technologies supported by digital platforms, 3D printing capabilities, robotics, biosensors and Big Data.

The prospects for modernizing the industry are huge. Agriculture is changing from a traditional to a high-tech industry that can create new markets for innovative developments that did not exist before. It is time that smart digital solutions should help the country's agriculture to cope with the challenges of increasing productivity and sustainable development.

Methods. The theoretical and methodological basis of the research is the work of domestic and foreign researchers on the theory and assessment of digital transformation of agriculture.

The research is based on a system-logistics approach to the formation of digital transformation of agriculture. It was based on dialectical, statistical, inductive and deductive methods used by world science in the knowledge of the agro-industrial complex.

To solve these problems, methods of comparative analysis, grouping of data, indexes, analysis and synthesis, modeling methods, methods of short-term and long-term forecasting, stages of digitalization of agriculture, expert-analytical method were used as special methods and research tools.

Results and discussion. The agricultural sector is the most vulnerable sector of the economy, largely dependent on the whims of nature. Moreover, the impact of climate change on food security in the world will only increase. The intensity, seasonality and amount of precipitation will become increasingly unpredictable, which will significantly reduce the ability of agricultural businesses to adapt to such changes.

To this we can add the possibility of huge damage that can be caused to the country's economy by drought or flooding caused by climate change. Only over the past 5 years, 30 billion tenge was spent from the national budget to eliminate the consequences of emergency situations.

Digitalization of the agro-industrial complex will reduce these risks, adapt to climate change, increase crop yields and animal productivity, and plan field work in a timely manner.

Reducing the cost of growing products, improving their quality and competitiveness based on efficient use of resources and science – based approaches-this is the main task of digitalization of agriculture. Providing the necessary information to rural producers will reduce transaction costs for buying and selling, simplify the supply chain of products from the field to the consumer, and reduce the shortage of skilled labor.

Rural entrepreneurs need to produce more food with fewer resources. Therefore, we need a significant breakthrough in agricultural production technologies. To work the old-fashioned way, "by eye" - means to lose the world competition.

A farmer, in order to remain competitive, must be able to predict the supply of their products depending on demand and consumer preferences. In order to make a correct or, as they say now, "smart" management decision, they need to possess digital technologies. This includes the use of satellite images, differentiated field processing algorithms, high-tech sensors, mobile applications and GPS systems.

This means that we need to change the system of professional training of specialists, starting with rural schools, colleges and universities.

Education should be continuous in accordance with modern requirements and tasks. To do this, our University higher school of agribusiness and top farmers ' school offers courses, conducted ongoing seminars, opening up access to the development of digital technologies.

Currently, digitalization is a strategic development priority in many countries. According to forecasts of the world's leading experts, by 2020 25% of the world economy will be digital, and the introduction of technologies for digitalization of the economy, allowing the state, business and society to interact effectively, is becoming an increasingly large-scale and dynamic process [1].

More than 15 countries are implementing national digitalization programs: Denmark, Norway, the United Kingdom, Canada, Germany, Saudi Arabia, India, Russia, China, South Korea, Malaysia, Singapore, Australia, New Zealand and Kazakhstan.

China's Internet plus program integrates digital industries with traditional ones. Singapore is creating a «Smart economy», Canada is creating an ICT hub in Toronto, the driver of which is ICT. South Korea's "Creative economy" program focuses on human capital development, entrepreneurship and dissemination of ICT achievements, while Denmark focuses on digitalization of the public sector.

As we can see, different countries set different priorities in the field of digital transformation. In our case, in the «Digital Kazakhstan» program, we expect progressive development of the digital ecosystem to achieve sustainable economic growth.

The most striking example of a digital privatisation approach is Singapore. So, in 2014, the state initiated the development of the Smart Nation concept and invited business and the expert community to cooperate to Refine and implement it.

The share of information technology in the gross domestic product of South Korea is 9%, in China and India-4.7% [2].

The progress in the development of the digital economy of different countries and the level of integration of the global network into the lives of billions of people reflects the rating of Digital Evolution Index 2017. After analyzing the current state and growth rates of the digital economy in each state, the authors of the study divided the countries into four groups:

Singapore, the United Kingdom, New Zealand, the United Arab Emirates, Estonia, Hong Kong, Japan and Israel demonstrate high rates of digital development, maintain it and continue to lead in the spread of innovation.

South Korea, Australia, as well as countries in Western Europe and Scandinavia have shown steady growth for a long time, but now they have noticeably reduced the pace of development. Without innovation, these States risk falling behind the leaders of digitalization.

Despite the relatively low overall level of digitalization, these countries are at the peak of digital development and demonstrate stable growth rates, which attracts investors. China, Kenya, Russia, India, Malaysia, the Philippines, Indonesia, Brazil, Colombia, Chile, and Mexico have the potential to take a leading position.

Countries such as South Africa, Peru, Egypt, Greece, and Pakistan face serious challenges associated with a low level of digital development and slow growth.

Kazakhstan does not start from scratch. In the 90s, the state program for accelerated industrial and innovative development was launched, the Bolashak international education program was initiated, and the formation of an «electronic government» was launched in 2005.

The Foundation for the digital transformation of the economy of Kazakhstan was the state program «Information Kazakhstan-2020», approved in 2013. It contributed to the development of the transition to an information society, improving public administration, creating institutions of «open and mobile government», and increasing the availability of information infrastructure not only for corporate structures, but also for citizens of the country. According to the results of three years of implementation of the state Program, 40% of its implementation has already been achieved.

The Head of state also noted that the development of the digital industry will provide an impetus to all other industries. In this regard, the President set a task to develop new industries that are created using digital technologies [3].

Digitalization will primarily cover those sectors that have great potential for economic growth: agriculture, energy, mining and oil and gas sectors, transport and logistics.

The projects «Smart Deposit» and «Digital mine» are already working. Local e-Commerce development is being invested.

According to forecasts, the combined effect of digitalization projects will provide up to 30% of the country's GDP growth from 2025.

A good example of the possibility of a breakthrough may be the digitalization of agriculture. The Food and agriculture organization of the United Nations and the Organization for economic cooperation and development estimate that the world's population will reach 9.7 billion by 2050. To ensure food security of the planet's inhabitants, it is necessary to increase agricultural production by 60-70% compared to the 2000s.

Here, such a competitive advantage of Kazakhstan, and the entire EEU, as huge reserves of fertile land comes to the fore. But it is possible to solve this global problem by introducing radical technological innovations. A tool for stable agricultural production will be the transition to a digital structure of the agricultural market.

According to Gartner forecasts, the overall economic impact of the introduction of the Internet of things in all sectors of the economy on a global scale will be $1.9 trillion by 2022. Agriculture accounts for 4%, i.e. approximately $ 76 billion [4].

According to Goldman Sachs, the total increase in crop productivity due to the introduction of precision farming solutions can grow by 70% and bring in $800 billion of additional production by 2050. The market for precision farming solutions for manufacturers and developers will bring in $240 billion in 2050. These are solutions for precise planting, precise irrigation, precise fertilization, spraying, field monitoring, data analysis, small agricultural machinery, including Autonomous [5].

The average penetration rate of precision farming technologies in the United States is estimated by the USDA at 30-50%, while the level of technology use in large farms is twice as high as in small ones. The penetration of precision farming technologies in active agricultural areas of the United States is 60-80%.

The most common: computer with high-speed Internet access, soil sample analysis (98%); yield maps, yield monitors, GPS navigation systems (~80%); differentiated application technologies (VR) and prescriptionmaps (prescriptionmaps) are used by more than 60% of respondents; satellite images and vegetative index analysis of plants are used by no more than 30% of farmers, although new developments in the use of unmanned aerial vehicles (drones) may increase interest in using images for scouting, data analysis and management decision-making.

In terms of data collection and processing technologies, the use of data and software for yield mapping is the most common practice (80%), followed by the development of plans or prescriptions for the use of VR technology for the application of nutrients and fertilizers, as well as for seeding and planting (50-60%).

The USA demonstrates stable growth of the agricultural machinery market, the country is the leader in the import of tractor equipment. The industrial nature of US agriculture and the combination of automation with rapid implementation of the latest high-tech achievements ensure the country's leadership in agricultural efficiency and AIoT market volume.

The development of precision farming systems Agro IoT in the United States is promoted by large farms with minimal state participation.

The most developed region in terms of agricultural equipment with modern technology is Germany: the number of tractors per unit area is the largest in the world. Germany is the world leader in tractor exports among the countries considered in the study. This is because at the level of national consciousness, the country aims at global industrial leadership (among the world industrial leaders a lot of German brands: Bosch, Siemence, BMW, Daimler, Volkswagen), is the «author» of the term «industry 4.0» (this is one of the subprogrammes of the state Hi Tech strategy of Germany) and initiated the processes related to the digitalization of the industry.

At the same time, despite the fact that in Europe 70-80% of agricultural machinery is sold with built-in smart and navigation systems in Europe, the number of «connected» equipment is at the level of 25% - 30%. The main barriers to the European market are a smaller share of large farms compared to the United States (the presence of a large number of «family», centuries-old successor businesses), for which the purchase of equipment with connected electronics is expensive, as well as the fact that most farms already have tractor equipment in use, which prevents its replacement with more innovative [6].

In the US and Germany, high Internet penetration in rural areas is 70-80%.

Every year, about 2.1 million new tractors are sold worldwide. About 50% of all tractors are sold in China and India.

China is developing at the fastest pace in terms of agricultural mechanization. The agricultural machinery market has been growing by an average of 13.3% over the past 5 years. China is almost completely self-sufficient in equipment, the volume of imported equipment in monetary terms is 8 times less than exported, despite the fact that in 2004 China had the same volume of exports and imports of tractors.

As a catch-up country with the least mechanized agriculture, India shows the greatest demand for these products and is rapidly increasing the level of agricultural mechanization. In the period 2006-2018, sales of new tractors increased by more than 3 times. In addition, according to J'son & Partners Consulting, India is one of the leading countries in the production of agricultural machinery. The main role in the engineering industry is played by 14 large companies, most of which work closely with well-known Western partners. India takes an active position on localization of the world's largest manufacturing enterprises. This is consistent with the national program Net Zero Export (Zero import) –

the state program of import substitution, according to which by 2021 the country should learn to produce everything independently and ensure zero imports. Therefore, the country is able to quickly master the production of modern high-tech equipment.

High penetration of precision farming technologies in Canada – 60-80% or more for some basic types. According to a survey of farmers, the overall attitude to precision farming in Canada is generally positive:

- 84% of the surveyed farmers use some form of «precision farming» technology;
- 93% agreed that «precision farming» is beneficial to use;
- 75% plan to increase the use of precision farming technologies.

Canada became the # 1 country in terms of output per employee (ratio: agricultural output/number of employees in the industry) and overtook the traditional permanent leader - the United States in 2015. Leadership is due to the high penetration of automated systems and hitech agropractic, a large number of employees in the agricultural sector, and strong government support for the industry (for example, farmers have free access to a variety of interactive maps made on the basis of satellite imagery).

The analysis of the activities of Kazakh farmers and government agencies on the issues of digitalization and automation of the agro-industrial complex in 2019 showed the following results:

Pavlodar region. Digitalization programs are already being used in crop and livestock production. For example, for producers, a program is connected that integrates information about the volume of milk received into an electronic system of information and analytical base. According to data, 568.3 thousand hectares of 1.3 million hectares of land in the region have been digitized, which is 42.6% [7].

North Kazakhstan region. In 2019, nanotechnology began to be used in 50 farms in Northern Kazakhstan.

Also, the basis of digitalization is an electronic map of fields. To date, 52% of the fields have been digitized. In the future, it is planned to use satellite monitoring of fields and equipment [8].

The center of information technologies of the regional Akim's office was opened in East Kazakhstan region within the framework of the «Digital Kazakhstan» program. The Center's goal is to develop the process of digitalization in the region. Electronic maps will be created in the cities of Ust-Kamenogorsk and Semey that reflect information about available land plots in localities [9].

Kostanai region. As part of the digitalization of the agro-industrial complex, the main focus will be on the introduction of elements of precision agriculture, which is expected to have the greatest economic effect. In kamystinsky LLP «PKF Kairat», using modern high-performance equipment that allows the use of digital technologies, when sowing 15 thousand hectares of grain, they saved more than 30 million tenge, or 15% of production costs. In «Troyana» LLP of the Fedorovsky district last year, during spring field work using satellite navigation, 4 units were sown with 6.4 thousand seeds. 10 million tenge was saved by preventing replanting, saving fuel, seeds and protection equipment. In The zhanakhay farm of the same district, due to the wide use of «smart» technologies, the annual savings amount to more than 9 million tenge. Given the scale of sowing and harvesting operations in the region as a whole, the economic effect may exceed tens of billions of tenge [10].

In Kostanay region, it is planned to complete the work on «digitization» of fields. These cards are planned to be linked to receiving all subsidies, preferential lending, and insurance.

A number of tasks on digitalization of agricultural production are being implemented in Akmola region. In the region, the process of transferring applications and payment of subsidies in electronic form through a web portal has begun Minagro.kz.

Now agricultural producers do not need to submit applications themselves, everything is translated into digital format. The region is working on the formation of an electronic map of fields aimed at the development of precision agriculture.

Three basic enterprises for the introduction of precision farming technologies were identified-AF «Rodina tselinogradsky district» LLP, «Belagash» LLP of «Zhaksynsky district and zhuravlevka-1» LLP of Bulandinsky district) and three enterprises in animal husbandry that produce products using smart-farm technology (AF «Rodina tselinogradsky district» LLP, «Yessil agro» LLP of «Burabaysky district» and «Enbek Akkol» district LLP.

In the near future, within the framework of the signed Memorandum between the Akimat of the Akmola region and JSC «Kazakh agrotechnical University named after S. Seifullin» on cooperation in the field of scientific and innovative development of the agro-industrial complex, it is planned to conduct

advanced training courses and retraining of farm specialists in teaching digital literacy and precision farming technology. In addition, a number of projects will be implemented to introduce digital technologies in crop production, online monitoring and accounting systems for field work using digital technologies and GPS equipment.

The introduction of digital technologies will make it possible to quickly make optimal decisions on field operations, save fuel and lubricants, increase the efficiency of fertilizers and herbicides, which will generally contribute to the sustainable growth of agricultural production in the region [11].

West Kazakhstan region. In April 2019, the house of farmers of Uralsk held a meeting on the preparation for the spring field work under the chairmanship of the first Deputy Governor of the region.

As a result of the meeting, it was instructed to take comprehensive measures to provide agricultural formations with the missing volume of seeds, bring them to sowing conditions, to etch seeds, to complete repairs of tractors, sowing and tillage equipment in time, to intensify work on the selection of allocated diesel fuel, as well as to assist agricultural producers in introducing elements of precision farming and digital technologies in the agro-industrial complex, to complete digitization of fields in electronic format. (newspaper «Priuralie»)

The Turkestan region. The use of digital technologies in the agro-industrial complex is developing dynamically in the region. In particular, modern technologies are being introduced in the region in agriculture and animal husbandry.

As a result of the use of advanced technologies, the productivity of intensive gardens planted on 2.8 thousand hectares has increased by 1.5-2 times compared to traditional gardens. It is worth noting that 70 percent of greenhouses in the region are automated. Along with this, the area of land on which the drip irrigation method is used has increased by 16%, amounting to 59.1 thousand hectares.in addition, the livestock industry maintains an automated accounting of livestock. This measure will allow you to control all animal movements and veterinary measures.

At the same time, new technologies are actively used in the production and processing of livestock products in the region. For example, the dairy farm «Borte-Milka» fully automated the entire production process, from milking to feeding and storage of milk. As a result of automation of production, the annual productivity of one cow will be up to 7 thousand liters of milk, when the traditional method of productivity is 3 thousand liters [12,13].

Roland Berger believes that the market for smart agriculture solutions in the world will reach €4.5 billion by 2022, and according to Gartner's forecasts, the overall economic effect of the introduction of IoT tools by 2022 will be $1.9 trillion, with 4% of them coming from agriculture, which in absolute terms will be more than $75 billion. Tractica concluded that the market for agricultural robots by 2024 will reach $74.1 billion, and production will grow 19 times and reach 594 thousand units of equipment.

According to J'son & Partners Consulting, the efficiency of business processes in agriculture can be increased by 50-70% if you use robotic systems that allow you to control the consumption of fuel, water, electricity, and harvest. When optimizing the main working processes with the help of robotic systems, you can increase productivity by 1.5-2 times, and reduce the cost of planting crops by up to 80%. In General, the global digital farming market is estimated at 3 billion euros, and by 2022 it can grow to 4.5 billion euros.

Summary and Conclusion. Currently, the development of agriculture in our country is a priority.

Improving the economic efficiency of agriculture to a competitive level from the positions of the world market is impossible without improving and developing the main creative force of the agricultural economy, which reflects the essence and inner core of rural residents. The development of agriculture is objectively determined by the need to form new effective infrastructure links of the digital economy and provide the population with food of appropriate quality in the required quantity. Modern information technologies help to increase the efficiency of agricultural production.

But, unfortunately, the innovations of the agro-industrial complex in Kazakhstan are not sufficiently developed. And in order to achieve effective development, it is necessary to create various programs for improving the skills of personnel that will move agricultural production forward, attracting new specialists to enterprises.

The key trend in the development of agriculture is the formation of an effective human and social capital with the right level of information provision and transparency of information flows, a highly organized institutional environment, with minimal transaction costs, is to build a system of directions and measures of agricultural development with the appropriate orientation of the digital economy.

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ҚАЗАҚСТАН РЕСПУБЛИКАСЫНДАҒЫ АУЫЛ ШАРУАШЫЛЫҒЫНЫҢ САНДЫҚ ТРАНСФОРМАЦИЯСЫ

Аннотация. Қазіргі уақытта көптеген елдерде цифрландыру стратегиялық даму басымдық болып табылады. Әлемнің жетекші сарапшыларының болжамдарына сәйкес, 2020 жылға қарай әлемдік экономиканың 25 пайызы цифрланады, ал мемлекет, бизнес пен қоғамның тиімді өзара әрекеттесуіне мүмкіндік беретін экономикаға цифрландыру технологияларын енгізу барған сайын кең ауқымды және серпінді процесс болады.

Дүние жүзіндегі ауыл шаруашылық дәстүрліден жоғары технологиялық индустрияға айналып келеді, ол бұрын болмаған инновациялық әзірлемелер үшін жаңа нарықтарды құруға қабілетті. Зияткерлік сандық шешімдер еліміздің ауыл шаруашылығына өнімділікті арттыру және орнықты даму проблемаларын шешуге көмектесетін уақыт келді.

Агроөнеркәсіптік кешен - бұл экономиканың ең осал секторы, көбінесе табиғаттың қыңырлығына тәуелді. Климаттың өзгеруі әлемдегі азық-түлік қауіпсіздігіне әсер етеді. Қарқындылық, маусымдық және жауын-шашынның болуы күтпеген жағдайға айналады, бұл аграрлық бизнестің осындай өзгерістерге бейімделу қабілетін айтарлықтай төмендетеді.

Агроөнеркәсіптік кешенді сандықтау осы тәуекелдерді азайтады, климаттың өзгеруіне бейімделеді, егістік өнімділігі мен жануарлардың өнімділігін арттырады, сондай-ақ кен орнындағы жұмыстарды дер кезінде жоспарлайды.

Қазақстанның аграрлық шаруашылығы үлкен маңызға ие және келешекте де қарқынды дамуы керек. Дегенмен, республикадағы табиғи жағдайлар, яғни күрт континентальды климаттың айқын болуына байланысты бұл оңай емес, алайда аумақтың үлкен болуына байланысты бұл саланың әлеуеті зор. Қазақстан болашақта әлемді азық-түлікпен қамтамасыз етуде маңызды үлес қоса алады.

Ауыл шаруашылығын цифрландырудың негізгі міндеті - өсіп келе жатқан өнімдердің құнын төмендету, ресурстарды тиімді пайдалану және ғылыми негізделген тәсілдер негізінде сапасы мен бәсекеге қабілеттілігін арттыру. Ауылдық тауар өндірушілерге қажетті ақпарат беру сатып алу-сату үшін транзакциялық шығындарды қысқартуға, кен орнынан тұтынушыға дейін жеткізілімдер тізбегін жеңілдетуге, білікті жұмыс күшінің тапшылығын азайтуға мүмкіндік береді.

Түйін сөздер: цифрлау, ауыл шаруашылығы, өндіріс, даму, тиімділік, цифрлау технологиясы, шетелдік тәжірибе, өнім, құн.

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ЦИФРОВАЯ ТРАНСФОРМАЦИЯ СЕЛЬСКОГО ХОЗЯЙСТВА В РЕСПУБЛИКЕ КАЗАХСТАН

Аннотация. В настоящее время во многих странах цифровизация является стратегическим приоритетом развития. По прогнозам ведущих мировых экспертов, к 2020 году 25% мировой экономики будет цифровой, а внедрение технологий цифровизации экономики, позволяющих государству, бизнесу и обществу эффективно взаимодействовать, становится все более масштабным и динамичным процессом.

Сельское хозяйство в мире превращается из традиционной в высокотехнологичную отрасль, которая способна создавать новые рынки для инновационных разработок, не существовавших ранее. Настало время, когда интеллектуальные цифровые решения должны помочь сельскому хозяйству страны справиться с проблемами повышения производительности труда и устойчивого развития.

Сельскохозяйственный сектор является наиболее уязвимым сектором экономики, в значительной степени зависящим от капризов природы. А влияние изменения климата на продовольственную безопасность в мире будет только усиливаться. Интенсивность, сезонность и количество осадков будут становиться все более непредсказуемыми, что значительно снизит способность аграрного бизнеса адаптироваться к таким изменениям.

Оцифровка агропромышленного комплекса позволит снизить эти риски, адаптироваться к изменению климата, повысить урожайность сельскохозяйственных культур и продуктивность животных, своевременно планировать полевые работы.

Сельскохозяйственный сектор Казахстана имеет большое значение и должен продолжать быстро развиваться. Однако из-за природных условий в стране, а именно – из-за резкого континентального климата, это нелегко, но из-за большой территории эта отрасль имеет большой потенциал. Казахстан может внести важный вклад в мировое снабжение продовольствием в будущем.

Снижение себестоимости выращиваемой продукции, повышение ее качества и конкурентоспособности на основе эффективного использования ресурсов и научно обоснованных подходов является основной задачей цифровизации сельского хозяйства. Предоставление необходимой информации сельским товаропроизводителям позволит снизить трансакционные издержки по купле-продаже, упростить цепочку поставок продукции с поля к потребителю, снизить дефицит квалифицированной рабочей силы.

Ключевые слова: цифровизация, сельское хозяйство, промышленность, развитие, эффективность, технологии цифровизации, зарубежный опыт, продукт, стоимость.

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