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AGRICULTURAL MARKET DIGITALIZATION IN KAZAKHSTAN

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Introduction. An increase of the Earth population leads to the necessity to increase food production. To ensure world food security, it is necessary to increase food production compared to the current time by 70%. The solution to this global problem is possible due to the modernization of the economy using digital technologies and artificial intelligence. Despite the fact that Kazakhstan, at present, has significant potential in food production, even its own needs are not fully provided. The article discusses the possibility of digitalization of the agricultural market of Kazakhstan in order to increase the volume of milk production and processing, increasing the competitiveness of dairy products, realization of the export potential and ensuring food security of the country.

Aim and tasks. The aim of the study is to justify the need for the adoption of digital technologies in the agricultural market of Kazakhstan.

Results. The article discusses the concept of the term "digitalization of the economy" in the world and its spheres of application. Practical examples of digitalization in countries with a developed economic system and the need for their usage in order to transfer to the digital structure of the agricultural market are given. The volumes of milk production in Kazakhstan over the past 3 years are analyzed. The reasons for the incomplete plant capacities of milk processing enterprises and the low level of marketability of dairy farming in Kazakhstan are identified. The rationale is given, that the use of digital technologies and other positive effects associated with their use will contribute to the improvement of the quality of milk.

Conclusions. According to the results of the study, the constraints on the development of the dairy industry in Kazakhstan were identified and it was found that most of them can be solved using digital technologies. The solution of these problems is possible with the aid of creation of information platforms and technological re-equipment, conditioned upon organizational, legal and financial support of the state. It was substantiated that the integrated use of digital technologies in the agricultural market of Kazakhstan along the entire product distribution chain from raw milk to sales to the final consumer will help to reduce costs, improve the quality of milk and dairy products, labor productivity, as well as to transform the workforce of the industry.

Keywords: agro-industrial complex, milk and dairy products, digital technologies, labor productivity, technological re-equipment, personal homesteading, quality of raw materials.

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ЦИФРОВІЗАЦІЯ АГРОРИНКУ КАЗАХСТАНА

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Вступ. Збільшення чисельності населення Землі призводить до необхідності нарощування обсягів виробництва продуктів харчування. Для забезпечення світової продовольчої безпеки необхідно збільшити обсяг виробництва продуктів харчування в порівнянні з поточним часом на 70%. Рішення даного глобального завдання можливо за рахунок модернізації економіки із застосуванням цифрових технологій і штучного інтелекту. Незважаючи на те, що Казахстан має значний потенціал у виробництві продуктів харчування, в даний час в повній мірі не забезпечуються навіть власні потреби. У статті обговорюється питання можливості цифровізації аграрного ринку Казахстану з метою збільшення обсягу виробництва і переробки молока, підвищення конкурентоспроможності молочної продукції, реалізації експортного потенціалу і забезпечення продовольчої безпеки країни.

Мета и завдання. Метою дослідження є обґрунтування необхідності впровадження цифрових технологій в аграрному ринку Казахстану.

Результати. У статті розглянуто поняття терміну «цифровізація економіки» в світі і сфери її застосування. Наведено позитивні приклади впровадження цифрових технологій в країнах з розвинутою економічною системою і необхідність їх використання в цілях переходу до цифрового укладу аграрного ринку. Проаналізовано обсяги виробництва молока в Казахстані за останні 3 роки. Виявлено причини неповного завантаження виробничих потужностей підприємств з переробки молока та низького рівня товарності молочного господарства в Казахстані. Наведено обґрунтування, що підвищення якості молочної сировини сприятиме застосування цифрових технологій, а також інші позитивні ефекти, пов'язані з їх використанням.

Висновки. За результатами дослідження виявлені проблеми, що стримують розвиток молочної галузі Казахстану, і встановлено, що основна їх частина може бути вирішена за допомогою цифрових технологій. Вирішення зазначених проблем можливе за допомогою створення інформаційних платформ і технологічного переозброєння, за умови організаційної, правової та фінансової підтримки держави.

Обґрунтовано що, комплексне використання цифрових технологій на аграрному ринку Казахстану по всьому ланцюжку руху товару від одержання сирого молока до продажу кінцевому споживачеві буде сприяти зниженню собівартості, підвищенню якості молока і молочної продукції, продуктивності праці, а також трансформації робочої сили галузі.

Ключові слова: агропромисловий комплекс, молоко і молочна продукція, цифрові технології, продуктивність праці, технологічне переозброєння, особисте підсобне господарство, якість сировини.

Introduction. The next stage of world globalization is currently manifested in digital globalization, which is characterized by data streams containing information, ideas and innovations. Experts from the Food and Agriculture Organization of the United Nations and the Organization for Economic Cooperation and Development predict an increase in the world's population to 9.7 billion by 2050. At the same time, today every seventh inhabitant of the Earth suffers from malnutrition. To ensure world food security, it is necessary to increase food production compared to the current time by 70%. The main trend for solving this problem is a steady increase in agricultural productivity.

The diet of each person includes milk and dairy products and is one of the main products. Milk and dairy products include a perfectly balanced composition of nutrients for a human.

Despite the fact that Kazakhstan has significant potential in the production of milk and dairy products, at present even its own needs are not fully provided.

This issue is on the agenda of the Eurasian Economic Commission, and the solution is to introduce radical technological innovations and it will take place in two directions: in the system of state regulation of the agro-industrial complex and technological re-equipment of the production sphere. The experience of implementing digital technologies has allowed countries with a developed agro-industrial complex to show that this has made it possible to increase labor productivity and competitiveness of the industry, as well as reduce unplanned costs.

Digitalization can become an effective tool to increase the production and processing of milk, increase the competitiveness of dairy products, realize the export potential and ensure food security of the country.

Analysis recent research and publications. The term “digital economy” was introduced into scientific use by Nicholas Negroponte and he formulated the concept of the digital economy, in the interpretation of the general understanding of this term, this means the use of digital technologies in all industries and fields of activity [1]. Digital globalization involves more and more people, companies and countries into the circulation of electronic world commerce, and gives them new opportunities for development.

In countries with developed economies, there is a dynamic modernization of the economy using digital technology and artificial intelligence. Currently, the increase in spending on scientific and technological developments in the world is 4% on average [2-3].

The source of information for writing the article was the works of scientists published in periodicals and posted on web sites.

Surveys of global trends in the dairy market, compiled by the Food and Agriculture Organization of the United Nations, the Organization for Economic Cooperation and Development and the European Bank for Reconstruction and Development were used.

Statistics data were obtained on the official website of the Committee on Statistics of the Ministry of National Economy of the Republic of Kazakhstan.

In the process of conducting scientific research, dialectical methods of a general scientific nature and specific methods for conducting economic research were used.

In the course of the study, the following methods were used: monographic, economic-statistical, expert evaluations, as well as abstract-logical and comparative.

Aim and tasks. The purpose of the study is to justify the need for the adoption of digital technologies in the agricultural market of Kazakhstan.

Results. Nowadays there has been a successful experience in the use of digital platforms and robots, which allowed to transfer to the artificial intelligence part of the production and managerial functions in various industries. For example: electronic exchange of laboratory test results; electronic notices on food and feed safety, electronic certificates of trade, etc. have been currently developed by the Economic Commission in Europe. Also, quite a lot of attention is paid to the Food and Agriculture Organization of the United Nations on issues of digital agriculture (digital-agriculture) and electronic agriculture (e-agriculture).

Kazakhstan's participation in integration associations, particularly in the Eurasian Economic Union, helps to synchronize the direction of movement towards digitalization of agriculture.

The Eurasian Economic Commission and the governments of the participating countries choose an instrument for stable agricultural production - the transition to a digital structure of the agricultural market.

Within the framework of the state regulation system, information platforms are being formed for the automation of public services, the purpose of which is the automation of licensing procedures, as well as ensuring transparency of authorized policies. Such platforms include governmental portals of state purchases, commodity exchanges, veterinary and phytosanitary records, livestock identification, etc. [4].

Technological re-equipment is implemented through the introduction and development of precision farming and the use of geo-information technologies (electronic field maps, space monitoring, accurate weather data), the creation of smart farms, greenhouses and gardens, automation of logistics processes.

Digitalization in the agricultural sector can reduce risks, adapt to climate change, increase crop yields. Reducing the cost of production, increasing its quality and competitiveness through the efficient use of resources and science-based approaches is the main task of digitalization.

Kazakhstan has a rather low level of advanced technologies adoption in various sectors of the economy, evidence of this is that, according to the results of 2018, our country ranked 74th in the ranking of countries according to the level of innovation development (The Global Innovation Index) [5].

Table 1. Rating of Kazakhstan in the Global Innovation Index

Years	2014	2015	2016	2017	2018
Place in the rating	79	82	75	78	74

Source: compiled by the author on the basis of data [6].

Taking into account the low rating of innovation development in the Message of the President of the Republic of Kazakhstan "Third Modernization of Kazakhstan: Global Competitiveness" dated January 31, 2017, the prerequisites for their development were created. Based on the Message, the state program "Digital Kazakhstan" for 2018-2022 was developed, approved by Government Decision No. 827 of 12/12/2017. The goal of the adopted program is to accelerate the pace of development of the economy of the republic and improve the quality of life of the population through the use of digital technologies in the medium term, as well as creating the conditions for the transition of the economy of Kazakhstan to a fundamentally new development path that ensures the creation of a digital economy of the future in the long term. One of the tasks set for the program is the digitalization of agriculture [7].

Also, one of the reasons for the adoption of digitalization is the need to increase agricultural production, mentioned in the Address of the Head of State to the people of Kazakhstan "New Development Opportunities in the Fourth Industrial Revolution" of January 10, 2018, in which there was an instruction to increase labor productivity in the agricultural sector over 5 years and export of processed agricultural products at least by 2.5 times [8].

The Ministry of Agriculture of the Republic of Kazakhstan is doing some work and processes such as:

- veterinary and phytosanitary safety;
- grain receipts;
- a system for collecting and managing loan applications;
- accounting of agricultural machinery;
- registration of livestock, including breeding;
- water and land management [9].

About 150 plants are involved in milk processing in Kazakhstan, with a total capacity of 2 million tons per year, while all production capacities are used by 70% due to a shortage of raw materials [10]. The reasons for the lack of raw materials is its low quality, since the bulk of milk is produced by private farms and does not meet technological requirements. This problem is compounded by the fact that private farms have informal distribution channels for products, which raises the issue of food safety. Also, the volumes of raw milk produced are uneven throughout the year; in the cold season, their production volumes are reduced. In general, this leads to a year-round shortage of raw materials and a loss of value added by the country.

Also, one of the goals of digitalization of agricultural production can be losses reduction, this problem is quite relevant, since about a third of agricultural food products are lost along the entire distribution world chain.

Little amount of processed milk by factories and a limited range of offered products led to the fact that the Kazakhstan market was flooded with imported goods that were previously not known to the local consumer. All this makes Kazakhstani producer carry out technological re-equipment in conditions of shortage of raw materials. Leading enterprises of this industry produce up to 140 items of dairy products and create new trademarks. But at the same time, this requires the development and implementation of technical regulations and standards for new types of dairy products that are harmonized with international requirements and stimulate milk processing enterprises to develop waste-free production [11-12].

The European Bank for Reconstruction and Development and the Organization for Economic Cooperation and Development carried out a calculation of the structure of the final cost of milk in Kazakhstan, as an example the whole milk with a fat content of 3.2% was taken.

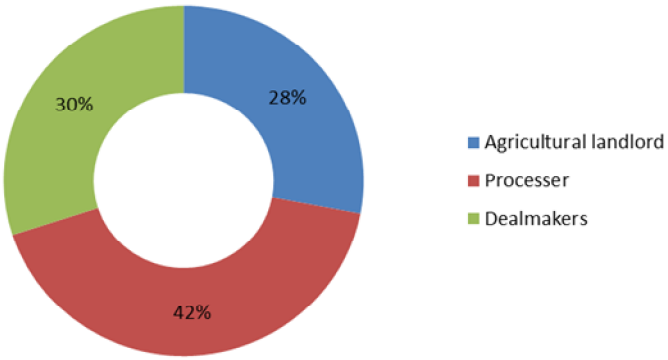

Fig. 1. The generated added cost of 1 liter of milk, %

Source: compiled by the author on the basis of data [10].

It should be noted, that about one third of the generated added cost is occupied by dealers and retailers who don't make surplus value. Adoption of digitalization of the dairy industry will reduce the number of intermediaries, that will increase the working load of processing enterprises by 1.3 times and reduce the trade margin by 15-20% and will reduce retail prices for agricultural products [13].

The main part of the raw milk produced in Kazakhstan comes from personal subsidiary farming. At the same time, only 10% of the milk collected from personal subsidiary farming for processing meets the conditions of the technical regulation of the Customs Union for microbiological and somatic indicators, which limits the country's export capabilities.

Despite the decline in the share of personal subsidiary farming in milk production over time, so far their role has been dominant, on average it is 75%.

As world practice proves, the highest livestock productivity and the high quality of dairy raw materials are achieved in large agricultural enterprises. However, objective reasons in the form of a change in the type of economic system in the 90s led to the disaggregation of agricultural formations.

Table 2. Milk production in Kazakhstan by farm category

Farm category type	2016		2017		2018	
	ths. of tons	%	ths. of tons	%	ths. of tons	%
Agricultural enterprise	319,9	5,99	361,4	6,57	384,6	6,76
Self-employed entrepreneurs, homesteading and farming enterprises	900,0	16,85	1 038,1	18,86	1 120,4	19,7
People's households	4121,8	77,16	4 103,9	74,57	4 181,3	73,54
Total	5341,6	100	5503,4	100	5686,2	100

Source: compiled by the author on the basis of data [14].

Lack of proper sanitary conditions for keeping livestock and planned veterinary measures in personal subsidiary farms, as a rule, leads to poor quality of manufactured products. To obtain high-quality raw materials, it is necessary to comply with the conditions for proper livestock maintenance and care, as well as sanitary and hygienic requirements for milking and primary milk processing, which is often not observed in farms and peasant farms and private farmsteads.

The main condition for maintaining the quality of milk is also violated - the immediate cooling of fresh milk to 10 ° C, which keeps its freshness to be preserved for more than 12 hours. The territorial remoteness of dairy production in small commodity farms, in the absence of adequate feeding of cattle, a storage and cooling system in them, negatively affects the quality of milk and its marketability. Since raw milk is a perishable raw material, its quality is reduced during collection, and there is no possibility of its analysis at acceptance, which affects its quality and cost. Using the GPS coordinate system makes it possible to measure time and track the movement path of the milk carrier in order to optimize its route.

For example, the US dairy industry has a high level of marketability (98.2%). Out of the total amount of milk produced, 38.5% goes for fresh consumption, 59.7% for processing [15].

In this study, it seems possible to use such an indicator as the converting rate of raw milk, which can be represented as follows:

$$CR = IC / OP \qquad (1)$$

where IC – industrial consumption and other industrial use of dairy raw materials, thousands of tons; OP – overall production of raw milk, thousands of tons.

The level of processing in the dairy industry in Kazakhstan for 2018:

$$CR = 1826.3 / 5686.2 = 32\%.$$

It follows that only a third of the total volume of raw milk produced is subjected to industrial processing.

In Kazakhstan, digital technologies projects for accurate mapping of the raw material zones of dairy plants and for applying information on the requirements of technical regulations for each milk supplier are being implemented.

The use of digital technology and satellite images makes it possible to rationally and efficiently use the feeding. Since the availability of complete feed fully reveals the productive potential of the dairy herd and accounts for half the cost of milk produced. It should be noted, that the cost of milk in Kazakhstan is on average below the global, due to the presence of pastures.

Adherence of technical regulations on microbiological and somatic indicators of raw milk is possible only with the use of advanced milking and primary processing methods. This, in turn, requires the presence of milking and refrigeration equipment, disinfectants, analyzers for express quality control of milk, stainless steel cans, etc. Robotics significantly reduces human participation in the production process and, as experts say, for example, milking robotics improves the quality of milk produced and maintains the health of highly productive cattle [16-17];

The use of information and communication technologies provides information on the frequency of milk collection, on suppliers who enter the raw material zone and have a milking machine and other equipment, indicators of bacterial contamination, milk yield and the number of goals. Such information makes it possible to evaluate suppliers, conduct explanatory work with them to improve the quality of raw materials received, as well as feedback on emerging issues. In order to make the right management decisions, milk producers and processors need to possess digital technologies such as mobile applications, satellite images and GPS systems. Based on the data obtained, it is possible to decide in which community it is advisable to purchase raw milk, and in which not. This enables the purchaser to consolidate, digitize and map all data.

Now, there is already an opportunity for milk producers to have free access to information on changes in biomass in specific pastures where grass has been preserved, and where pastures have undergone degradation, etc. Pasture mapping has been started since 2012.

The assistance of the Organization for Economic Cooperation and Development with the European Bank for Reconstruction and Development in Kazakhstan is to increase the competitiveness of the dairy industry by achieving compliance with standards and regulations.

These organizations support the creation of an automated milk balance, a raw milk quality monitoring system, and pasture condition assessment [18].

Due to the unattractiveness of agricultural labor in agriculture sector, aging of workers and the outflow of youth from rural areas are observed. In Kazakhstan, the share of the rural population in the total number over the past 10 years from 2008 to 2018 decreased from 46.92% to 42.12%, respectively. This undesirable trend can be smoothed out under the conditions of digitalization by increasing labor productivity and, as a result, the release of some workers from the production process, as well as the attractiveness of labor for young people. Moreover, the use of robots and automatic machines in the production process reduces the adverse effects on humans, in particular in dairy production, work associated with animal waste [19-21].

Along with this, the digitalization process is impossible without the availability of appropriate personnel. Today in Kazakhstan there is a shortage of modern and practical knowledge in the dairy industry. High level specialists are required. The Organization for Economic Co-operation and Development and the European Bank for Reconstruction and Development in 2018-2019 focuses on building the capacity of local consultants in the dairy business. Moreover, it requires IT specialists with knowledge of the specific features of milk production and processing, computer programs and applications, workers with knowledge of new technology features with which they will have to work, etc. Digitalization of the dairy industry will entail the creation of additional jobs in related industries, which will maintain this process [22-24].

Dairy industry digitalization is quite expensive, not all peasants and farmers have the opportunity to purchase the necessary equipment. The state is interested in the innovative development of the economy, and without its participation the diffusion of innovations, their application and replication is impossible. Information and communication links between subjects of the dairy industry should be formed in a single information space of the cluster, in conditions of cooperation, as well as horizontal and vertical integration.

The basis of these relations should be the principles of systemic, mutually beneficial exchange, adaptability and information security. The results of the digitalization of the economy, reflected in the system of indicators of economic entities, spheres and industries, require their further study and improvement in order to conduct a comprehensive and complete analysis of their activities. [25-29].

To ensure effective interaction of participants within a single information field, some measures should be taken aimed at: monitoring information support of organizations; unification of the process of entering information into a single automated system; briefing participants on the provision, use of information resources, updating information and increasing responsibility for its reliability; ensuring information security, etc.

Conclusion. The solution to the problem of ensuring world food security is possible due to the innovative development of the economy of any country, while the use of digital technologies and artificial intelligence is its integral and inevitable part. Digital technologies in various industries are already successfully used in the world today. Certain work on the development of information and communication technologies is also being carried out in Kazakhstan. To a greater extent, the movement is carried out within the framework of integration development in the context of program documents adopted by the Eurasian Economic Commission.

The transition to the digital structure of the agricultural market of Kazakhstan is advisable in the following areas: the creation of information platforms and technological re-equipment. The implementation of these areas is impossible without state support mechanisms.

The main reasons for the insufficient volume of milk and dairy products produced in Kazakhstan are the low quality of raw materials supplied to dairy plants, the seasonal unevenness in the supply of raw materials, which affects the utilization of production capacities of plants, a year-round shortage of raw materials and, as a result, the loss of added cost. The situation is also aggravated by the loss of agro-food products in the distribution chain and the presence of a network of intermediaries, which significantly increases the generated value added.

The bulk of raw milk in Kazakhstan is produced in private farms, where there are no necessary conditions for its getting and storage, which in turn leads to the fact that it does not meet the requirements of technical regulations and limits the possibility of export. The raw milk processing level in Kazakhstan is 32%, which significantly indicates that only a third of the raw milk produced is processed. It should be noted that Kazakhstan has significant potential in the development of the agricultural market, due to the availability of feeding in the form of pasture land.

Other problems that can be solved by digitalizing the agricultural market are the reduction in the number of rural population and low labor productivity in agriculture.

Thus, the study showed that the integrated use of digital technologies in the agricultural market of Kazakhstan along the entire product distribution chain from raw milk production to sale to the final consumer will help to reduce costs, improve the quality of milk and dairy products, labor productivity, as well as transform the workforce of the industry.

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