

# Digitalization as Tool of Innovative Development of Agrarian Territories

T Kh Sozaeva<sup>1</sup>, I R Mikitaeva<sup>1</sup>, S A Gurfova<sup>1</sup>

<sup>1</sup>Kabardino-Balkarian State Agricultural University named after V.M. Kokov  
Lenin Avenue, 1v, 360030, Nalchik, Russia

E-mail: sozaytanzilya@yandex.ru

**Abstract.** The article considers the impact of digitalization on the innovative processes in the economic agrarian sector. Today a key trend of agricultural development is digitalization. It will help increase the volume of agricultural production and the profitability of the agroindustrial complex industries. In the developed countries, digitalization has a positive effect creating new management principles and rules for the innovative activity conduct. In Russia the development of digital economics and the introduction of innovations into the agroindustrial complex is limited by depleted technical facilities, financial pressure and staff qualification. In the framework of the research the authors have identified that the digital technology introduction will increase labor efficiency, product quality, decrease inflation and unemployment providing for a stable economic growth. However, most technologies are accessible only for large and medium business. The authors suggest forming IT platforms in the agrarian sector of the country's macroregions with the state&private interaction in part of innovation introduction. Understanding the importance of digital technology introduction into the economic agrarian sector as a method of increasing the efficiency of agricultural production, the state builds a general strategy of breakthrough innovation introduction. Consequently, digital technologies will accelerate the integration of various economic areas transforming the innovative processes into an essential trend of economic development.

## 1. Introduction

Agriculture digitalization can transform the agrarian sector into a high-tech business based on the growth of efficiency and production and logistics cost reduction. For the last decade the use of some technologies have become commonplace in the agricultural production, such as a positioning system, integrated management of precision farming equipment. Nevertheless, the level of digital technology introduction in agriculture remains quite low. Understanding the importance of digital technology introduction into the economic agrarian sector as a method of increasing the efficiency of agricultural production, the state builds a general strategy of breakthrough innovation introduction.

## 2. Relevance

Among the important directions of economic digital transformation (for the agriculture as well) the most significant ones can include robotics, big data use and the artificial intelligence systems. The relevance of a rapid development of these digitalization directions for the agroindustrial complex (AIC) of Russia is preconditioned by the opportunity of a significant increase in the efficiency of agricultural production to overcome an existing gap with the developed countries.



The development of agrarian territories in the global practice occurs in the epoch of digital globalization based on information and innovations (*Gurvich (2016), Akcigit, Kerr (2018), Rassel, Smorodinskaya (2018)*). J. Schumpeter (*Schumpeter (1982)*) considered innovations as the means of economic crises overcoming. However, these are not just innovations but so-called "radical innovations" which define the orientation of structural shifts and economic growth. Today the experts believe that the radical innovations, providing competitiveness of national economies, include NBIC - technologies (NANO-BIO-INFO-COGNO), i.e. the symbiosis of nano-, bio-, information and cognitive technologies (*Canton (2006), Frolov (2013), Maslova, Avdeev (2018), Sandu and..(2015)*).

### 3. Problem statement

A prospective area in the agrarian sector development is the introduction of digital technologies in the production process at the AIC facilities. The development of each economic branch is not possible without new technical means, a material base that can be used for building efficient business. The purpose of the research is to consider the peculiarities of innovative technologies in the conditions of digitalization of the AIC branches and suggest forming IT platforms in the agrarian sector of macroregions of the country with the state&private interaction.

Understanding the importance of digital technology introduction into the economic agrarian sector as a method of increasing the efficiency of agricultural production, the state builds a general strategy of breakthrough innovation introduction. State programmes directed at the development of digital economics will provide for: 1) lowering the barriers in those areas which use digital technologies; 2) development of the infrastructure for new types of agricultural business and scientific networks; 3) re-training and training of specialists; 4) assessment of the risks of investments into new technologies.

### 4. Theory

In the developed countries the industrialization process is already at a new stage of development with the use of digital platforms (Agriculture 4.0), artificial intelligence and robotics (Agriculture 5.0). The digitalization processes from high-tech areas quickly transit from to other sectors of the economics in developed countries (*Rakhaev, Sozaeva, Mambetova (2018), Tumenova (2020)*). The farmers in the developed countries apply digital technologies in their activity (unmanned aircraft, satellite systems, online applications) which allow defining not only the production (area, type of cultures, crop yield, soil state, etc.), but also tracing the product way from the field to the consumer.

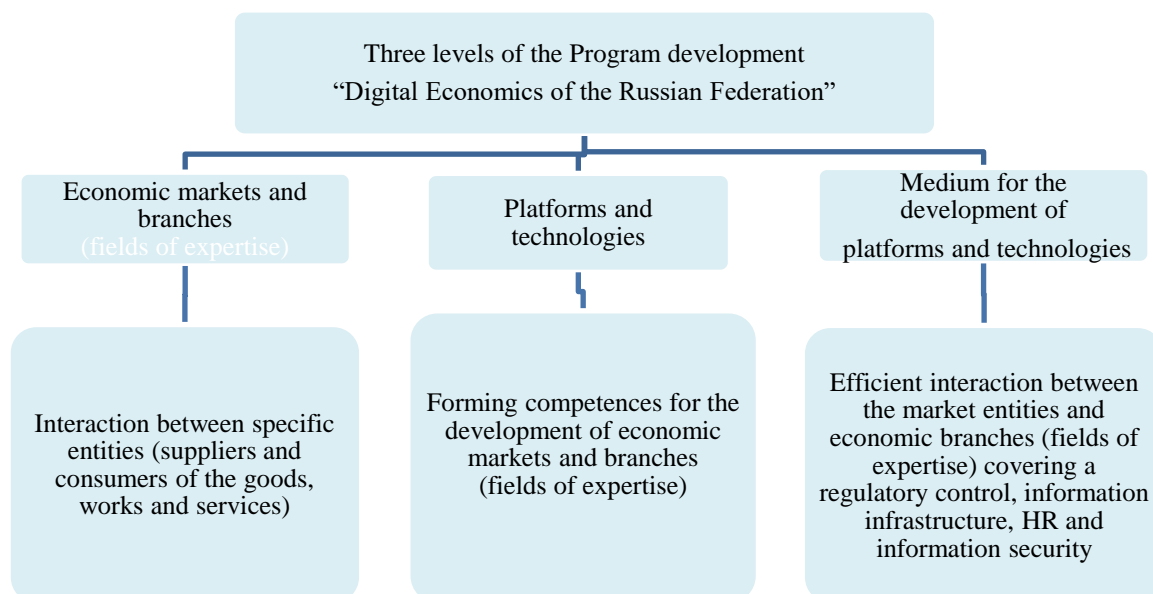
Digital technologies have a great potential for expediting innovative processes and, as a result, are the main indicator of the AIC branches competitiveness (*Alon, Berger, Dent, Pugsley (2018), Tumenova, Sozaeva (2019)*). The agrarian economic sector forms a great data flow, these are the data from meteorological services, satellites, agrotechnics producers, product suppliers, retail chains, etc. All the information is accumulated, analyzed and made available for farmers, processors and consumers in the form of various online applications (*Batishcheva (2019), Syutkina (2019)*). Additionally, the programs has such advantages as defining the time of planting, optimal amount of fertilizers, necessary moisturizing, selecting the time of harvest, etc. For animal breeding their application helps calculate the diets, performance, etc. In general, the data exchange on the basis of the Internet of Things facilitates the growth of product, raw materials and food output for the manufacturers of agricultural goods.

One of the country's breakthrough areas of development is forming digital economics to improve the efficiency of the economic sectors, competitiveness and the citizens' quality of living by means of digital technologies (*Mobeladze, Bifova (2014), Sozaeva, Pshigosheva and..(2019)*). The need for rapid transformations in the course of the implementation of the Strategy for Information Society Development in the Russian Federation for 2017-2030 yy [23] made the Government of the Russian Federation adopt the state program "Digital Economics of the Russian Federation" with the implementation period until 2024 [24]. After the approval of the Program "Digital Economics of the Russian Federation" the Ministry of Agriculture of Russia suggested developing the state subprogram "Digital agriculture" in 2017. The main purposes of the subprogram: making up a uniform information system for

accounting agricultural lands; organization of a system for tracing the flow of agricultural products “from the field to the store”; forming an interactive soil map of the country with the help of using robots to collect and analyze information on the soil state [21]. The subprogram implementation is intended at the development of a new agrarian technological policy of the Russian Federation which will gradually lead to the optimization of the use of mineral fertilizers and chemical agents of plant protection, reduction of the environmental impact, development of selection&seed center and in general, to the optimization of life cycle processes in the agriculture. Simultaneously, new educational standards will be introduced in the educational programs in the agrarian professional educational organizations as well as at the advanced training courses.

The program “Digital Economics of the Russian Federation” stipulates for three levels of its development (see Figure 1). It is important to note that the basic areas of the Program implementation are the second and third levels, i.e. the development of infrastructures, information security and key institutes in the framework of which the conditions are created for the development of digital economics. These include regulatory control, appropriate human resources and education, formation of research competences and groundwork.

In the agrarian sector of the economics of Russia the digitalization level is only 10% (annual growth - approximately 2-3%). Taking leading positions in the world in terms of productive acreage, Russia ranks only the 15th in terms of agricultural digitalization. Alongside with this, precision farming in Russia is applied only in 3% of the agricultural enterprise while in the USA this percentage is 60%, in the EU countries - 80% [19, 21]. AIC digitalization is greatly differentiated in the territorial entities of the Russian Federation. However, many digital solutions in the AIC in the RF territorial entities are aimed at the resolving of certain problems: precise farming system, “smart” farms, hot-houses, etc.



**Figure 1.** Levels of the development of the Program “Digital Economics of the Russian Federation”.

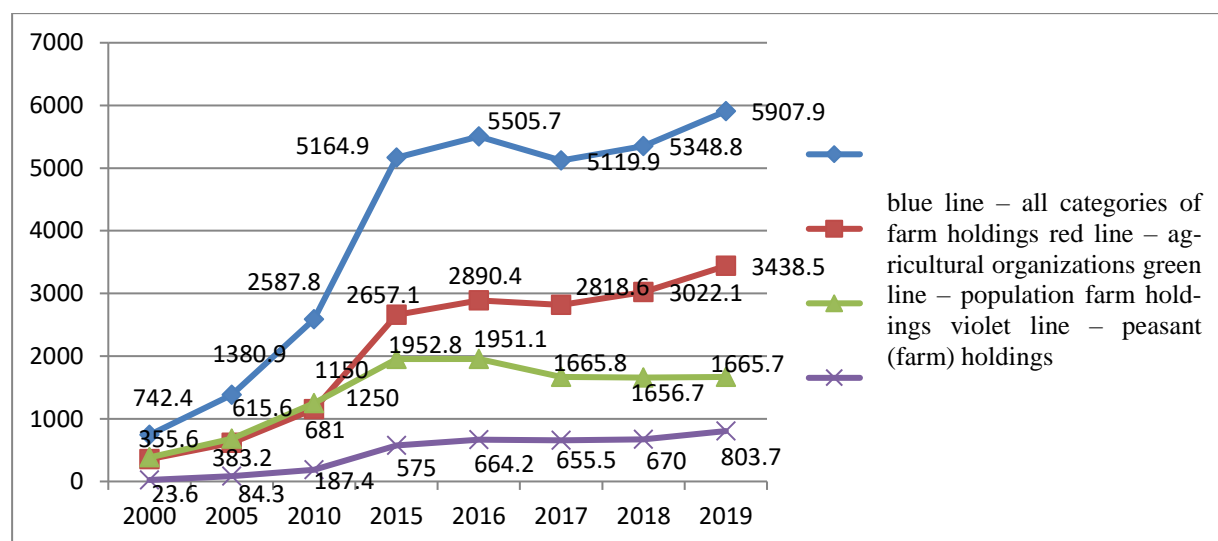
One of the reasons of poorly developed digitalization in the agrarian territories is the absence of regional municipal programs that could be a logical follow-up of the federal target programs (*Ushachev, Maslova, Chekalin(2018)*) Additionally, it is necessary to improve a categorical framework of digitalization as applied to the village economics. Making up a uniform digital platform for the economics of agrarian territories should stipulate for the opportunities to attract investments using not only some conventional methods but also by means of blockchain technologies, ICO (Initial Coin Offering). A great importance is attributed to the development of electronic document flow, modern electronic

communication channels, methods for information accounting and storage, development of new business models, startups, new market development. It will be possible by means of the optimization and expediency of the settlements for the goods and services with the use of cryptocurrency; digital information&communication technologies; Internet and mobile communication (Sozayeva, Rakhayev, Bak-kuyev(2019)).

Information technologies used to be applied only for the optimization of certain production facilities and business processes. However, under the conditions of economics digitalization it is important to define "new business models" that stipulate for a complex informational support and automation (Sozayeva, Khitiyeva (2016)).

Note that the key entities of economic relations on the activation of the digitalization components' introduction into the economic agrarian sector are state bodies and agricultural goods manufacturers. Judging by a recently formed economic structure of the agriculture, one could identify the following components: agricultural organizations, population farm holdings, peasant (farming) holdings (see Figure 2).

In Russia for 19 years the share of agricultural production significantly increased in the agricultural organizations (+13%) and peasant (farm) holdings (+10.4%); at the same time, the share of product manufacture in the population farm holdings reduced (-23.4%). Thus, agricultural organizations are more responsive to the introduction of digital innovations while the population farm holdings relate to the conservative ones in terms of new technologies. Alongside with this, digital technologies present a new and prospective direction for the economic growth of agrarian production.



**Figure 2.** Production of agricultural goods by farm holding categories in the Russian Federation for 2000-2019, billion rubles. [19, 24]

In the framework of the research the authors suggest building information platforms (IT platforms) on the basis of automation of production&technological processes; jobs; logistics; interaction of the AIC entities with the state&private partners, consumers, competitors, investors and governmental bodies.

Considering the readiness of the AIC participants for the innovative activity in the conditions of digital economics formation, IT platforms can be made for the following groups:

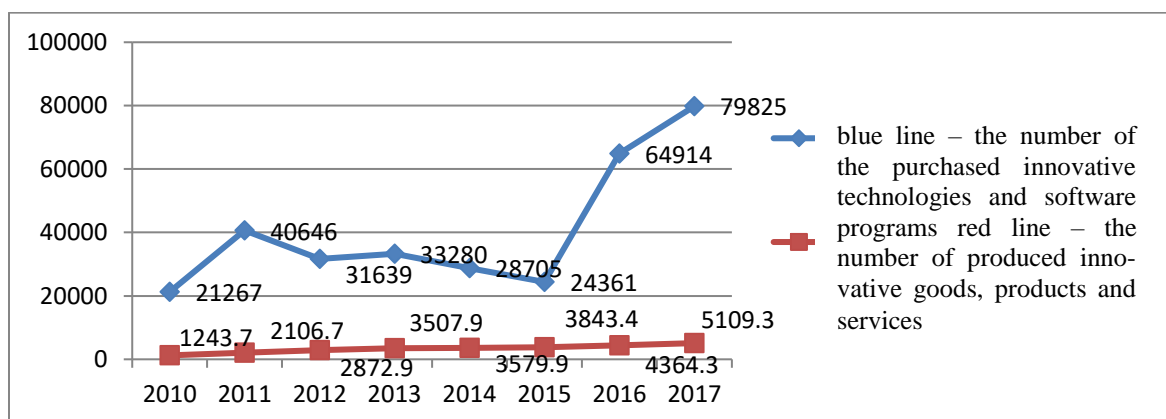
1) *high readiness* - here the authors consider reasonable to include economic APC entities using advanced technologies. This group comprises very few organizations. The regional statistics for such companies varies from 0% to 5-10% as maximum.

2) *relative readiness* - this group can include consistently working and profitable agricultural service companies, the companies of food and processing industry, retail chains, poultry farms;

3) *able to adapt* - this group includes medium-sized and large agricultural companies; having material, financial and labour resources for the application of modern information technology. According to Rosstat, for the last five years such agricultural organizations have formed at least 70-80% of a total number.

4) *not ready for self-adaptation* - this group should include loss-making companies, small peasant (farm) holdings and other farmsteads owned by population. They require a significant help to adapt to digital economics: from teaching computer literacy to manufacturers to digital equipment purchase.

The AIC innovative development is inseparably associated with the application of modern information technologies, automation and robotization of the production. The key tools of agriculture digitalization are the system of agriculture control, animal breeding control system, precise farming, "smart" irrigation. Robots, sensors, satellites and drone aircraft. The development of digital agriculture is not possible without an organizational mechanism of the AIC state support. Today an active re-equipment of agrarian production is being actively conducted in various agricultural areas. Thus, within the framework of the allocated funding, the volume of the funds for agricultural equipment purchase at discounted prices was increased by virtually 3 times. In addition, animal breeding facilities are being re-equipped. According to the Ministry of Agriculture of Russia, approximately 3% of the gross agricultural production is manufactured on the basis of new technologies and digitalization (see Figure 3).



**Figure 3.** The dynamics of innovative technology introduction in the agrarian sphere of Russia for 2010-2017 yy., billion rubles [19, 24].

The share of innovative technologies in the organization of the 1st AIC sphere is not significant and forms only 1/10 of all the innovative sector products. A large part of digital technologies is used in food products processing and production.

## 5. Practical relevance and results

The peculiarity of the Russian agrarian sphere is its passive attitude towards the investments into innovations as the largest effect from them can be seen only in three years. That is why the investments made today into the economic agrarian sector will provide the optimal effect only at the beginning of the 20-s of our century. This aspect should be taken into account in the concept of agriculture digitalization. The interaction between the territory digitalization and its production indices is confirmed by the correlation analysis results (see Table 1).



**Table 1.** Correlation matrix.

Gross regional product (GRP) per capita	Share of agricultural economy in GRP	Internet use	
GRP per capita	1		
Share of agricultural economy in GRP	-0.48080961	1	
Internet use	0.19847226	-0.26528725	1
Number of personal computers for	0.02916016	0.11619795	-0.02403622

The fact that the agrarian sector lags behind in terms of IT use is explained by a specific nature of the industry that is oriented towards traditional technologies of information, poorly developed infrastructure of digital communications in the village.

It is important to note that the agricultural digitalization in the country is at the primary level: deficiency of research&practice knowledge on innovative technologies, absence of precise forecast of agricultural product prices as well as a poorly developed system of logistics, storage and delivery. All these factors cause high production expenditures. In Russia the number of agricultural manufacturers having sufficient funds for the purchase of the equipment, equipment use and information technology platforms is quite few. The amount of costs for information&communication technologies (ICT) in 2015 equaled 4 billion rubles which forms 0.34 % of a total number of ICT investments, while in 2017 this value equaled 0.85 billion rubles. (0.2 %) [19,24]. It is the lowest indicator on the industries showing a low digitalization of the agrarian sector having a high potential for ICT investments.

In the conditions of digital economics the AIC innovative development implies the use of innovative digital technologies, products, services, information, nanotechnologies, biological and ecological innovations as well as new control, economic, organization methods with absolutely new properties that have not been previously used as a scientific novelty and aimed at the increase of production efficiency of the AIC branches.

## 6. Conclusion

Digital economics stipulates for a new stage of introducing the achievements of scientific-technological progress in all industries and areas of the social and economic activity as well as in the foreign and domestic state policy. Creating the IT platforms of agrarian territories to reflect the peculiarities of the macro-regions of the Russian Federation will make it possible to define the specific character of integration of various industries and areas into the digital economics. Russia has a significant reserve for increasing the efficiency of the agrarian production (approximately by 3-5 times) and the potential growth of agricultural turnover by means of introduction of digital technologies into crop cultivation and livestock farming, increase of labor efficiency with the use of IT platforms to provide control at all production levels.

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