

DIGITAL AGRICULTURAL TECHNOLOGIES FOR SUSTAINABLE RURAL DEVELOPMENT: OPPORTUNITIES AND BARRIERS

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Abstract. The article examines the economic and technological potential of the digital environment and the state of the application of digital agricultural technologies for sustainable rural development, explains the visible and expected features of the “green agricultural economy”. The process of mastering and sustainable use of digital agricultural technologies does not meet the requirements of the “green economy”. The main reasons for this situation and the nature of the existing obstacles to sustainable development of rural areas have not been sufficiently studied. In this context, it is highly likely that the opportunities provided by digital technologies will be used more effectively to ensure sustainable rural development. There is a serious economic, social and technological need to determine the directions and means of realizing this potential. There is a need to look for ways to overcome the existing and anticipated obstacles to sustainable rural development. The purpose of the study is to identify potential opportunities and obstacles to the use of digital agricultural technologies for sustainable development of rural areas. By analyzing sociological surveys conducted among specialists, the economic and environmental requirements for digital agricultural technologies from the point of view of sustainable development of rural areas of Azerbaijan were clarified, opportunities for sustainable use of agricultural technologies for sustainable development of rural areas in the digital environment were identified. As a result, obstacles in the application of digital agricultural technologies for sustainable rural development were identified and some ways to overcome them were shown.

Keywords: sustainable development, rural areas, digital technologies, agriculture, obstacles, applicability, efficiency.

Introduction

Agrarian sector is an important factor in the development of rural areas. The influence of its technological development on sustainable development of these areas is not a little [1].

Until the actuality of the criteria for sustainable development, agrotechnologies have been assessed mainly from the economic and economic-technological point of view. Such cases can still be coming across when approached from a specific manufacturer position. It means, that most of the time, agrarian manufacturer looks at the agrotechnologies, at the same time, at the digital agrotechnologies as a tool of increasing of productivity and saving of resources, in short, as a tool of competition [2]. The problems of the influence of these technologies on the environment, at the level of individual manufacturers have never been at the extent desired degree in the spotlight. [3]. Of course, there is always a need for a healthy competitive environment for digital economic and technological development. “In order for digitalization to benefit all companies and citizens, there is a need for a healthy competitive environment that promotes, disseminates and helps people benefit from technology” [4]. At the same time, digital “when the platform is focused on cost-effectiveness, is recommended to exercise strict control and stimulate competition among platform users” [5]. At present, the technological capabilities of the information society are expanding in terms of supporting sustainable development through the integration of activities [6]. However, the use of digital agro-technologies for sustainable development of rural areas has been little studied [7]. In this regard, not enough attention is paid to obstacles [8].

Therefore, in terms of sustainable development of rural areas, the economic and environmental requirements for digital agricultural technologies should be specified, and the elimination of the existing and expected barriers should be researched.

Materials and methods

The using of digital agro-technologies has just begun in Azerbaijan. Data are not sufficient to assess the impact of these technologies on sustainable development of rural areas. Therefore, various sources have been used to identify opportunities and barriers to the application of digital agricultural technologies for sustainable development of these areas.

It can be agreed with those who recommend the use of a realistic pricing approach [9] to assess the role of digital agricultural technologies in sustainable development of the village [8]. Distinguished

features, depending on the scale of the realistic assessemnet [10], are important from a methodological point of view. Let us note that distinguished features, which about we say, prove themselves more on social and service spheres. The PEST parcing, which can be used together with SWOT, shows itself in research in terms of environment and resourses [11].

The elements of the mentioned above approaches and experimental approaches were applied in the process of the parcing of the survey matreials, which has been conducted between specialists on economic-ecological requirements for the digital agro-technologies in Azerbaijan for sustainable development of rurual areas. To clarify the role of digital agricultural technologies in sustainable development of rural areas in Azerbaijan, the study analyzed the results of a survey of 40 people representing 17 organizations. For this purpose, one-dimensional (descriptive) and multidimensional analysis methods were used. Analitical materials have been used for the characterization of facing barriers and the promotional opportunities of sustainable development of rurual areas of digital agro-technologies.

Results and discussion

Balanced interaction of social and economic development in rural areas is one of the main conditions for sustainable development [12, p.11]. The active development of the digital economy contributes to economic growth, as well as sustainable development in other regions along with the specific region [13].

The transition to sustainability as a multi-level and complicated process, at the same time is a socio-technical in characteristic [14]. Sustainable development of rural areas implies a dynamic increase in potential in these areas, the formation of competitiveness, improving the living standards of the population, quality of life, improving the demographic situation. In order to ensure sustainable development of rural areas, the development of social infrastructure of the village, protection of the environment more funds are allocated [15].

There are different approaches of decision-makers to achieve sustainable development of rural areas. From a strategic point of view, these approaches are based on economic dynamism and environmental protection [16]. Agriculture has the following 5 main effects on the environment: land degradation, deforestation, biodiversity, the problems of pests, wastage [17]. There are more barriers on the way to sustainable development in small farms. The barriers to the application of digital agricultural technologies for sustainable development of rural areas are numerous and varied. These limitations, mainly due to lack of financial resources, also limit access to the benefits of the digital environment [18].

Suggested in research viewing to the digital technology as repetitive collective action between the parties the creation of the conditions for sustainable development reconciling different interests, is interesting until the right balance is achieved [8].

The following are significant barriers to the application of digital technologies in modern agriculture: “Weakness of information technology infrastructure and network, relatively high costs for technological technologies, low level of digital literacy, lack of state policy for the development and promotion of sustainable agricultural digital technologies” [19].

It is becoming increasingly clear that the entire rural population must be prepared to take advantage of the real potential of the digital environment. Individual measures are not enough to achieve a positive result in the digitalization of rural areas. Large-scale and systematic application and dissemination of cloud technologies, unified information platforms and infocommunications in rural areas is necessary [20].

In order to take advantage of the digital environment for sustainable development of the village, it is important to improve the quality of data as a key measure to be implemented. It is considered that “promoting the collection of more accurate information on digital technologies and digitalization at the territorial and human levels, especially the providing of information in a differentiated manner in urban and rural areas; creation of sustainable business models that provide digital solutions to enable small farmers in the process of digital transformation of agriculture” serves the sustainable development of rural areas [1, p.16/18].

The place and role of digital village projects, such as a testing ground for digital technologies, including digital agricultural technologies, for sustainable development of the village is determined in practice. “Digital Village can be defined as an ecosystem that needs to be built and developed on the principles of agility, inclusion and sustainability” [21]. The digital village involves the joint efforts of all interested partners. These parties should include users, technology developers, beneficiaries, local and central authorities, banks, educational and scientific circles.

The opportunities created by digital agricultural technologies for sustainable development of the village can be realized in the environment of digital technologies in general. These opportunities include the emergence of new business models, increased transparency and monitoring of economic transactions, identification and measurement of transaction costs, their reduction, more flexible adaptation to market requirements, the benefits of digitalization [22, p. 10/12] are noted.

One of the important opportunities created by digital agricultural technologies for sustainable development of the village is the public-private partnership [23, pp. 58-68]. Thanks to this partnership, it is possible to expand the financial opportunities for the use of digital agricultural technologies for sustainable development of the village, and to improve the institutional environment. Barriers to the sustainable development of rural areas faced by digital agricultural technologies are, first of all, low incomes of the rural population, unemployment, migration [24].

The lack of trust of users of digital agricultural technologies [25] is an important factor hindering sustainable development of these technologies in rural areas. Delays by beneficiaries may significantly extend the application of digital agricultural technologies in the sustainable development of rural areas [26]. Incompleteness of information exchanged between partners limits the application of digital technologies in agriculture. The institutional aspect is important for sustainable development of rural areas. Therefore, “inadequate support for institutional development, over-centralization, inefficient use of resources, as well as human resources, and urban-rural exploitation” [27] are important barriers to sustainable development of rural areas.

The Azerbaijani government considers that for the application of digital technologies should be upgraded the normative-legal base, the broadband network should be expanded with the participation of the private sector, digitalization of documents, promotion of digital literacy and a number of other measures should be realized [28].

A survey was conducted in Azerbaijan to clarify the role of digital agricultural technologies in the sustainable development of rural areas. The survey covered the following institutions with participation of 40 people: The Center for Economic Reforms Analysis and Communication, Regional Department of Ecology and Natural Resources No 1 (Lankaran), SINAM ICT Company, Veterinary Science Research Institute, Lankaran Tea Branch of Science Research Institute of Azerbaijan Fruit and Tea Growing, Agricultural Research Center of the Ministry of Agriculture, Economic-Research Scientific-Research Institute, Institute of Information Technologies of ANAS, Institute of Management Systems of ANAS, Lankaran Regional Scientific Center of ANAS, “Tea and subtropical plants” department, Azerbaijan State Agrarian University, Lankaran State University, Azerbaijan State Economic University, Azerbaijan Technical University, Azerbaijan University of Oil and Industry, Azerbaijan Cooperation University.

The survey included the following questions.

1. Are you familiar with the goals of sustainable development?
2. Is there a need to change attitudes towards the environment in agricultural activities?
3. Are you satisfied with the resource conservation of agricultural technologies?
4. Is crop production ready for the application of digital technologies (digitalization of fields, differential fertilization, etc.)?
5. Is cattle-breeding ready for the application of digital technologies (digital quality monitoring, milking robotization, etc.)?
6. Is there a need for ecological expertise of digital agricultural technologies?
7. Does the digital infrastructure meet the requirements of agricultural technologies?
8. Can digital agricultural technologies make a significant contribution to sustainable development of rural areas?

9. Is positive impact of digital agro-technologies expected on the structure of employment in agriculture?
10. Is digital agrotechnology expected to have a positive impact on youth and women's agrarian entrepreneurship?

35 people (87.5%) in the survey said that there is a need to change the attitude to the environment in agricultural activities, only 6 people (15%) were satisfied with the resource conservation of agricultural technologies (Fig. 1).

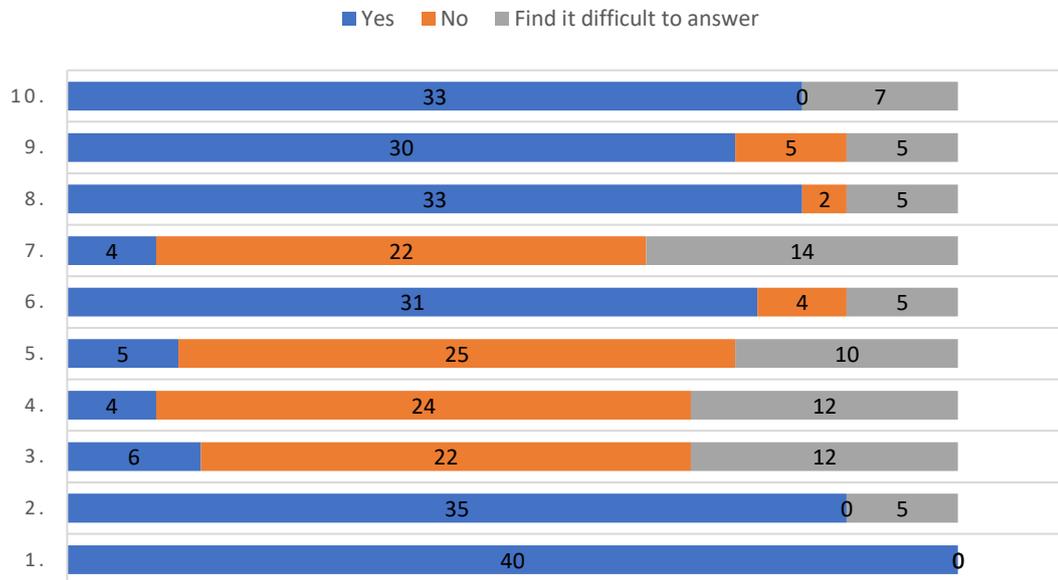


Fig. 1. Results of a questionnaire analysis on the role of digital agricultural technologies in sustainable development of rural areas

60% of respondents answered negatively to the question on the readiness of plant growing for the application of digital technologies, and 62.5% answered negatively to the question on the readiness of cattle-breeding for the application of digital technologies. 77.5% answered positively to the question of the need for ecological expertise of digital agricultural technologies. 55% of respondents asked “Does the digital infrastructure meet the requirements for the application of agricultural technologies?” answered the question in negative. 82.5% of respondents consider that digital agricultural technologies can make a significant contribution to sustainable development of rural areas. 75% expected that digital agro-technologies will have a positive impact on the structure of employment in agriculture. It is interesting that 82.5% of those expect the positive impact of digital agricultural technologies on the agrarian entrepreneurship of young people and women.

A comparison of opportunities and obstacles in the application of digital agro-technologies in Azerbaijan in the process of sustainable development of rural areas with foreign experience shows that “precise agricultural technologies” are used in the EU countries and their opportunities for digitalization are wider [29, pp.163-174]. This suggests that these countries have a higher level of readiness for the application of digital technologies in the field of crop and animal husbandry and the development of digital infrastructure. The Declaration of Cooperation of 26 European countries for the digitization of rural areas promotes sustainable development [30]. In these countries, there is a balanced approach to the environment in agricultural activities, the level of resource conservation of agricultural technologies is high, and environmental expertise of digital agricultural technologies is carried out. Thanks to digital technologies, farmers' rights in governance are increasing [31]. Such a situation can partially eliminate obstacles in the application of digital agro-technologies for sustainable development of rural areas. In this regard, the New Zealand experience in resolving conflicts arising in the process of applying digital agro-technologies [32, pp. 152-162] is noteworthy.

The Norwegian experience in managing the impact of digital technologies on the structure of employment in rural areas [33] is noteworthy in terms of predicting the impact of these technologies on

the structure of employment in agriculture. In the European Union, the proportion of young people in rural areas is relatively high, and this factor expands the opportunities for the application of digital technologies in agriculture [34].

Conclusions

The level of user's indifference to digital agricultural technologies in terms of sustainable development is high, as can be seen from the survey results. Respondents explained their pessimism about the level of readiness of plant growing and cattle-breeding for the application of digital technologies by significant delays by beneficiaries, inadequate support for institutional development, and incomplete information exchanged between interested parties.

The opportunities to overcome the barriers mentioned are likely to be realized in the digital technology environment. To this end, it is expedient to develop public-private partnerships, create new business models based on digital platforms, increase transparency and monitoring of economic transactions, reduce transaction costs, adapt more flexibly to market conditions, and ensure that everyone benefits from the results of digitalization. It is desirable to promote the creation of sustainable business models that provide digital solutions to help small farms in the process of digital transformation of the countryside and agriculture.

The majority of respondents are saying that digital agro-technologies will have a positive impact on the agrarian entrepreneurship of young people and women, they praised the role of these technologies in reducing unemployment and poverty in rural areas.

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Author contributions

The contribution of each author. Example: Conceptualization, R.B. and N.M.; methodology, R.B. and N.M.; validation, R.B. and N.M.; formal analysis, R.B. and N.M.; investigation, R.B. and N.M.; data curation, R.B. and N.M.; writing -original draft preparation, R.B. and N.M.; writing - review and editing, R.B. and N.M.; visualization, N.M.; project administration, N.M.; funding acquisition, R.B. and N.M. All authors have read and agreed to the published version of the manuscript.

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