
AGRICULTURAL ADVISORS' ROLE IN THE USE OF ICTs AS A TOOL FOR A MORE SUSTAINABLE SERBIAN AGRICULTURE

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ABSTRACT

The aim of this paper was to show the role and importance of agricultural advisers in the development and implementation of information and communication technologies (ICTs) in a path to the more sustainable agriculture, and achieving the SDG2 Zero Hunger of the UN 2030 Agenda. There are a lot of challenges in the efforts to develop so-called "hi-tech agriculture" and smart farming in the Republic of Serbia. This research is conducted on the territory of the Nisava district in three municipalities: Merošina, Gadžin Han and Niš. The obtained data were statistically processed and presented through tables and charts. Agricultural advisers play an important role in the digital literacy of agricultural producers on their pace to implement in practice principles of hi-tech agriculture. The most important is the funding of permanent education of advisers, as well agricultural producers to acquire the state of art knowledge and experience needed to become more competitive in the EU and global market.

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Introduction

The United Nations Agenda, Transforming Our World: the 2030 Agenda for Sustainable Development is seen as a plan of action for people, the planet, and prosperity. 17

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sustainable goals (SDGs) which are declared in the Agenda 2030 are not easy to achieve (Al Zubi, Radovic, 2019). The SDG2 (Zero Hunger) aims to end all forms of hunger and malnutrition by 2030, making sure all people especially children have sufficient and nutritious food all year. This involves promoting sustainable agriculture, supporting small-scale farmers, and equal access to land, technology, and markets (United Nations, 2015; Popescu et al, 2017).

The Food and Agriculture Organization of the United Nations (FAO) has identified five key principles that balance the social, economic and environmental sustainability, and provide a basis for developing adapted policies, strategies, regulations and incentives. Five key principles are:

1. Increase productivity, employment and value addition in food systems;
2. Protect and enhance natural resources;
3. Improve livelihoods and foster inclusive economic growth;
4. Enhance the resilience of people, communities and ecosystems
5. Adopt governance to new challenges (FAO, 2018).

Agriculture is the fourth largest sector in the Republic of Serbia, accounting for 17.4 percent of employment and 5.4 percent of total exports. In 2019, the total budget for agriculture and rural development is US\$348 million, of which 12 percent (or US\$ 43 million) comes from EU resources). The remainder of the budget is covered by national program resources, of which US\$44.6 million is allocated to rural development (World Bank, 2019). Serbian agriculture despite numerous efforts of policy-makers in the last decades still lacks consistent agricultural policy and strategy, which would lead to changes and compliance with the European Union Common Agricultural Policy (EU CAP) (Djurić et al., 2019). Achieving more sustainable agriculture in the Republic of Serbia is a particularly complex issue in the rural region (Todorović, Drobnjaković, 2010; Radović, Cvijanović, 2018; Dimitrovski et al., 2019).

Innovation is a main driver of sustainable agriculture. Therefore, in the global digitalized world there are many facts which addressed that the digitalization of agriculture has to be a number one priority on the agenda of all interested parties.

Information and communication technologies (ICTs) are the basis of economic development because they significantly affect the development of the economy and society (Spasić, Georgijevski, 2013). The fourth industrial revolution brings important opportunities for future agricultural development, particularly in less-advanced developing countries. Furthermore, a significant increase in ICTs application in developing countries, like Serbia represents a unique opportunity to pass on valuable information to different locations and to different people who were previously unable to access such information, and markedly reduce the cost of deploying the new services.

In the Serbian scientific community, there is some organization which is working in the area of providing ``tech solutions for sustainable agriculture``. The BioSense Centre at the University of Novi Sad Serbia has partnered with the Foundation for Agricultural Research DLO at the University of Wageningen in the Netherlands to increase food security in Serbia through the integration of advanced IT solutions into agricultural practice. They create Wireless Sensor Networks (WSN) and Remote Sensing to acquire detailed crop data for analysis. The sensors provide data about humidity, soil temperature, illumination, plant diameter, and growth rate. Biosense has pioneered a new trend in sustainable agriculture in Serbia called **precision agriculture**, and more details are available on the platform (agrosens.rs/#/app-h/about). It brings the benefits of ICTs to the end-users, providing free tools for record-keeping and for better decision making based on remote sensing.

Precision agriculture is given as one example of the many ways to support agricultural production through high technology, with the aim of reducing energy use, monitoring soil conditions, and enhancing yields, and also focus on socio-economic aspects. Government, industry, academics, civil society, and agricultural producers need to collaborate to ensure that all of society is able to benefit from rapid advances in technology and precision agriculture.

Progress in agriculture and rural development cannot be imagined without consulting the public service, which is organized in a modern way. The primary function of such an organized public service in agriculture is to enable easier transfer of knowledge (Simonović, 2016). The tasks of the agricultural advisory service are activities that achieve the set goals. These activities are focused on jobs that improve agricultural production by branches of production, in crop production, livestock production, fruit growing, and viticulture, improving plant protection, mechanization and quality of agricultural land, and more. The Law on the provision of advisory and professional activities in the field of agriculture regulates the conditions and methods for advisory and professional activities in the field of agriculture, the Register of agricultural advisors, training of agricultural activities and agricultural producers, development planning advisory services in agriculture, as well as other issues of importance for advisory work in agriculture (Official Gazette of RS no 30/10, 2010).

The author's core observation is that information and communication technologies (ICTs) have the potential to increase the rate of diffusion of a very wide range of technologies, applications, and platforms across agriculture. It is based on data that only 14 percent of farmers had adopted smart farming technology, and eighty-one percent cited equipment cost as the most important reason for not doing so (ITU, FAO, 2020).

The aim of this article is to highlight the use of ICTs in the achievement of SDG2, as well all other SDGs, and creating more sustainable agriculture in the Republic of Serbia based on the emphasis on the role of agricultural advisors to encourage the agricultural producers to use ICTs, and so far become more involved in the process of developing sustainable agriculture. Therefore, the conducted research consider

the previous researchers related to the ways how agricultural producers obtain useful information, through which communication channels they try to achieve additional knowledge needed for their future work and etc. All data are provided based on work of eleven agricultural advisers in charge for those actions in the territory of Nišava district in 2019 (psss.rs/nis.html).

Obtained results confirmed a new paradigm for agricultural research which reflects farmer first, embraced participatory approaches, provided to farmers market information, weather warnings, mobile payments, connecting with customers of goods, and acknowledging the challenges of increasing complexity and uncertainty of situations.

Advisers have three major tasks to performed in future activities to engage agricultural producers to be more devoted to sustainable agricultural practice: make new things visible, respect the traditional knowledge and the third, emphasize the use of ICTs, facilitate learning, and help producers overcome major hurdles in adapting their farms to the age of the fourth industrial revolution.

Literature review

In less developed countries there are high transaction costs and restrictions on accessing information, which limits the optimal production of farmers. Rapid technological change, linked to climate change, requires farmers to have accurate and reliable information in order to make effective decisions. The information needs at each stage of the agricultural cycle must be met if an adequate response to each challenge is desired. As mobile phones have become the basis for providing advisory assistance to farmers, a number of researchers have begun to consider their impact on agricultural and rural development (Aker, 2008; Fu, Akter, 2012).

In addition, Srinivasan and Burrell point out that mobile phones are important for improving connections between different actors in the fish market and simplifying coordination in case of adverse events (Srinivasan, Burrell, 2013). The geographical location of the coastal area, as well as the very large lending opportunities, allow fishermen to optimize profits by selling catches in different markets. A study by Islam and Grönlund (2013) presented the application of the Agricultural Management System (AMIS) based on mobile telephony, which was locally promoted under the name Pallinet, in remote villages of Natore District in Bangladesh.

The study (Ruiz-Garcia et al. (2009) discuss the impact of information and communication technologies in poor communities in rural Lesotho. It points out that although information and communication technologies have the potential to improve the socio-economic aspects of small farmers, are: costs, illiteracy, infrastructure, access, and lack of necessary skills reduce the positive effect and potential for improving living conditions in agricultural communities

Since Serbian rural areas are usually poorly informed, so the provision of information has become a major goal of most development initiatives (Chapman, Slaymaker, 2002).

As a result, the largest information and communication services are based on the ability of farmers to access information that is relevant to life and livelihoods.

Several studies have analyzed farmers' information needs, based on which possible applications of information and communication technologies can be identified. For example, a national survey of farmers in India identified three categories of information necessary for farmers: (1) information that helps farmers what to plant and which varieties to choose, (2) market information that includes prices and indicators price, (3) contextual information that includes weather conditions and best practices (Mitrović et al., 2009). These categories of information are needed at different stages of the agricultural life cycle, which includes: crop planning, purchase of seeds and raw materials, planting, growth, harvesting and sales (Filipović et al., 2017). The most critical information farmers need is: weather conditions, pest and disease control, information on seeds and market prices.

Although the most representative applications of information and communication technologies in agriculture are based on the use of mobile phones to transmit information, there are also examples of projects based on participatory approaches. These approaches include the integration of the Internet, mobile devices such as portable projectors, TV sets, and devices for the production and delivery of agricultural content (Janković et al., 2015). Among them is a representative example of Digital Green, which uses short videos with instructions, in which local farmers cooperate with agricultural experts. Videos are recorded with pocket video cameras and displayed locally using a pico projector. Farmer feedback is provided through Interactive Voice Response (IVR).

Farmers who receive timely information about the market situation can look for the cheapest possible market entry. Up-to-date information can be obtained from various persons who trade in goods in the form of SMS messages, e-mails, telephone calls, which is done almost immediately using mobile telephony services. In some situations, access to mobile phones leads to increased revenue. An analysis conducted by the World Bank in the Philippines confirms that mobile phone purchases are associated with higher revenues, ranging from 11% to 17%, (Labonne, Chase 2009).

Radenović with colleagues (2020) examined key indicators that are necessary for the implementation and development of smart farming concepts in the agricultural industry, especially from the applied mobile technology point of view. They proved that those countries that invest the most in the ICTs in the agricultural sector can achieve a significant increase in value-added in the production process and ultimately to an increase in the percentage share of the agricultural sector in GDP.

The most valuable literature source for authors was the review which provides the results of a one-year study jointly conducted by ITU and FAO, addressing a broad range of issues related to contemporary policy and practices across Europe and the Commonwealth of Independent States (CIS) in e-agriculture. It features the experiences of countries in their ongoing efforts to develop and implement digital agriculture strategies (ITU, FAO, 2020).

The theoretical; background is also based on analyses of sustainable development literature (Antholt, 1994; Radovic et al., 2015), ICTs scientific researches related to agriculture (Pedersen et al., 2006), principles of stakeholders' participation in policy-making and implementation processes (Emerson, 2015), and social partnership and inter-organizational collaboration ideas were taken into consideration (Seitanidi et al., 2010), and many other available sources.

Materials and methods

With the aim to substantiate a research construct which would enable to present the importance of the use of ICTs in agriculture on the territory of the Nisava district in three local communities: Merošina, Gadžin Han, and Niš. The authors used few various methods: scientific discourse analysis, a survey of respondents, statistical data analysis, and systematization and synthesis of scientific insight. The research was conducted on 90 respondents, a sample of occasions, and 30 from each mentioned municipality. The research was done through a non-experimental method, through a questionnaire containing 20 items. The first part of the questionnaire refers to socio-demographic data, while the second part of the questionnaire refers to data on the use and utilization of new information technologies and data distribution via electronic devices. The obtained data were statistically processed and presented through tables and graphs.

Results and Discussions

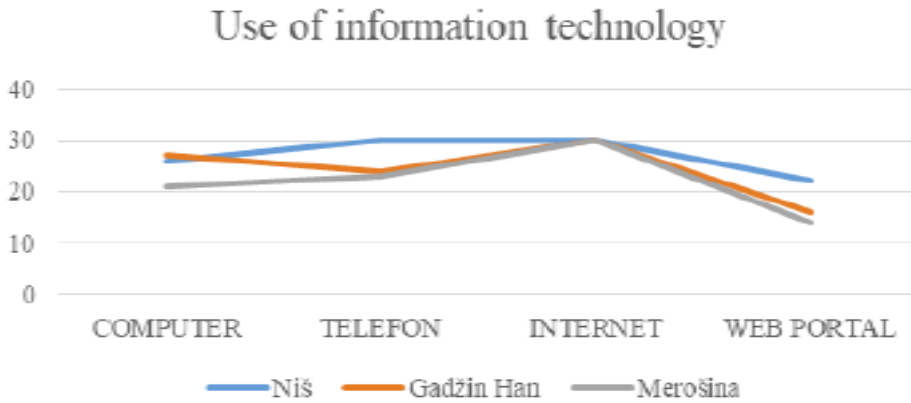
Research dedicated to considering the possibility of implementing advisory agricultural services using ICTs analyzed information and communication systems and their use in the Nisava district as well as mechanisms for implementing advisory assistance and their primary purpose through services for voice, radio broadcasting, and calls, auxiliary services realized through SMS messages through the portal of advisory services and e-learning programs through printed publications. The obtained results are shown in Table 1.

Table 1. Use of different types of ICTs

MUNICIPALITIES OF NISAVA DISTRICT	Used service							
	Computer		Mobile phone		Internet		Website	
	no	%	no	%	no	%	no	%
Niš	26	86.6	30	100.0	30	100.0	22	73.3
Gadžin Han	27	90.0	24	80.0	30	100.0	16	53.3
Merošina	21	70.0	23	76.6	30	100.0	14	46.6

Source: Author's calculations

The presented results indicate that the use of mobile phones and the use of the Internet by agricultural producers is very represented as much as 100% of the total number of respondents, while the use of computers is represented by 86.6%, and the use of information from web portals is the smallest, only 73.3%. The results are presented in Figure 1.

Figure 1. Use of ICTs

Source: Author's calculations

By analyzing the initial and current efforts to develop information and communication technologies, we found a significant shift from the application of centralized approaches, such as the use of televictory (<http://televanta.pro.talkiewalkie.org/>), to the application of decentralized approaches, such as mobile systems and direct transmission of information “in hand” to users via mobile phones. This result is similar to those proved by Ceranić et al. (2011). Their prevalence and potential benefits, potential uses, can significantly improve the transfer of knowledge and information as well as improve the application of technologies and facilitate agricultural sustainable development.

The use of computers and the Internet is leading to improvements in all sectors. In the agricultural sector, computers are used to accomplish a number of tasks. Computers are much more common in the agriculture of developed countries, while very few farmers use computers in developing countries. However, the number of users is increasing every day (Ceranić et al., 2015), and the possibilities of application are increasing.

Taking care of finances in agriculture is a very important task in larger agricultural activities. That's why a computer is a necessary tool for recording records. Keeping notes with paper and pen is very time consuming and not secure enough, and computers make the job much simpler and less time consuming, while all calculations are done almost instantly. Rađenović with his colleagues concluded the same in one of his recent research and stated “that farmers which understand the importance of using ICTs in agriculture are more likely to adopt a mobile technology perspective as a part of smart farming concept” (Rađenović et al., 2020). The information provided to agricultural producers is crucial in making important decisions that can be useful to them in agricultural production and the manifestation of economic effect and profit.

The results shown in Table 2 show that farmers receive the largest amount of data through contact of consultants with farmers through the media, web portals of advisory services, direct visits to farmers, while the smallest percentage was the use of various

sort of printed materials. Advisers provided to them different printed materials like bulletins, as well as one specific journal named ‘‘Berićet’’.

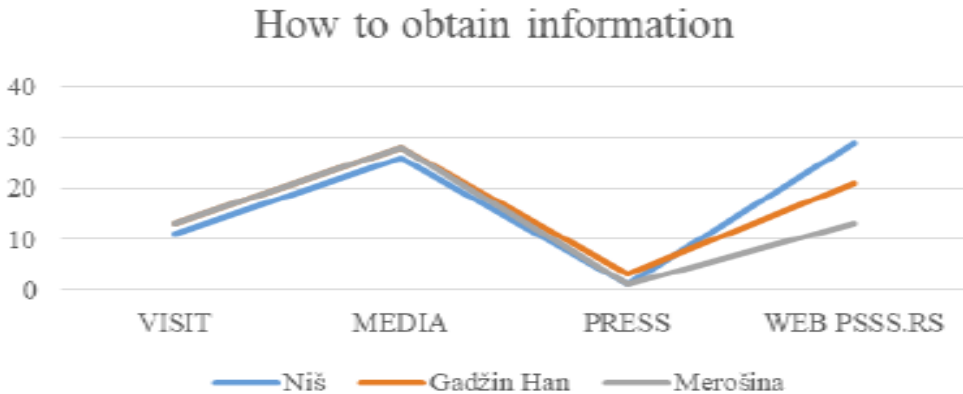
Table 2. Communication channels (obtaining useful information related to agriculture)

MUNICIPALITIES OF NISAVA DISTRICT	Communication channels							
	Site visit		TV, e-media		Printed material		website httpspsss.rs	
	no	%	no	%	no	%	no	%
Niš	11	36.6	26	86.6	1	3.33	29	96.6
Gadžin Han	13	43.3	28	93.3	3	10.0	21	70.0
Merošina	13	43.3	28	93.3	1	3.33	13	43.3

Source: Author’s calculations

A graphical presentation of the results was performed in Figure 2.

Figure 2. How to get useful information about agriculture



Source: Author’s calculations

The third part of this field research was related to the specific role of agricultural advisory services in this region, focused on providing adequate skills and knowledge. The research question was devoted to the ways how additional knowledge is obtained in this region. The knowledge system in agriculture is based on the functions that the system should fulfill and operationalized on a total of six basic functions: identification of (cognitive) needs, creation of innovative knowledge, operationalization of knowledge, dissemination of knowledge, application of knowledge, and evaluation of experiences.

And futurist Daniel Burns, author of *TechnoTrends -24 Technologies That Will Revolutionize Our Lives*, emphasizes, ‘‘the future belongs to those who are capable of being retrained again and again’’ (Rose, Malcolm, 1997). The primary function of agriculture advisory services is to enable easier transfer of knowledge. Some scientists consider that they have also one more task: connecting agricultural producers with educational and scientific institutions (Vujičić, Ristić, 2006, p.69).

Therefore in practice, the role of the counselor in working with the target group is at least twofold: he is, on the one hand, an expert who has the necessary knowledge and information that can help farmers solve a problem, but also an educator whose task is to provide a situation that will stimulate learning (adoption of new knowledge), and thus motivates the farmer to change his opinions, attitudes, and behavior in order to improve his farm (Janković et al., 2003). From the point of view of improving domestic agriculture, the main target group of advisory work is farmers/farmers and their farms. The way in which advisors transfer their knowledge and transfer information is shown in Table 3.

Table 3. The role of the advisor in the transfer of expert advice

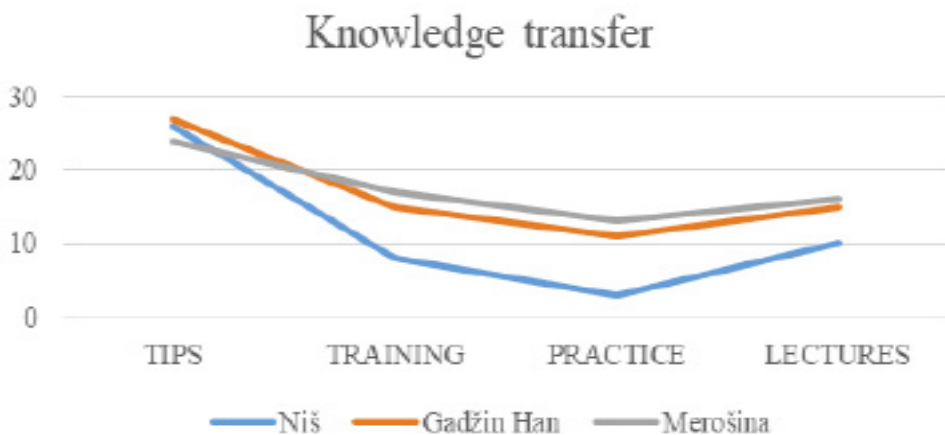
MUNICIPALITIES OF NISAVA DISTRICT	Knowledge transfer							
	tips		training		practice		lectures	
	No	%	no	%	no	%	No	%
Niš	26	86.6	8	26.6	3	10.0	30	100.0
Gadžin Han	27	90.0	15	50.0	11	36.6	15	50.0
Merošina	24	80.0	17	56.6	13	43.3	16	53.3

Source: Author's calculations

The presented results indicate that the activity of advisors is most pronounced through the provision of advice through direct contact with farmers, lecturing, while the provision of practical training in the field and training of farmers is less represented. All actions performed by advisors were performed in accordance with the Rulebook on the manner of performing advisory work in agriculture (Official Gazette of the RS, 2014 no 65/14).

The obtained results are graphically presented in Figure 3.

Figure 3. The role of advisors in the transfer of professional knowledge



Source: Author's calculations

The most important precondition for the successful work of agricultural advisors is the establishment of a system of permanent links between advisors and agricultural producers, based on mutual trust.

In order to engage scientific knowledge related to the ICTs in creating conditions for more sustainable agriculture, policy-makers will need to reconcile traditional knowledge as a guide for bridging a gap. Both kinds are based on human observation and experiences and are tested, replicated, and transmitted within the respective community through social institutions, and mechanisms put in place for that purpose (Ammann et al. 2007).

Despite ICTs provides standardization and regulation of agricultural processes while reducing the large gap between researchers in the field of agriculture and farmers, its integration is faced with additional challenges in Serbian societies like lack of data, inadequate skills, inadequate state of physical-digital infrastructure, and limited connectivity particularly in rural areas.

For successful planning and implementation of advisory work in the Nisava district, future activities must be carried out related to the development of advisory modules, training of advisors, and promotion of a more efficient system of work. Few recommendations based on the gained experiences are:

- The special importance in the work of advisors is emphasized through direct communication with farmers, touring farms, and providing new information through lectures, and other forms of informal education.
- Educational centers (PSSS) for counseling and information and communication systems (mobile telephony, computers, internet, and web portals) have to play a more significant role.
- The importance and role of agricultural advisory life in the life of the village and the rural community are extremely important, especially in the new environment and increasingly fierce competition in the market.
- The agricultural advisory service should be able to provide advisory services to farms that are commodity producers and to a larger number of small farms which could be interested in more innovative products.

Conclusions

The Republic of Serbia is a country devoted to achieving the goals and targets set out in the 2030 Agenda for Sustainable Development Agenda, and so SDG2 is one of the priorities. Serbia's Smart Specialization Strategy is in relation to other public policy documents in the Republic of Serbia (Serbian Government, 2020), and one of them is the Agriculture and Rural Development Strategy 2014-2024 (Serbian Government, 2014). It is coherent with development activities within the FOOD FOR THE FUTURE priority area. Although, many actions were performed after all the fact is that the low adaptation rate of advanced technologies is recorded. The majority of agricultural producers addressed that they need subsidies for the adoption of hi-tech

technologies. The application of ICTs in agriculture requires new skills that cannot be created overnight and require changes in education and vocational training. Advisors in the Nisava district moved beyond rhetoric of participatory approaches to extension, towards a greater understanding of how ICTs need to be transformed into practice with a clear acknowledgement of potential constraints. Therefore, the vital role of the advisers in the process of achieving more sustainable agriculture also needs to be more clearly determined and acknowledged in the future.

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Conflict of interests

The authors declare no conflict of interest.

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