Digitization of Agriculture: Mobile Applications in Agriculture as an Important Aspect of the Third Green Revolution

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Abstract: Information and communication technology has caused (r)evolution in many industries, and the agricultural sector is not an exception. The paper deals with the use of mobile applications that have informative, educational and advisory services in agricultural activities. The paper aims to present the features and benefits of the use of mobile applications in agricultural production. The use of these applications enables the spread of specialized knowledge in certain agricultural sectors practically and easily, and at the same time contributes to the increase of efficiency in agricultural production. The link between the public advisory service and farmers and the dissemination and exchange of good practices among farmers are important features of mobile applications in agriculture aimed at raising the overall competitive advantage. The research is expected to prove the role of mobile applications in the development of the third green revolution in the agricultural sector.

1. INTRODUCTION

The paper deals with the role of mobile applications in raising the efficiency of agricultural production. The relevance of the research subject stems from the fact that the conventional approach to agriculture is unsustainable and that it is necessary to carefully monitor and optimally use production resources with the aim of higher yields, but also the ultimate quality of agricultural goods. The research aims to present the features and benefits that result from the use of mobile applications in agricultural production.

The paper is divided into a total of six thematic units. After the introduction, the concept of the third green revolution was explained within the framework of the development of the use of information and communication technology in agriculture. The features of mobile applications in agriculture and the functions to which mobile applications contribute to the realization of the third green revolution are presented in the following thematic units. Then, the basic assumptions for the successful implementation of mobile applications in agriculture are analyzed, with an emphasis on social and technological assumptions. The basic results of the research are presented in the concluding section.

2. THE THIRD GREEN REVOLUTION

In order to approach the elaboration of the research problem comprehensively, it is first necessary to explain in detail the concept of the third green revolution. A third green revolution is an innovative approach and view of agricultural production. The context in which the third green
The third green revolution is taking place is the extremely high degree of urbanization and the ever-growing world population, as well as the growing awareness of the importance of organic farming for human health and well-being. The third green revolution, therefore, requires the adaptation of agricultural production to the way of life of modern man. Aspects of the third green revolution are numerous and range from the incorporation of agricultural crops into urban lifestyles to the use of “smart” systems based on information and communication technology in the process of agricultural production (Suma et al, 2017).

The third green revolution aimed at using information and communication technology to raise yields and the quality of cultivated food is a real step towards the development of agricultural products that meet the needs of humankind from a nutritional, economic and environmental point of view. The third green revolution is therefore based on the idea of realizing a rational approach to agricultural effects, respecting the principles and frameworks of sustainable development. The fundamental question that the Third Green Revolution seeks to answer is how to feed humanity sustainably? (Horlings, Madsen, 2011).

The use of information and communication technology in modern agriculture and in the context of the third green revolution should be understood as a means of facilitating networking and connecting different stakeholders in the system of “smart” agricultural production, to promote knowledge management on sustainable access to agricultural production and communication ideas and good business practices among stakeholders involved (Mbow et al., 2014). One of the approaches that promote the concept and philosophy of the third green revolution is the use of mobile applications in agriculture.

3. MOBILE APPLICATIONS IN AGRICULTURE

The use of mobile applications in agriculture has become possible thanks to the development of smartphones, tablets and similar computing devices. Although technological development is crucial as a precondition for the development of “smart” agricultural production and turning to the principles of the third green revolution, the use of mobile applications in agriculture should be understood as a powerful driving force for social change. Therefore, in this research, the use of mobile applications in agriculture will be understood from the socio-technological aspect, and the applications themselves are understood as socio-technological systems.

The aim of developing mobile applications in agriculture is to ensure the networking of farmers with key stakeholders in the public sector and/or academia in order to systematically and continuously work on the adoption and dissemination of new knowledge on agricultural production and to promote sustainable production principles. In this way, it also significantly contributes to the optimization of agricultural production in the spirit of the needs of the 21st century, which seek to balance economic, environmental and social goals. The need to use mobile applications as a means and tool in the process of developing specialized knowledge of farmers arises from very fundamental reasons. Significant soil, air and water pollution resulting from the conventional approach to agricultural production are key issues that need to be addressed at the level of the agricultural community as a whole. In addition, a “smart” approach to agricultural production ensures the rational use of resources following the continuous monitoring of the state of agricultural production through a monitoring system (Gondchawar, Kaeitkar, 2016).
4. FUNCTIONS OF MOBILE APPLICATIONS IN AGRICULTURE

The advantage of mobile applications in agricultural production is that they provide the ability to monitor and control the real state of agricultural crops, effective networking with the aim of education, consulting and coordination, successful cooperation at the value chain level and monitoring and recording the sequence of production processes market users. These functions do not exhaust the benefits of using mobile applications in agricultural production because each application can be upgraded and adapted to the specific needs of target user groups.

4.1. Monitoring the Real Situation of Agricultural Crops

Monitoring the real state of agricultural crops is the basic function based on which the real needs for the implementation of certain agro-technical measures are assessed to optimize the effects of agricultural production sustainably. Without a real-time monitoring system, many aspects of agricultural production are left to empirical assessment, and such an approach can result in significant impact reductions. (Pimentel et al., 2004).

Real-time monitoring of agricultural crops is carried out through the implementation of temperature and humidity sensors, lighting sensors, insect presence sensors and video surveillance, which enables real-time monitoring and prevention of disturbances to agricultural holdings. All of these sensors communicate with the mobile app by sending real-time status reports to farmers (Gondchawar, Kaeitkar, 2016).

The system of supervision or monitoring is the basis for continuous monitoring of crop conditions and successful regulation of agricultural production conditions in accordance with key physical and biological-chemical parameters. The sensors are connected to individual automated systems, such as irrigation and lighting systems, and the use of mobile applications in agricultural production can greatly automate the implementation of individual production processes or manage remote processes according to assessed needs. The already described role of monitoring and automation in the management of agricultural crops is making significant progress towards increasing production efficiency and rational use of resources.

4.2. Networking, Educational-Advisory Role and Development of Good Production Practices

The role of mobile applications in agricultural production is not limited to monitoring, automation and efficient remote management. This is just one aspect by which IT technologies improve business in the agricultural sector. Another and very important function of mobile applications in agriculture is focused on effective knowledge management. In agricultural practice so far, farmers have relied on their own, largely inherited knowledge of how to manage agricultural resources, and such practices have significantly contributed to the adverse environmental impact of agricultural production globally. An example of one such practice is the irrational and uncritical use of pesticides in agricultural production which has caused numerous negative consequences for food safety for humans (Knežević, Serdar, 2011) and ecosystem sustainability; for example, through the impact on the disappearance of bees as key natural pollinators (Tucak et al., 2015).

Ignorance combined with striving for the highest possible yields can result in uncritical use of pesticides and a generally irrational approach to resource management in agriculture. For this
reason, the educational, informative and advisory function of mobile applications in agriculture is especially important, which contributes to the construction and application of good practices in the implementation of certain production processes. Mobile applications are therefore often networked with public or academic advisory bodies and serve as two-way communication between the advisory body and farmers. Through the mentioned function of mobile applications, experiential learning and application of good agricultural practices and dissemination of good practices within the network of agricultural producers are systematically supported.

Mobile applications are communication and coordination tools that support the process of knowledge management and dissemination of knowledge in individual agricultural sectors. “The Internet, along with other information and communication technologies (ICT), is a means of bridging the gap between professionals from different professions, people from rural areas and agricultural producers, through interaction and dialogue. It can also strengthen new cooperation and networking through cross-sectoral connections between government institutions, various support agencies and farmers themselves” (Turkalj, 2012, p. 74). Modern technological communication solutions support the synergistic impact arising from networking and knowledge sharing among different stakeholders in agricultural production.

The development of mobile applications ensures the cooperation of theorists and practitioners in agricultural production and the collaborative approach leads to the construction of new insights aimed at continuous improvement of production practices and strengthens the competitiveness of agricultural entities in the market. The link between advisory services and farmers as well as the exchange of experiences between farmers has been significantly facilitated. Advisory services are thus able to provide individually tailored guidelines to farmers based on monitoring results and are also well acquainted with the real situation on the ground and the development of strategies that are feedback on the real needs of farmers. In this way, it contributes to the systematic development of knowledge as the most significant modern market advantage (Rupčić, Žić, 2012).

4.3. Value Chain Cooperation

The benefits of networking are also ensured through cooperation with stakeholders in other phases of the overall value chain such as transport organizations, agricultural processors and distributors. “The basic concept of the value chain starts from the assumption that all types of organizations, regardless of whether they are profit-oriented or not, are composed of a set of activities oriented to the same common goal. Activities are a connected system that closes the whole from the procurement of raw materials to the delivery of finished goods to consumers in the market “(Lozić, 2017). The development of cooperation in the chain process values brings welfare characteristics to the entire sector. The essence of successful value chain management is the adoption of a market orientation aimed at meeting the demands of all stakeholders in the chain.

Communication and exchange of market information is the basis for the adoption and development of orientation in which the customer is the center of all processes. Based on cooperation with other participants in the value chain, farmers can obtain the necessary market information on customer preferences and requirements and adjust production processes accordingly. Such an approach is the basis for improving the competitiveness of agricultural production in a modern dynamic environment characterized by a large supply of agricultural products from different producers. Cooperation at the level of the value chain also results in economies of scale, i.e. reduces fixed costs per unit of product because it rationalizes the amount of dependent costs of procurement and costs of
product processing (Stipanović, 2017). Joint action based on cooperation can eliminate very high production costs arising from the fragmented and isolated market presence of individual agricultural producers. Mobile applications are therefore an important communication and coordination tool in the work of agricultural clusters and producer organizations (Sudarić et al., 2018).

4.4. Records of All Steps in The Production Process

In the modern market, significant attention is paid to the traceability process when it comes to food production. These requirements are the result of the application of the HACCP standard, but also the requirements of increasingly sophisticated customers with a developed awareness of the impact of diet on the health and well-being of every person (Filipović et al., 2008).

Mobile applications enable farmers to enter all the necessary data and records on agricultural production, which significantly raises the level of transparency of their business and contributes to the development of trust by target customers. Thus, data on the total agricultural area and location where the production takes place, the number of trees or seedlings, the total performance and the applied agro-technical measures in the production process can be entered into the application. In this way, it is easier to cooperate with impartial certification bodies that certify the food quality and safety management system of individual producers.

5. PREREQUISITES FOR SUCCESSFUL IMPLEMENTATION OF MOBILE APPLICATIONS IN AGRICULTURE

Mobile applications in agriculture represent socio-technological systems. For this reason, the starting point is the sociological and technological assumptions for the successful implementation of mobile applications in agriculture.

Competences that enable the efficient use of all IT solutions in business, including mobile applications in agriculture, relate to information (computer) and information literacy. Computer or information literacy includes a set of competencies that ensure access to and retrieval of certain information content (Vrkić Dimić, 2014). By its nature, computer literacy is a set of specialized technical competencies. With user-friendly mobile applications, and interfaces that are highly user-friendly and intuitive, acquiring computer literacy skills can be assessed as relatively simple.

Information literacy of each stakeholder is the process of processing available information content into useful and practically usable knowledge in the processes of agricultural production management. Based on information literacy, a cognitive process takes place or the process of converting data and information into business knowledge that contains an additional market value and represents good manufacturing practices. Evaluating the information available plays a key role in creating a competitive advantage in modern market conditions (Rašidović, 2018). Information literacy can be counted among the social preconditions or prerequisites for the successful implementation of mobile applications in agriculture.

Another important social prerequisite for the successful implementation of mobile content in agriculture is the developed awareness of all stakeholders about the needs and benefits of networking in both physical and virtual environments. It is therefore very important to motivate farmers to use mobile applications through the presentation of their features and the development of awareness of how they can positively affect their competitive advantage.
6. CONCLUSION

The paper analyses the role of mobile applications in agriculture as an important aspect of the third green revolution. The third green revolution concerns the adaptation of agricultural production to the modern way of life. The use of IT technology in agriculture significantly contributes to increasing production efficiency and cost rationalization. Mobile applications in agriculture enable monitoring of the real state of agricultural crops and management based on the analysis of the real state, which optimizes the use of resources. The educational and advisory role contributes to the combination of theory and practice and the creation of additional market value based on synergistic relations of cooperation, partnership and exchange of opinions and ideas. These values do not only apply to farmers but have the potential to spread to the entire value chain. Mobile applications also facilitate the documentation and traceability of all production steps and are an important tool in the implementation of quality management systems. The successful implementation of mobile applications in agriculture is conditioned by the competencies of information and information literacy as well as the motivation for networking and the development of a culture of cooperation, dialogue and partnership in creating additional market values.

REFERENCES


