

# Considerations Regarding the Digitalization of Romanian Agriculture

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## ABSTRACT

Smart and modern agriculture has a substantial contribution to the progress of the current economy and the agricultural potential of Romania largely influences the management of these rich resources. By introducing the new technologies required by digitalisation, digital agriculture will provide a shift towards efficiency, productivity and sustainability at farm level and across the sector. Given these aspects, this approach aims to investigate the phenomenon of digitalization of agriculture in terms of the need for its implementation, opportunities, benefits and implications for the Romanian economy.

**Keywords:** *digital agriculture, farmer, smart farming, digital technologies, skills, agricultural solutions*

## 1. INTRODUCTION

The digitalization of agriculture is among the priorities of the European Union in the coming years, a chapter in which Romania is still deficient, ranking second to last among the Member States, according to the Digital Economy and Society Index for 2019, while registering a large gap of digitization between urban and rural areas [1]. Digitization in agriculture is seen as a new concept that refers to a number of its links, namely: software for managing farm activities and monitoring crops, their vegetation, the evolution of weeds, diseases and pests, of the need for mineral substances in the soil depending on the condition of the crops. This is, in the opinion of some, rather an evolution of the concept of precision agriculture, which is a starting point for smart agriculture [2]. Thus, research and innovation can be the main tool through which a smarter and more sustainable system in agriculture can be achieved. Due to the fact that the world's population is constantly growing, requiring a demand for healthy food and made in optimal conditions, determines that food is one of the greatest challenges facing humanity, a solution achievable only through technological innovation and agricultural technologies, which will have great potential in transforming a much more productive and sustainable agriculture. The penetration of agriculture in the digital age is due to the continuous increase in demand for agricultural products [3]. In this sense, the introduction of new information and communication technologies will help farmers to manage their farms much better, which will significantly contribute to a much more viable quality of life for farmers and consumers, and improve the quality of plants health production and the quality of animals health. Also, digital technologies can help farmers in providing safe food, made by clean methods with the environment and quality, achieving increased production with reduced resources [4]. Through existing and new technologies, such as the Internet of Things (IoT), artificial intelligence, robotics

and large volumes of data, they can contribute to streamlining processes and creating new products and services in this field [5].

## 2. RESEARCH METHODOLOGY

The research strategy approached generated a series of questions and answers regarding the digitalization of agriculture. All these were extracted from the information sources of the bibliographic documentation, which were represented by scientific works, current affairs published in national and international specialized journals and journals, various sites or bodies. From their study, the main phenomena and processes that conceptually affect the phenomenon of digitization were analyzed by specific methods. This approach is a documentary that through its content and presentation represents its own and original approach to the investigated topic

## 3. RESULTS AND DISCUSSIONS

### *3.1. Approaches for the need to digitize agriculture*

At present, the digitalization of agriculture is generated by the need to increase the amount of food to cope with the growth of the world's population, especially in conditions of substantial reduction of agricultural areas, as a result of urbanization and growth of industry, increasing profitability of agricultural activities, reducing increasing costs and risks due to extreme weather conditions, compliance with legal regulations on reducing pollution, conserving the environment and the ongoing fight against climate change and desertification. In fact, all these

aspects are aimed at increasing the efficiency of modern agriculture.

The solutions for digitization in the coming years will materialize in: generalization of self-guidance, control of applied doses, application of variable doses and section control, optimization of automatic adjustments, development of autonomous and robotic machines, widespread use of satellite or drone photographs, extended use plant health sensors, crop and soil quality sensors, making and using multilayer maps that overlap information of various types, data transfer, selection and analysis, creation of multidisciplinary software, public data platforms, training of operators and farmers to make the most correct and optimal decisions [6]. At the same time, digitalization is the link that contributes to the development of efficient agriculture, which will increase farm performance, reduce consumption and costs, protect the soil, increase profits and protect the environment. This phenomenon of digitization makes a large part of the activities to be carried out without human intervention, integrating a series of information obtained with the help of sensors, making possible the communication between tractor and agricultural machine, but the most important decisions are also made by the farmer. This digitalization in the field of agricultural machinery began long ago, when it switched from analog to digital in on-board displays of tractors and other agricultural machinery, when engines and transmissions were equipped with computers to control operation, when the error codes, the functional parameters, the calculation of the worked areas or distances traveled, the fuel consumption, the tracking of the seed distribution and the warning when the distribution is not according to the settings have been displayed. All these aspects are strictly legal by the other links of precision agriculture and are complementary, because digitization without intelligent machines, capable of applying variable doses or ensuring a special quality of agricultural work, does not make sense in this evolution. Therefore, in this whole process are involved, machine builders, producers of seeds, pesticides and fertilizers, universities and farmers, whose openness, will, involvement and determination from all will be a premise and a certainty that the future of agriculture will be a digital one [7].

In order to achieve digitalization, we need specialized experts in this field, respectively external consultants or farm employees, not only because the solutions are technical and require expertise, but especially because a successfully implemented digital transformation must start from strategy. At the same time, we need experts in change and organizational development, because digitalization is a process of change, which has a major impact on people and the processes they go through, and the success of digitalization of agriculture depends on people and processes more than the technology implemented. It is also necessary to allocate an optimal budget for the realization of digitization which should include not only the acquisition costs for hardware and software, but also the cost of their implementation and maintenance services. A consistent budget cannot always

lead to success if it is not associated with a particular strategy. Therefore, the transformations generated by digitalization will have an impact on all categories of activities, which will create new types and jobs, both for current employees and for future generations.

Introducing and adopting the technologies require the acquisition of new skills and knowledge by farmers and consultants through the organization of necessary training at regional or local level, especially at small and medium-sized farms, where the use of digital technologies is not always considered profitable. In this regard, it is necessary to develop specific data analysis tools, with a particular focus on costs and benefits, which can help consultants in informing farmers about digital technologies. Thus, through the smart agriculture platform within the Smart AKIS thematic network, farmers will be able to identify and evaluate smart agricultural technologies through a very fast assessment tool to help them choose the most suitable technologies for small and medium sized farms [8].

Therefore, digitalization is what transforms agricultural and food companies and allows the optimization of production costs, reducing labor costs and the possibility of their development in a much shorter time. Moving to this new stage will mean that business people in agriculture and the food industry will transform their work environment by applying new technologies, where a digital farm is not just about driverless tractors, variable fertilization or maps, which have to warn farmers when certain soil problems arise.

### ***3.2. Opportunities and benefits of agriculture digitalization***

Currently, digitization and innovation are on the list of objectives of many agricultural companies. Digitization is the one that gives rise to a number of opportunities and benefits, such as: process optimizations, productivity increases and cost reductions. Subsequently, as generations of users and buyers change and their behaviors change, and digital natives prefer and demand a different kind of experience, which highlights the need for digitization, as the digital economy has been joined by a new economy, that of distancing, where in the event of a state of emergency, the survival of many businesses has depended on their ability to move quickly to digital solutions, in future periods farms will continue to meet their customers needs more easily and quickly, but with less physical interaction [9]. Digitization is what changes the relations between the partners of the agricultural sector as it has happened in other fields, and short-term agriculture must find the key to this transformation to highlight all the risks existing at the time of the act and to be able to correct them in the future. This extensive process of digitalization of agriculture, has multiple advantages for achieving a modern and sustainable agriculture, among them we can mention [10]:

- international programs for the provision of data on family farming, especially in emerging countries;
- local authorities and agricultural chambers will encourage direct sales of agricultural goods from the short production circuit by setting up a site dedicated to this way of information;
- freedom of investment in order to achieve national and global performance;
- the establishment and operation of an experimental “open data” program for certain sectors in order to recreate a balance between the production and the sale price;
- allows the entry of farmers’ products into certification and food traceability applications;
- encourages the agri-food sector to put in place traceability tools for the general public to inform where the product comes from;
- encourages automatic traceability and intelligence in the international circuit of agricultural goods;
- allows simplification and easier labeling of food.

The benefits of using digital technologies also include improving crop yields and animal performance, optimizing production factors and reducing labor, which converge towards increasing profitability. At the same time, digitization contributes to improving working conditions for farmers, reducing the negative impact of agriculture on the environment, and improving information flows upstream and downstream of agri-food chains, generating a number of benefits for both farmers and distribution stakeholders and retail trade [11].

The pandemic with Coronavirus - 19, which started in Romania at the beginning of March 2020, forced agricultural companies to transfer their products from the traditional market to online platforms or marketplaces, although some of them did not even have websites presentation so far. Thus, agricultural producers of fruits and vegetables, joined forces through social networks or an online store, began to take orders and deliver products to customers’ homes, thus changing the habit of buying for Romanian people, mostly online and therefore, they created a new market, a modern one adapted to the imposed situation.

Although the digitalisation of agriculture brings many benefits and a number of actions and tools have already been implemented, there are still a number of barriers to exploiting its full potential. At present, the vast majority of farmers already use digital technologies, such as smartphones, tablets, field sensors, drones and satellites, such technologies offering multiple agricultural solutions, such as: remote measurement of soil condition, better management of water and livestock and crop monitoring [12]. By analyzing the data collected, farmers can get an idea of future crop patterns or animal health and welfare, which allows them to make planning more effective and efficient.

### ***3.3. The situation of Romanian agriculture at the current moment of digitalization***

Romania ranks last in digitalization in agribusiness, only 1% of Romanian businesses in the agri-food sector use industrial robots, and digital literacy is as important as the sales market and development and promotion strategies. Only 1% of Romanian agri-food enterprises use industrial robots, which ranks Romania on the last place in the European Union on the digitalization of companies. The share of gross value added in GDP places Romania’s agriculture on the first place in the European Union. At the same time, we are the 8th agricultural power as a value of the sector in the European Union, but the low degree of technologicalization places us on the last place in labor productivity. In Romania, technology serves both as a threat and as an opportunity. Given the fact that Romania’s agricultural system brings only 4.5% of GDP, compared to 25% for the IT industry, there seems to be an extraordinary opportunity for growth. However, there are a number of particularly complex associated problems, such as the predominant structure of small farms, fragmented land ownership and low levels of mechanization, the growing lack of available labor, which are barriers to rapid change of the agricultural system, which in order to remain viable in business in the economy, the obvious solution is also digitalization and automation. It remains to be seen how the barriers to the global development of digital agriculture can be overcome, including insufficient access to information and know-how, infrastructure gaps, inadequate digital literacy, lack of competitiveness in a workforce. orld in which digital technologies are able to significantly replace human activity [13, 14]. In a study conducted by a digital agricultural company, it is shown that for 75% of Romanian farmers the mobile phone is an indispensable tool every day, but only 17% of farmers use software to manage their own farm. Also, 49.5% of Romanian farmers use an agenda as the main tool for keeping track of land and agricultural works, 20% excel programs, 13.5% say they do not consider that they need such tools, while only 17% use a computer program or a dedicated application to manage their own farm, which is very little compared to other European countries, such as Germany or France.

As a result of the fact that the Romanian agriculture exceeded at the end of 2019, 40 billion lei, the sector can become more competitive, if they increase the investments in technology and digitalization. Also, by adding value to raw materials, when farmers understand that the association in cooperatives or the conclusion of partnerships with processors and joint investments, are the main key to the realization of finished products [15]. At the same time, the increase of food production in Romania can be achieved through large chains of stores, guaranteeing the access of Romanian products on the market.

#### 4. CONCLUSIONS

Digitization not only changes the way farms are operated and managed, but also has a strong impact on the agricultural system as a whole, thus helping to reduce the problems of isolating rural areas and increasing their capacity for social inclusion. So digital technologies will provide the opportunity to develop new businesses, while increasing rural attractiveness, especially for future generations of young people. All this will have a strong economic and social impact on employment, quality of life, markets and value chains, competitiveness and adaptable opportunities for agricultural and rural enterprises.

Digital technologies will transform the agricultural sector in the coming years and will fundamentally reshape the agri-food value chain in Europe, without being limited to a technical or technological dimension and taking into account aspects related to strategy, marketing, organization, management and design. Therefore, Romania needs innovative digitalization of agriculture to support the resource base, communities, cooperation and solidarity of farmers. At the same time, cooperation between laboratory sciences, agronomy and farmers must become vital, especially to improve knowledge of natural resources for sustainable and modern production methods, as well as government policy support that can give farmers access to research and integrated agro-ecological consultancy and a series of incentives for all actors involved in the digitalisation of current agriculture. Therefore, agriculture will increasingly look like a computer process, in which managers and machine operators must know not only agriculture, but also work easily with a rapidly evolving technology, requiring the creation of Intelligent Digital Educational Laboratories - SMART Lab - in all agricultural schools in Romania.

#### REFERENCES

- [1] M. Măcriș, *Bazele economiei*, Universitas, 2013
- [2] J. Ingram, D. Maye, What Are the Implications of Digitalisation for Agricultural Knowledge? *Frontiers in Sustainable Food System*, 4(66), 2020, DOI: <https://doi.org/10.3389/fsufs.2020.00066>
- [3] S. Rotz, E. Duncan, M. Small, J. Botschner, R. Dara, I. Mosby, et al. (2019). The politics of digital agricultural technologies: a preliminary review, *Sociologia Ruralis* 59, 2020, pp. 203–229. DOI: 10.1111/soru.12233
- [4] L. Klerkx, B. Van Mierlo, C. Leeuwis, Evolution of systems approaches to agricultural innovation: concepts, analysis and interventions,” in *Farming Systems Research into the 21st Century: the New Dynamic*, editors: I. Darnhofer, D. Gibbon, B. Dedieu (Dordrecht: Springer), 2012, pp. 457–483
- [5] H. Van Es, J. Woodard, *Innovation in agriculture and food systems in the digital age. The Global Innovation Index 2017: Innovation Feeding the World* (Ithaca, NY; Fontainebleau; Geneva), 2017, pp. 97–104
- [6] M. Ciurea, *The Digital Economy in Romania: Theoretical Approaches and the Current State of Development in the Context Imposed by the European Union*, *Advances in Economics, Business and Management Research* (Atlantis Press), vol 105, *Proceedings of the 1st International Scientific and Practical Conference on Digital Economy (ISCDE 2019)*, 2019, Chelyabinsk, Russia, pp.539-545. DOI: 10.2991/iscde-19.2019.104
- [7] V. Saiz-Rubio, F. Rovira-Más, From smart farming towards agriculture 5.0: a review on crop data management, *Agronomy* 10 (2020) 207 DOI: 10.3390/agronomy10020207
- [8] L. Dovleac, M. Bălășescu, Perspectives for Romania on adopting agricultural Innovations, *Bulletin of the Transilvania University of Brașov, Series V: Economic Sciences*, Vol. 9 (58), No.1, 2016
- [9] D. Budaev, A. Lada, E. Simonova, P. Skobelev, V. Travin, Conceptual design of smart farming solution for precise agriculture, *Management Application Complex System*, 13, 2019, pp. 309–316. DOI: 10.2495/DNE-V13-N3-309-316
- [10] M. Ciurea, C. Ioanăș, Characterization of the Romanian Agriculture in the Current European Context, *Proceedings of the 30 th International Business Information Management Association Conference: November 8-9, 2017, Madrid, Spain*, pp. 5123-5135.
- [11] L.V. Borisova, I.V. Baranova, O.V. Bruzhukov, Digital Marketing: Drivers for the Development of the Russian Agricultural Sector, *Advances in Economics, Business and Management Research* (Atlantis Press), vol 138, *Proceedings of the 2nd International Scientific and Practical Conference “Modern Management Trends and the Digital Economy: from Regional Development to Global Economic Growth” (MTDE 2020)*, April 16-17, 2020, Yekaterinburg, Russia, pp.177-181. DOI: <https://doi.org/10.2991/aebmr.k.200502.028>
- [12] EIP\_AGRI, *Agriculture and Innovation, Modelarea revoluției digitale în agricultură*. Available from: [https://www.rndr.ro/documente/eip-agri\\_brochure\\_digital\\_revolution\\_2018\\_ro\\_web.pdf](https://www.rndr.ro/documente/eip-agri_brochure_digital_revolution_2018_ro_web.pdf).

[13] A.V. Lesnykh, Maintaining a Balance of Private and Public Interests in Agricultural Land Transactions Within the Digital Economy Development, *Advances in Economics, Business and Management Research* (Atlantis Press), vol 138, Proceedings of the 2nd International Scientific and Practical Conference “Modern Management Trends and the Digital Economy: from Regional Development to Global Economic Growth” (MTDE 2020), 2020, Yekaterinburg, Russia, pp.79-83. DOI: 10.2991/aebmr.k.200502.012

[14] I. Oncioiu, O. C. Bunget, M.C. Türkeş, S. Căpuşneanu, D. I. Topor, A. S.Tamaş, I. S. Rakoş, M. Hint, The Impact of Big Data Analytics on Company Performance in Supply Chain Management, *Sustainability* 11 (2019) 4864. DOI: 10.3390/su11184864

[15] M. Man, M. Ciurea, Considerations on the Common Agricultural Policy in Romanian Agriculture, “Ovidius” University Annals, Economic Sciences Series, Volume XVII (2), 2017, pp. 243-248