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Smart Farming Technologies Existent in SE of Romania

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Abstract

With the goal of improving both the quality and quantity of agricultural products, smart farming is the integration of contemporary information and communication technologies (ICT) into the agricultural sector. Internet of Things (IoT), data management, GPS access, soil scanning, and other smart technology are all part of smart farming. Romania should mechanize a sizable portion of the agricultural land in order to raise the value of its agricultural output. Due to the highly scattered character of Romanian properties—farms typically span an area of 3.7 hectares—doing this is challenging.

Keywords: smart farming, IoT, Crop management, Stakeholders

Introduction

More than 50% of Romania's farmers operate on farms that are smaller than one hectare in size. At least half of Romania's agricultural laborers engage in subsistence farming. About a million individuals and their families are ripped away from civilization. In comparison, the average size of the about 30 agricultural properties in Romania that have legal identity is around 200 hectares. As a result, they are considerably simpler to operate mechanically, and their owners can afford to buy cutting-edge machinery to create agriculture fit for the twenty-first century. Thankfully, Romanian tractors manufacturing facilities have returned, and this year saw the introduction of TAGRO, the country's first entirely Romanian tractor made at IRUM Regain [1]. This tractor will be offered both domestically and internationally, with its primary market being small and medium-sized farms. TAGRO will be equipped with all the amenities of a contemporary tractor, such as air conditioning and radio orders. The tractor was tested in Romania and Italy before it was introduced, and the Romanian Auto Car Registry will finish the homologation procedure by the end of this year. The output of these tractors will double in less than ten years if the government comes up with a plan to encourage farmers to purchase them.

This, however, is insufficient for a well-thought-out plan involving agricultural automation and mechanization. In Romania, autonomous combines and seedling robots are still not in use, and it's likely that they won't be for some time. However, the technological revolution is rapidly approaching, and Romanian agriculture should continue to be mechanized and modernized. Because of this, a thorough investigation is necessary to have a better understanding of the actual situation and specifics in the southeast region of Romania.

Smart farming in SE of Romania

Compact and big farms alike are using more and more components of precision farming. Large vertically integrated agricultural holdings are leading this market in the adoption of new solutions, whilst medium and small farms are still implementing solutions slowly because of their financial constraints and a shortage of trained staff. The adoption of new technology and the overall expansion of the agrifood sector are often slowed down by the disproportionately large representation of small farms and auxiliary households in the nation's total agricultural production volume. Currently, small agricultural businesses use digital services designed to address particular challenges in product promotion and marketing, such exploiting niche markets. This is one of the causes of the agri-food system's continued digitalization behind other economic sectors [2].

After a research was conducted in 2021 to investigate the state of preparation for smart farming in the BSB South-East region of Romania, a questionnaire was developed and sent to the important parties determined by the quadruple helix. The following summarizes the investigation's findings about people's knowledge of smart and Internet of things technology. The first question was related to the smart farming applications that the stakeholder's are aware, and they replied by "Yes" or "No" to the following examples give in the questionnaire: the water deficit detection and control, cattle monitoring and management, crop management, weed detection and control, climate conditions monitoring, pest and diseases detection and rural property management. In the picture below is depicted the number of replies to the above mentioned question. The results are presented in Figure 1.

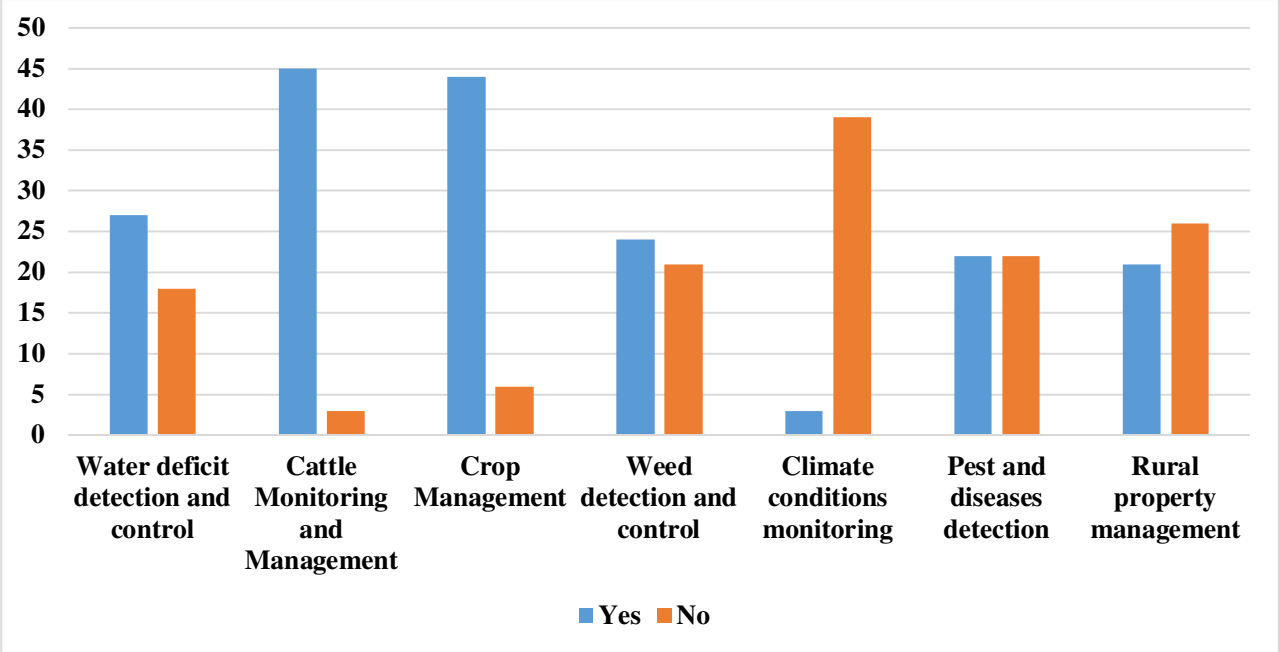

Figure 1. Stakeholder's awareness about smart farming application in the SE Region of Romania

Source: Black Sea (2021), *Jointly preparing the conditions in the agricultural and connected sectors in the BSB area for the digital transformation (BSB Smart Farming). Regional Analysis (Romania),* p. 37, https://blacksea-cbc.net/wp-content/uploads/2021/04/BSB908_BSB-Smart-Farming_Conditions-in-the-agricultural-and-connected-sectors-in-the-BSB-area-of-Romania-for-the-digital-transformation_EN.pdf

As can be seen, the highest awareness is for Cattle Monitorinf and Management and Crop Management, while the lowest awareness is for Climate conditions monitoring.

Earth observation satellites are particularly significant in the context of climate change because they make it possible to track variations in the planet's climate system throughout time. Understanding trends and patterns as well as the causes and effects of climate change is made easier with the usage of this data [3], being an important aspect in agriculture.

In the second question, the stakeholders indicated whether or not they were aware of the smart farming technologies used in the South-East region of Romania. Examples of these technologies included in the questionnaire were data or images from sensors, digital maps, GPS, automated systems, robotic systems, drones, software, and applications for farm management. The number of responses to the aforementioned question is shown in the image below.

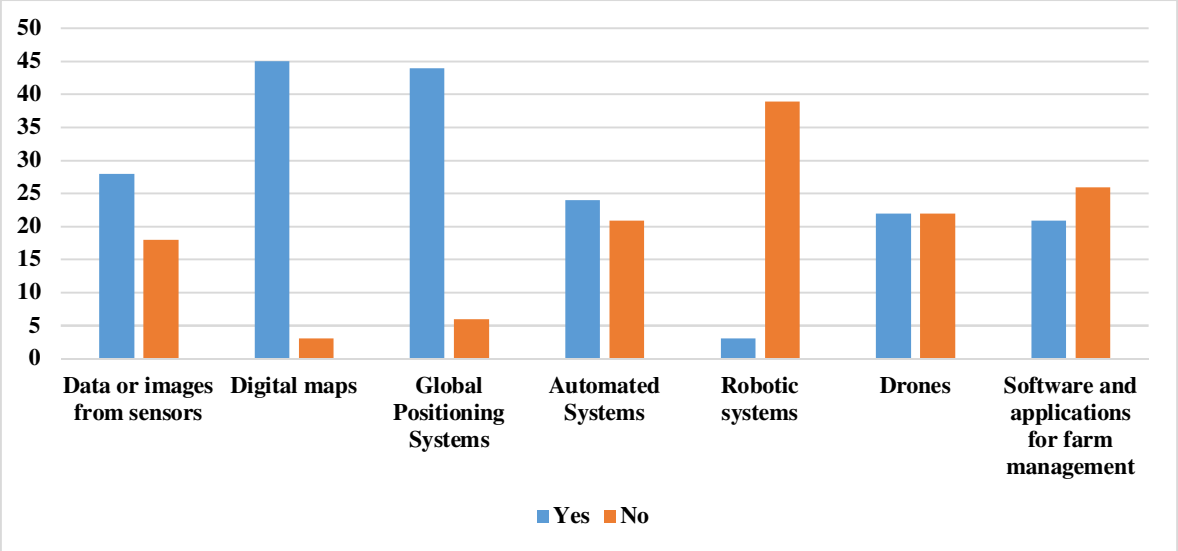

Figure 2. Stakeholder's awareness about smart farming technologies in the SE Region of Romania

Source: Black Sea (2021), *Jointly preparing the conditions in the agricultural and connected sectors in the BSB area for the digital transformation (BSB Smart Farming). Regional Analysis (Romania),* p. 38, https://blacksea-cbc.net/wp-content/uploads/2021/04/BSB908_BSB-Smart-Farming_Conditions-in-the-agricultural-and-connected-sectors-in-the-BSB-area-of-Romania-for-the-digital-transformation_EN.pdf

The next query concerned knowledge of the benefits of smart agricultural practices. Ninety-nine percent of the stakeholders valued productivity increases; sixty percent valued reducing environmental impact; sixty-nine percent thought productivity increases could result in high-quality products; seventy-seven percent valued cost reduction and profit increases; eighty-five percent valued labor efficiency increases [4].

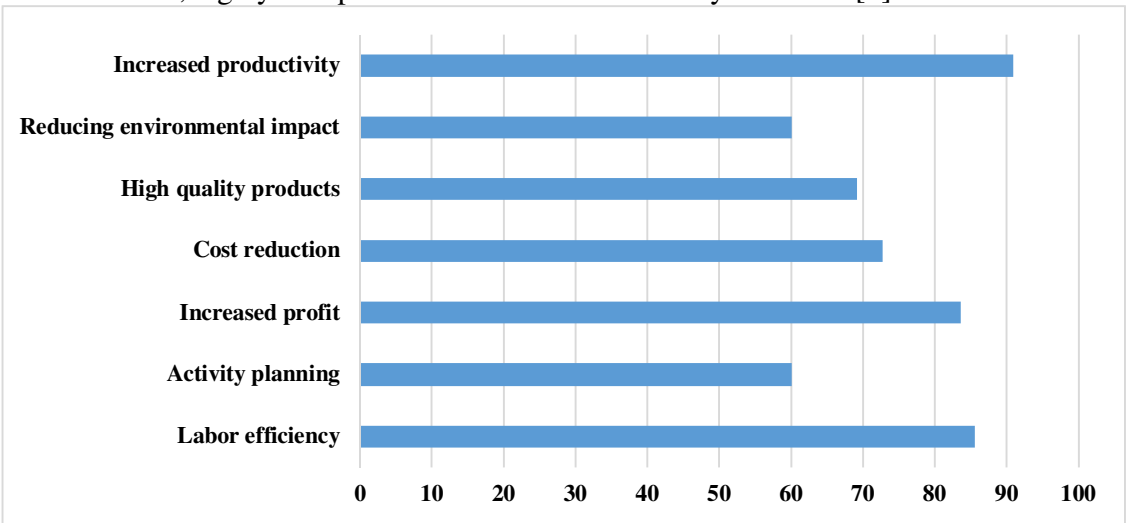

Figure 3. Stakeholder's opinion about the advantages provided by using smart farming in the SE Region of Romania

Source: Black Sea (2021), *Jointly preparing the conditions in the agricultural and connected sectors in the BSB area for the digital transformation (BSB Smart Farming). Regional Analysis (Romania),* p. 39, https://blacksea-cbc.net/wp-content/uploads/2021/04/BSB908_BSB-Smart-Farming_Conditions-in-the-agricultural-and-connected-sectors-in-the-BSB-area-of-Romania-for-the-digital-transformation_EN.pdf

Another question was related to the awareness about the agricultural fields that need smart farming technologies in SE Region of Romania.

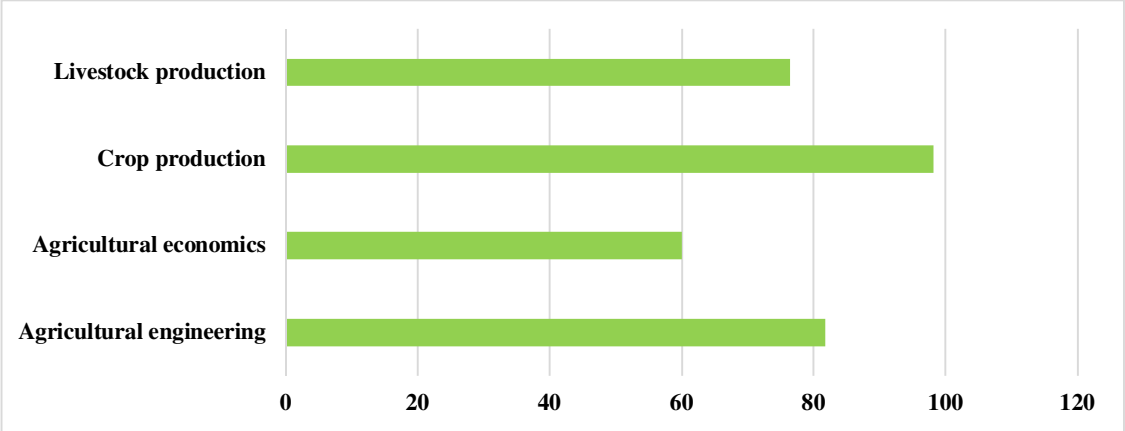

Figure 4. Stakeholder's opinion about the agricultural fields that need smart farming technologies

Source: Black Sea (2021), *Jointly preparing the conditions in the agricultural and connected sectors in the BSB area for the digital transformation (BSB Smart Farming). Regional Analysis (Romania),* p. 39, https://blacksea-cbc.net/wp-content/uploads/2021/04/BSB908_BSB-Smart-Farming_Conditions-in-the-agricultural-and-connected-sectors-in-the-BSB-area-of-Romania-for-the-digital-transformation_EN.pdf

The stakeholders deemed that smart farming technologies are necessary for crop production in 98.2% of cases, agricultural engineering in 81.8%, animal production in 76.4%, and agricultural economics in 60% of cases [4].

To be more precise, the stakeholders were asked to rate the need of using smart technology in cattle production systems on a scale of 1 to 5. Their responses were sorted in order of highest point value: milking automated systems came in top, followed by feeding or drinking control in second place, cattle/sheep/health monitoring in third place, barn monitoring (video surveillance, environment control) in fourth place, and animal tracking in fifth place. both inside and outside.

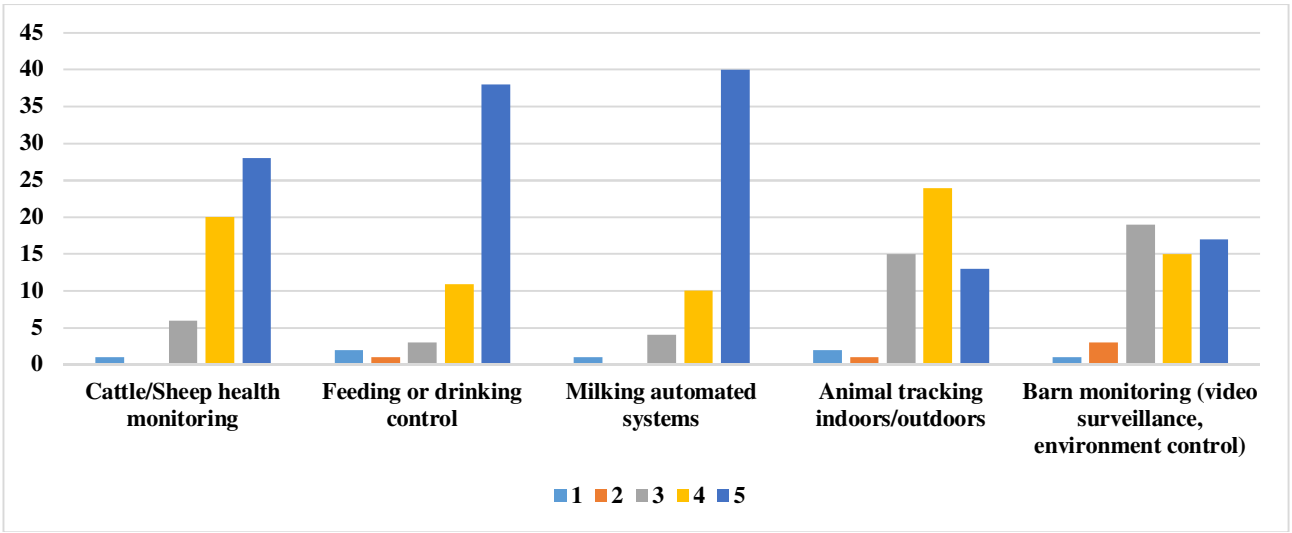

Figure 5. Stakeholder's opinion about need of smart farming technologies in livestock

Source: Black Sea (2021), *Jointly preparing the conditions in the agricultural and connected sectors in the BSB area for the digital transformation (BSB Smart Farming). Regional Analysis (Romania),* p. 40, https://blacksea-cbc.net/wp-

content/uploads/2021/04/BSB908_BSB-Smart-Farming_Conditions-in-the-agricultural-and-connected-sectors-in-the-BSB-area-of-Romania-for-the-digital-transformation_EN.pdf

In addition, the stakeholders were asked to rate the need of implementing smart technology in agricultural production systems on a scale of 1 to 5. Their responses indicated that irrigation systems came in top, with a maximum score of five; soil and field analysis came in second; fertilisation and crop protection came in third; precision mechanical weeding came in fourth; and drone inspection and monitoring came in fifth.

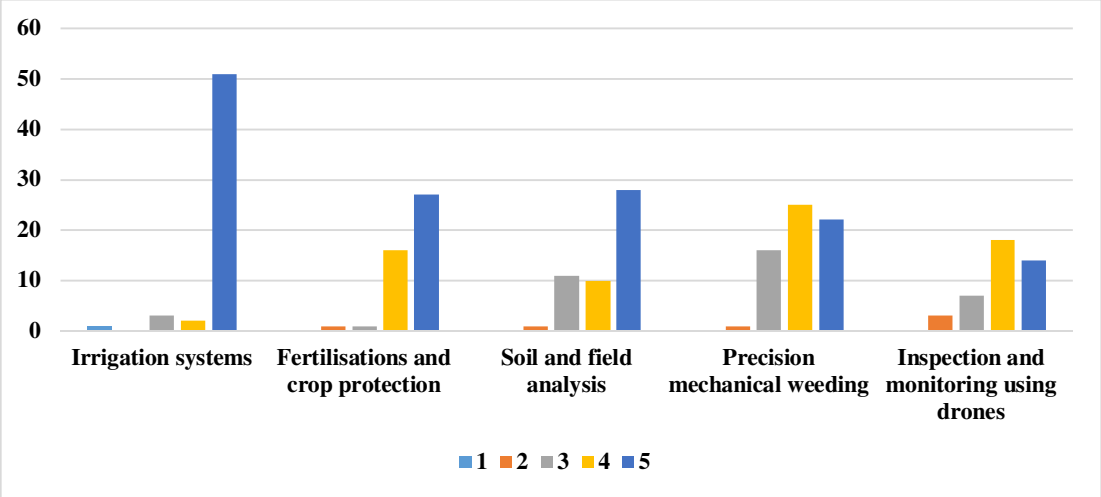

Figure 6. Stakeholder's opinion about need of smart farming technologies in crop production

Source: Black Sea (2021), *Jointly preparing the conditions in the agricultural and connected sectors in the BSB area for the digital transformation (BSB Smart Farming). Regional Analysis (Romania),* p. 340, https://blacksea-cbc.net/wp-content/uploads/2021/04/BSB908_BSB-Smart-Farming_Conditions-in-the-agricultural-and-connected-sectors-in-the-BSB-area-of-Romania-for-the-digital-transformation_EN.pdf

Conclusions

Agriculture's digitization is a complicated and continuous process that is impacted by a number of variables, such as market dynamics, government regulations, technology developments, and capital availability. Notwithstanding the difficulties and roadblocks, farmers, food producers, and consumers stand to gain a great deal from the digitalization of the industry. These benefits include higher production and efficiency, better food safety and quality, and more systemic transparency and dependability. Through funding R&D, training and education, infrastructure development, and public-private partnerships, we can keep stepping up the digitization process and bringing digital technologies in agriculture to their full potential.

Large agricultural holdings, which are better positioned to use smart farming and contemporary technology, and smaller farms, which suffer from budgetary limitations and a shortage of trained labor, are clearly separated. The total pace of Romania's agricultural development is slowed by this discrepancy. Stakeholders in Romania's southeast are aware of certain smart farming applications, particularly in relation to crop and livestock management. However, considering the rising influence of climate change on agriculture, there is a lack of understanding in critical areas such as climate conditions monitoring. According to the study results, stakeholders firmly believe that labor efficiency, profitability, and production can all be increased through smart farming. But more funding and attention must still be paid to technology in fields like livestock monitoring and irrigation systems.

While Romanian agriculture is beginning to modernize, more work has to be done to speed up the adoption of smart farming technology. This work needs to be done through a consistent and targeted approach that includes government backing. This will guarantee a more egalitarian and productive agricultural sector nationwide by bridging the gap between huge agricultural holdings and small-scale subsistence farmers.

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