The benefits of introducing digitization in agricultural sectors

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Abstract The rapid development of digital technologies has propelled the introduction of digitization in all fields. Among them is agriculture. Thus, farmers can benefit from innovations that make their work easier and increase their efficiency. Digitization aims to increase competitiveness in terms of agricultural production in a shorter period and has the role of helping to prevent the large losses that are specific to agriculture carried out using traditional methods. Through digitization (i) losses caused by poor production planning can be prevented, based on inaccurate data, (ii) the erroneous design of agricultural activities is reduced, such as the delayed application of protection treatments against pests, (iii) reduces/eliminates the lack of transparency regarding the information you must provide in relation to each product.
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1. Introduction

Digitization has the potential to revolutionize the agricultural industry by improving efficiency, reducing costs, and increasing productivity. In this essay, we will explore the benefits of introducing digitization in agricultural sectors and how it can transform the industry for the better (Rabiya Abbasi, 2022).

Although the digitization of agriculture is still a fairly new concept for many farmers, the benefits it offers are numerous, and its use can be quite affordable. Some of the digital solutions are of great help to farmers because they allow tracking the evolution of the crop and contribute to data management from a financial-accounting point of view (Madhu Khanna, 2020). Also, there are digital tools that provide real-time alerts if crop problems are predicted, that allow the control of agricultural equipment, that provide information by comparing the level of productivity of hybrids, that can prepare reports and that offer various recommendations regarding fertilization (Dhanaraju M., 2022).

Digital agriculture is the application of new technologies such as: data science, automation and field sensors. In this way, more and more farmers have access to better information to make the right decisions, improve productivity and reduce waste (Balasundram S.K, 2023).

Modern farming technology can be achieved by implementing digital systems directly on farms, regardless of size and production capacity. These systems have the role of effectively monitoring soil and air activities by continuously collecting, centralizing and interpreting information received about all parameters that can influence crop quality: temperature and relative humidity in the air and in the soil; the amounts of macronutrients existing in the soil; atmospheric pressure, wind speed and direction, CO_2 concentration in the air and on the ground; the presence of harmful elements in the air, soil or that come with the rain; light intensity (UV, IR and visible); wind speed and direction (Subeesh A, 2021, Mohd Javaid, 2022).

2. The advantages of digitization in agriculture

• These types of systems can predict optimal conditions for seeding, harvesting and disease prevention. Thus, digital technologies promise to revolutionize agriculture, helping farmers to work more precisely, efficiently and sustainably;

• Digital practices could also help increase environmental performance;

• They can attract more and more young people in this increasingly depopulated field of labor;

• Digital technologies have the potential to give consumers greater transparency into how food has been produced and processed; In this case, we can also talk about the possibility of belonging to an integrated production chain;

• Beyond agriculture, digital technologies can be the solution of the future to make rural communities more attractive, reducing the problems related to their distance from the city and access to services;

3. Improved efficiency

One of the main benefits of digitization in agriculture is improved efficiency in farm operations. With the use of technology, farmers can automate many manual tasks such as planting, irrigation, and harvesting. This reduces the time and labor required to perform these tasks and allows farmers to focus on other aspects of their business.

Drones equipped with cameras can provide farmers with real-time data on crop health and soil moisture levels, allowing them to make informed decisions about watering and fertilization (Abderahman Rejeb, 2022). This not only saves time and labor, but also helps to reduce inputs such as fertilizer and water, which in turn can lower costs for farmers.

4. Reduce costs

Digitization also has the potential to reduce costs in the agricultural sector and improved financial management. With the use of technology, farmers can reduce the amount of inputs such as fertilizer, water, and pesticides needed to produce crops. Precision agriculture techniques allow farmers to apply inputs only where and when they are needed, reducing waste and saving money. (Shafi U., 2019). Additionally, digital tools can help farmers to manage their finances more effectively, by allowing them to track expenses and income in real-time and make more informed decisions about spending. This can lead to increased profitability, as farmers are better equipped to manage their finances and respond to market trends

5. Increased productivity

Increased productivity is another key advantage of digitization in agriculture. With the use of technology, farmers can make more informed decisions about planting and harvesting times, as well as optimize their use of resources such as water and fertilizer. This leads to higher crop yields and increased profits for farmers. Additionally, digital tools can help farmers to better manage their supply chains, by providing real-time data on market conditions and allowing them to make informed decisions about pricing and sales (Mohd Javaid, 2023).

6. Improve the quality of life for farmers

Digitization also has the potential to improve the quality of life for farmers. The use of technology can reduce the time and effort required for manual tasks, allowing farmers to focus on other aspects of their business and have more time for personal activities. The use of mobile apps can help farmers to keep track of their operations, manage their finances, and connect with other farmers, allowing them to access information and resources more easily (Mendes J., 2020).

Despite the many benefits of digitization in agriculture, there are also some potential drawbacks. One of the main challenges is the cost of adopting technology, which can be a barrier for small farmers with limited resources. Additionally, there is a need for trained personnel to use and maintain the technology, which can also be a challenge for small farmers in rural areas.

7. Digital solutions for agriculture available on the market

A farm that integrates digital tools into its activity is much more efficient and sustainable than a conventional farm. More and more digital tools are being developed and made available to farmers. These are intended to provide farmers with the benefits of better management, with lower risk and increased predictability for improved planning of farm activity. Whether farmers are ready or not, the digitization of agriculture is becoming a reality on more and more farms.

SysAgria - are digital solutions that provide complete information in real time about the environment and the conditions of development in different phenological stages of crops (SysAgria, 2023). Based on this information, proactive treatment, planned fertilization, sowing and harvesting at optimal times can be carried out. This information is vital for the development of any agricultural crops, fruit trees, vines, etc. SysAgria systems include state-of-the-art sensors integrated into a box-type system mounted on the ground, resistant to weather and extreme atmospheric conditions. Data transmission is done in real time, from any location, through various types of wireless transmission (Wi-Fi, LoRa, GPRS), and the information can be viewed even from a mobile phone. So, it provides access at any time to information related to soil moisture, for example, through a device that is usually carried in the pocket. It is also very useful that the software of this type of device calibrates itself for each type of culture. In addition, it is set to send alarms to the beneficiary when the values of certain parameters fall or rise above the optimal values for the type of culture being monitored (https://www.sysagria.com/?lang=en).

AgAssit app - farmers' personal assistant - provides solutions and information related to BASF products, including regional and individual weather forecasts with location and personal threshold settings, disease risk warnings, regional agronomic recommendations, location-specific product recommendations, news and news. All information is available both online and offline, the app is constantly being improved with new features useful for farmers. In addition, all content is optimized for use on mobile devices.

AGRIVI is a digital platform dedicated to agricultural management and includes complete solutions for managing all farm processes (AGRIVI, 2023). These solutions are applicable for both small and large farms. These digital farming tools have been designed to help the farmer manage risk and maximize profitability. Through simple and intelligent crop planning with the help of a crop rotation history. Thus, it is possible to choose the best crops for each individual land and according to each season. It monitors the progress of crops, issues weather reports, reduces the risks of crop pests and diseases. Analyze the performance of agricultural land, workers, agronomic practices with the help of approved statistics. Thus, it helps farmers achieve key performance indicators for financing and optimize costs and yields. The products thus obtained can be traced from production to consumption. Thus, better prices and higher profit can be achieved (https://www.agrivi.com/).

Granular Link is a digital platform that brings value to farmers through variable speed maps for precision seeding, daily high-resolution satellite imagery, fertilizer

and fungicide applications and silage corn harvest date. This digital system is designed to offer farmers a personalized omnichannel experience. This application helps professionals in the field to make the best decisions and become more profitable and sustainable at the same time with the help of accurate data and information (https://www.corteva.ro/servicii-digitale/granular-link.html).

Vantage solutions offers both complete packages of services and products for the practice of precision agriculture, as well as technical support and consulting: equipment for precision agriculture; software for farm management; integrated agronomic services. Vantage solutions that help farmers increase efficiency and reduce costs for all types of production or agricultural work: soil analysis; monitoring the condition of the culture; guiding machinery; managing nutrient delivery; harmonization of irrigation systems; analysis of weather information; machinery and fuel consumption monitoring; machinery and fuel consumption monitoring; precision weather station https://www.vantagesolutionsltd.com)

Crop360 is a digital platform that integrates the best third-party digital agriculture solutions, giving farmers the tools they need to be more efficient and reduce their production costs (https://crop360.agricover.ro/). Using the platform allows farmers to meet EU requirements towards sustainable agriculture. The digital solutions integrated into the platform are structured as follows:

• decision support for agriculture: parcel geolocation, satellite images and weather data, crop monitoring, field access, etc.

• useful business tools: lease management, management system of warehouses for stocks (seeds, plant protection products and plant nutrition)

• digital interactions with the Agricover Group: e-care module and e-commerce platform for Agricover Distribution, online "banking" system for Agricover Credit.

Xarvio® SCOUTING app is part of the suite of apps used by farmers in over 100 countries (https://www.xarvio.com/global/en/products/healthy-fields.html). With the help of this, farmers can identify weeds that are difficult to distinguish, especially in the first stages of vegetation. In addition, the application developed by Xarvio can identify several weeds in a single picture. The technology database can identify over 100 weed species. Also, the xarvio® SCOUTING application can recognize the types of diseases. The application can identify with an accuracy between 75 - 100 % over 130 diseases in 37 crops, and the database is constantly updated. Specifically, it can recognize 9 different wheat diseases, 2 canola diseases, 6 corn diseases and 7 soybean diseases. Additionally, with the help of the Radar feature, users can receive notifications if farmers in their area (app users) are experiencing attacks that may spread.

Other features include:
• Measuring the level of nitrogen used by crops, such as wheat or canola or vegetative mass, to provide accurate and easy-to-interpret results.

• Emergence degree analysis: This estimation helps to optimize the fertilization strategy to achieve the desired production.
• Estimation of leaf damage: the application can measure the affected area of the leaves, measuring the ratio between the normal color of the leaf apparatus and the color of the problem areas. In this way, you can get a good estimate of the degree of infestation or the effect of stress factors on crop plants.

8. European research and innovation

Horizon 2020 has boosted the digitalization of the European agricultural sector towards revolutionizing the industry, promoting efficiency, sustainability and competitiveness. Through this program, more than 200 million euros have been allocated for research and innovation to advance the development and implementation of digital technologies that allow the development of precision agriculture, sustainable agriculture and more efficient food production (https://digital-strategy.ec.europa.eu/en/policies/future-farming).

Horizon Europe aims to further develop smart agricultural systems, digital solutions for precision agriculture and the integration of digital technologies throughout the agricultural value chain. The main objectives are to help European farmers increase their competitiveness, reduce their environmental impact and improve their overall productivity (https://digital-strategy.ec.europa.eu/en/policies/digitalisation-agriculture-horizon-2020).

9. Conclusion

Digitization has the potential to revolutionize the agricultural industry by improving efficiency, reducing costs, increasing productivity and improving the quality of life for farmers. However, there are also some challenges to adoption, including the cost of the technology and the need for trained staff. Despite these challenges, it is clear that digitization offers many benefits to the agricultural sector and its adoption is sure to increase in the coming years.

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