Smart Agriculture in the Digital Age (Opportunities, Challenges and Solutions)

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Introduction

For nearly a decade now, digital transformation has been making waves in the agriculture and food sector. It has enabled private and public entities to use innovations in digital technology to improve processes and identify new business models.

However, the term "digital" does not mean the same thing to different people at different levels of the organization. While for one person, digital can simply mean adopting modern technology to streamline business processes and gain competitive advantage, for another, it is a great solution to strengthen relationships with buyers or consumers. Likewise, for another person, it can represent the digitization of all data to improve efficiency and save time and money.

Despite all that it is and can be, what is the role of digital transformation in agriculture? Why is it essential for agricultural businesses to align their strategies with the anticipated digital transformation of the organization?

The potential of digital transformation in the agricultural sector

Digital technologies have a tremendous capacity to transform the agricultural sector by improving the efficiency of farming methods and thus making better use of resources and energy. The main driver behind the increasing adoption of digital technologies in this sector is the need for sustainable and permanent production, which helps the industry to meet the challenge of high demand for food with limited resources (especially water and land), climate change and increased overcome the cost of labor and raw materials.

The digital transformation in agriculture involves the use of granular monitoring techniques (with sensors), drones, agricultural vehicles and robots to optimize the use of resources (seeds, fertilizers, water) and respond quickly to threats (weeds, pests, fungi).

Why is research and innovation important in the digital transformation of agriculture?

Digital technologies have the potential to revolutionize agriculture by helping farmers work more precisely, efficiently and sustainably. Data-driven insights can improve decision-making and practices and help increase environmental performance while making agribusiness more attractive to new generations.

Digital technologies in agriculture also have the potential to provide consumers with greater transparency about how their food is produced. They offer opportunities to renew business models in the value chain by connecting producers and consumers in innovative ways.

Beyond agriculture, digital technologies work in agriculture to make rural communities more attractive, smart, and sustainable, as well as to reduce remoteness issues and improve access to key services. Research and innovation are crucial to facilitate and accelerate digital transformation in agriculture and rural areas for the benefit of citizens and businesses.

9 key areas of transformation in the agricultural sector

In general, there are 9 key areas of transformation in the agricultural sector that are possible with digital transformation. These areas include the following:

- **Crop management:** Refers to monitoring crop, soil and plant conditions through in-field sensors or satellite imagery by collecting and analyzing data such as temperature, moisture and soil fertility.
- **Automated irrigation systems:** Consider automating irrigation activity based on data collected from crop management sensors, smart weather stations, weather reports and other environmental factors.
- **Livestock Management:** Considers the use of digital technology in agriculture to monitor the health and location of livestock.
- **Indoor Vertical Farming and Smart Greenhouses:** It involves the use of technologies in controlled environments, customized to plant needs in greenhouses or indoor farms (using hydroponics or aeroponics). Drone agriculture refers to the use of drones to enhance various agricultural practices including crop health assessment, irrigation, field analysis, spraying and crop planting.
- **Farm automation and robots:** All automation solutions to perform repetitive tasks performed by farmers, especially robots used for harvesting, planting seeds, weeding and self-driving vehicles such as tractors.
- **Farm Management:** Includes platforms to integrate data collected from all devices and sources to maximize productivity, farm planning and operations management.
- **Production monitoring:** The use of digital transformation technologies in the agricultural sector covers post-harvest, but pre-processing operations. It mainly focuses on quality control and sorting in farm warehousing.
- **Supply monitoring:** Tracks input sources such as fertilizer, fuel such as diesel, animal feed and water.

What does the digital transformation of agriculture require and what are the effective solutions?

Digital transformation in the agricultural sector is described as the process of applying technical tools from production to processing, distribution and consumption of products. Significantly, the use of technological techniques is a key differentiator between modern agriculture and traditional agriculture.

What tasks does the digital transformation of agriculture include?

Currently, several contemporary technologies are used in agriculture, including IoT and farm sensors, machine learning and analytics, and drones for monitoring crops.

Digital transformation in the agricultural sector should organically integrate the components of the agricultural ecosystem along the value chain in addition to using current technology, with the center for developing technology solutions occupying a central position. Other elements interact with each other and help to grow and enjoy the benefits provided by the Technology Solutions Development Center.

Reforming the management of agricultural activities

Digital transformation in the agricultural sector is reflected not only in the application of technology in production and value chain links, but also in changing the way companies operate. Because of this, agricultural companies can work more efficiently, increase productivity in supporting departments and save costs. To improve activity management, agricultural companies should

- **Digitization process:** Digitization is required at every stage from production and harvesting to warehousing and distribution. Businesses must also improve their communication with all parties involved in the agricultural sector, which will improve supply chain visibility. In addition, the company's agricultural operation procedure is more transparent and effective.
- **Optimization of administrative work and human resources:** business processes should be optimized using management software. In other words, managers may now have access to critical data, assets, and inventory, as well as monitor sales across all branches and retail locations, while accounting professionals have remote work options, CRM system connections, e-invoicing connections. And they have online tax registration capabilities.
- **Modernization of agricultural practices:** The use of modern technological innovations in agriculture enables farmers to be more productive and efficient. At the same time, all stakeholders in the ecosystem benefit.

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Several solutions for the digital transformation of agriculture

Businesses are encouraged to adopt a number of digital transformation solutions in the agricultural sector, such as improving the quality of human resources, applying technology in land management, improving access to capital, and building database platforms.

Increasing the quality of human resources
Challenges and issues

Few companies are participating in digital transformation. The limited quality of human resources with high expertise in digital agriculture makes it difficult to access and master advanced technologies. Experts have little experience in practice. Farmers are still concerned about digital transformation. The aging rate of the agricultural workforce is increasing rapidly. Both farmers and companies do not have a proper understanding of e-commerce.

Solutions

Creating e-government and digital transformation in the agricultural sector, especially in management to propose, direct and implement effective policies for the digital transformation of agriculture.

Encouraging companies and young workers to join the digital transformation.

Train digital transformation professionals in agriculture to be good in both theory and practice.

Strengthen communication, organize training courses, and train skills for farmers.

Training residents to use trading platforms to promote products.

Connect organizations such as women's unions, farmers' unions and cooperatives to help each other in the technology adoption process.

Encouraging residents to use modern electronic devices, participating in discussions on how to apply advanced technology and...

Invite successful digital farmers to share their experiences.

Earth solution
Challenges and problems

The scale of agricultural production is small and scattered. The use of land in agricultural production is ineffective due to the low level of mechanization and the lack of use of supporting technology. Companies face many challenges and obstacles in implementing land assignment contracts with several houses at the same time.

Solutions

Encouraging concentration of land for agricultural production.

Strengthening the application of technological solutions in the production of agricultural products, such as: GIS solutions, monitoring of environmental soil properties, etc.

Local authorities are involved in linking and concluding land transfer contracts between farmers and companies.

Investment solution
Challenges and issues

Agriculture industry has not yet attracted FDI. Both farmers and companies have difficulty accessing domestic credits.

Solutions

To improve access to capital, governments should
Compile and publish the agricultural industry development document.

simplify procedures and processes; increasing the number of agricultural areas; The credit of agricultural companies with advanced technology.

Identification of productive assets as collateral such as ponds, greenhouses, etc.

Help farmers with business strategy and debt repayment.

Developing policies to attract foreign companies to invest FDI in digital transformation projects in the agricultural sector.

Allow businesses access to capital before providing support policies.

Creating database platforms
Challenges and issues

There is no simultaneous scientific database on environment, market and technology. Data collection is problematic.

Solutions

The implementation of the digital transformation of agriculture must be based on data:

Changing the traditional habits of farmers to record agricultural diaries on paper: Instead, with the training and guidance of farmers, recording of diaries is digitized on electronic devices.

Organizations under the Ministry of Agriculture must prepare accurate statistics of important data related to their management area.

Establishing an integrated air and ground surveillance network to support agricultural activities.

Increasing the availability of information about the environment, soil and climate to help farmers increase crop productivity and crop quality. Sharing of agricultural equipment through digital platforms should be supported by regulatory agencies at the same time.

Create data management software, then rely on local individuals and groups to collect, update, operate, manage, and maintain databases.

Conclusion

In general, it is believed that digital transformation is an inevitable trend in the global agricultural industry, where the agricultural industry must adopt solutions in different areas and collaborate with different companies, sectors, businesses and farmers to successfully enter Become a digital era. We hope the above information has helped managers gain a deeper understanding of digital transformation in the agriculture industry, including its definition, segments, changing trends, and effective solutions.

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