The future of agriculture: Emerging technologies and innovations

With the digital agricultural revolution underway, emerging technologies and innovations continue to redefine how agribusinesses work and function.

At a glance

- From the early civilizations to the age of technology, agriculture has significantly evolved both as an industry and a business sector.
- The digital agricultural revolution in agriculture has influenced production systems and processes, resulting in agribusinesses needing to adapt.
- While emerging technologies are already redefining agriculture, agrifood players can take advantage of existing opportunities for further improvement.

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Part I

A brief history of agriculture and food production

Early farming practices

The first people to inhabit the planet survived through hunting and gathering, which suited their nomadic lifestyle. Then, people gradually started learning how to grow their own crops and domesticate animals. As people practiced agriculture, they were able to produce surplus food and develop permanent villages and civilizations.

To maintain production, early farmers used different tools, planting methods, and irrigation systems. They also soon discovered the seasonality of certain crops, which then led to a more strategic way of farming and food production. The various improvements in farming and agriculture also paved the way for a more widespread trading of goods and products among communities.

Evolution of food production

Ultimately, agriculture eventually developed into a business and industry with the use of machinery. Simple tools like axes, digging sticks, and claypots were replaced by new inventions and machines like mechanical reapers, seed drills, tractors, and plows.

As society continued to evolve and the world population kept growing, agriculture and food production also had to adapt accordingly. With the current projection that the population will reach 9.7 billion by the year 2050, the demand for food is also expected to constantly increase, and so, more technological innovations have been invented throughout the years.

Part II

Agriculture business in today's world

Growth of the agribusiness industry

Undeniably, food production is extremely vital for the sustenance and survival of mankind — which is why it only makes sense that agriculture is now considered as the world's largest industry, responsible for 4% of global gross domestic product (GDP) and generates more than $1.3 trillion worth of food annually. With food and agriculture being a necessity in an ever-changing world driven by economics and capitalism, agriculture has also transformed into business.

Figure 1: Warehouse management for agribusiness

Source: Shutterstock

The term "agribusiness" is a combination of the words "agriculture" and "business" and is used to refer to the business sector that involves farming-related commercial activities. The entire value chain of the agribusiness sector fuels food production and is responsible for feeding billions of people around the globe.

Now that agriculture has evolved into a business sector, several factors influence the success and decision-making processes of the key players in the industry. One of the factors that can make or break an agribusiness is the use of technology.

Part III

The role of modern technology in agriculture

Importance of innovation

As with any other business sector, technology plays a crucial role in the fruition of the agribusiness value chain. The Food and Agriculture Organization (FAO) of the United Nations emphasizes the importance of digitalization in creating highly productive systems that will ensure that the agriculture industry sustainably meets the needs of the global population well into the future — and the increasing pervasiveness of digitalization in the industry is referred to as the "digital agricultural revolution".

According to a report by the World Bank, digital innovations and technologies can be beneficial both on the farm and off the farm, helping create a more efficient agrifood value chain.

On the farm, emerging digital technologies can help boost technical efficiency and improve the allocation of physical, natural, and human capital. Off the farm, they can allow for lower transaction costs by providing access to different types of transaction data and market information.

The availability of digital technologies can therefore result in more efficient and sustainable production and transaction processes in the agrifood system.[1]

Part III

The role of modern technology in agriculture

Opportunities for technology integration

Simultaneously, however, the agriculture sector faces a wide array of challenges which include the recent COVID-19 that disrupted the food supply and highlighted weaknesses and inefficiencies in the food system; the war in Ukraine that interrupted the shipment of grain and fertilizer, contributing to grain and fertilizer shortages in various areas in the world; and the climate crisis that exacerbates food insecurity, which can then lead to malnutrition and result in health crises.

But with the current technological revolution happening in different stages along the agrifood value chain, the digitalization of agriculture is expected to aid businesses in coping with the issues they currently face.

To maximize the advantages of the digital agricultural revolution, it is crucial for agribusinesses to adapt innovations and emerging technologies so they meet their business goals, gain a competitive edge in the market, and make a significant contribution in meeting the needs of consumers and alleviating world hunger. Fortunately, there is a wide array of agricultural technologies that are currently available for use.

Part III

The role of modern technology in agriculture

AI and machine learning

In the past few years, a number of significant developments to artificial intelligence (AI) have been achieved. With the use of AI, organizations see improved business processes, customer experience, and efficiency and productivity among employees.

In the agricultural space, AI and machine learning include the latest technologies like drones (UAVs), remote sensors, and robotics and automation. These technologies are typically used for monitoring farms and for simplifying farming techniques and production processes.

Robotics, for instance, is used for the automation of irrigation, water management, weeding, and spraying. Similarly, drones are used for spraying as well as yield mapping and monitoring.[2]

Internet of Things (IoT)

The internet of things, or IoT, refers to the network of interrelated devices, software, and other technologies that allow for the exchange of data with other devices and systems through the internet.

In agriculture, IoT technologies provide businesses with insights into food production by allowing them to analyze correlations between structured and unstructured data. Another common use of IoT is for the monitoring of crops and livestock.

Additionally, the data acquired through sensors and drones that monitor farms are typically stored in the cloud, providing businesses with easy access for conducting data analysis and exchange.

Part III

The role of modern technology in agriculture

Digital data tools and technology

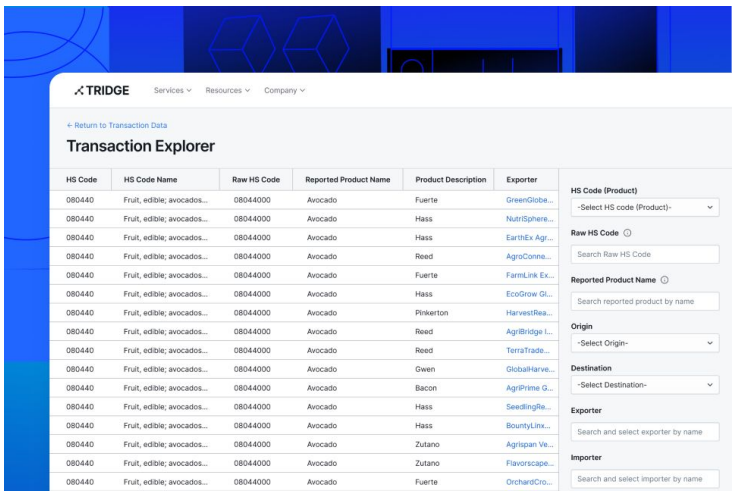
Data, without a doubt, is vital in empowering agribusinesses as it provides them with insights on market trends, opportunities, and risks; allows them to track their competitors' behaviors; and helps them identify potential buyers or suppliers. Thus, a data-driven approach to business allows both agri-food suppliers and buyers to make better informed decisions based on real-time information.

In the age of technology, much of the information and data required to efficiently run a business and make smarter decisions are accessed, sourced, and shared through digital technology.

According to FAO, another way digital technology can be beneficial to farmers and rural agribusinesses is by helping them tap into workforce talent; access support services like financial, legal, and training services; and build rapport with potential suppliers.

One digital data tool that agribusinesses can use is Transaction Data, which provides transaction data obtained from global market trends. Using the aggregated data from the tool, businesses can gain a competitive edge in the market, identify buyers or suppliers, keep track of competitors, and analyze market trends.

Figure 2: Transaction Data Explorer



Source: Tridge

Part III

The role of modern technology in agriculture

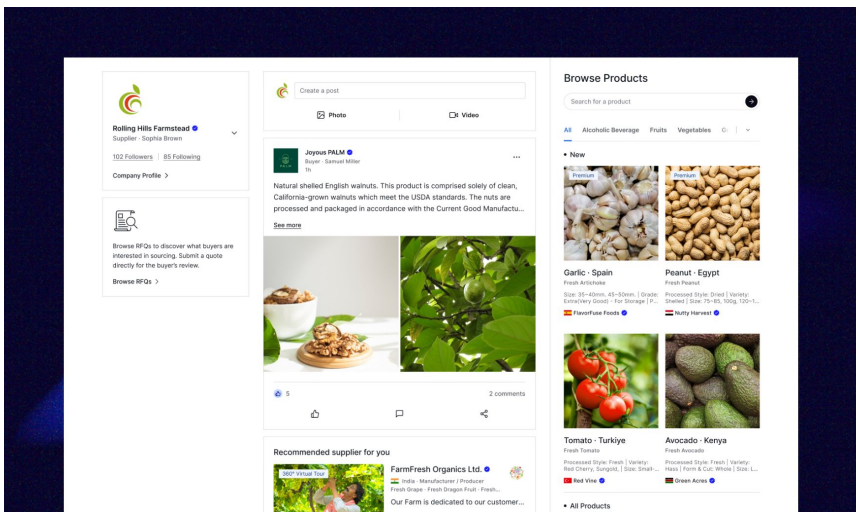
Transaction platforms

Establishing rapport with other key players in the food and agriculture industry is a course of action that any agribusiness owner must take. Tapping into potential partners, whether they are buyers or suppliers, will help agribusinesses expand their market reach and increase profitability. In turn, maintaining these partnerships will strengthen their credibility as a business.

An example of digital technology that allows agrifood suppliers and buyers to connect with each other is the Tridge Social Marketplace. With this platform, buyers can discover suppliers that meet their sourcing needs and vice versa.

The networking that the Social Marketplace provides will make it easier for agribusinesses to build and maintain rapport with each other, allowing consistent transactions and a stronger credibility in the market.

Figure 3: Tridge Social Marketplace



Source: Tridge

Part IV

Challenges in agricultural technology

Limited access to data

As with any other industry development, the expansion of the integration of emerging technologies and innovations into the agrifood sector does not come without challenges.

For one, there is not enough data on the digital agricultural transformation, especially research that offers distinction in the application of agricultural technologies in urban and rural areas. There is also the digital divide[3], which results in disparities in the access to information and technologies between people of different ethnic groups, socioeconomic status, gender, geographic areas, and so forth. This disparity is also seen in the differences in resource accessibility in developed and developing countries.

Standardization also remains as an issue for most agribusinesses. It is crucial for transaction data and market data to be standardized so that they are usable and actionable. Without access to data tools that allow for this standardization, businesses will face difficulties in analyzing the data that they have gathered.

Part V

The future of the agriculture business

Increasing use of technology in food production

While the digital agricultural revolution is already underway, there remain to be rooms for improvement and other opportunities for agribusinesses to innovate. In the future, ramping up on the use of technology in food production will help in further streamlining processes and achieving long-term value.

To maximize the use of technologies in agriculture, businesses can take the initiative to modernize data collection methods and data tools to improve their management practices and acquire more profit.

There are also opportunities for the use of IoT to scale up and aid in precision irrigation, livestock monitoring, and performance tracking for buildings and large fleets of machinery. Moreover, access to digital data tools like Transaction Data can help agribusinesses make smarter decisions by accessing standardized, aggregated, and usable transaction data.

On a larger scale, governments can aid in the proliferation of digital technologies and improve access to these technologies through public policy measures. Government intervention in the digital agricultural revolution will help close the digital divide and ensure that production systems and processes are more seamless.

Conclusion

Empowering agri-food suppliers with data-driven competitive analysis

Emerging technologies in agriculture are changing the way the value chain works, and it is predicted that they will continue to make a shift in farming and food production. However, businesses and governments alike also need to exert effort and assume leadership in minimizing the issues that come with the integration of technology and in taking advantage of the opportunities made available by the digital agricultural revolution.

Ultimately, the future of agribusinesses will be sustained by the effective and sustainable use of AI, robotics, IoT, and digital platforms like Transaction Data and Social Marketplace.

References

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[3] Schroeder, et al. *What's Cooking: Digital Transformation of the Agrifood System*.

About Us

At Tridge we believe in bringing together the power of data, technology, networking, and human expertise - to transform, innovate, and positively impact individuals, businesses, and ultimately the world.

We are pioneers in the agri-food supply chain space, committed to revolutionizing the way intelligence is produced, reshaping the information ecosystem, building trust between businesses, and driving supply chain optimization.

At the heart of it, it is about empowering businesses to make smarter decisions that transform their supply chain network to be more resilient, profitable, and sustainable.

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