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Indicators of digitalization technologies in the agricultural production, food industry and marketing sectors - a review

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Abstract

Some Arab countries have faced many problems in the growth of the economy, which depends largely on agricultural production, food industries, marketing and electronic commerce. This review came to extract the most important advantages and obstacles to the application of digitalization techniques in the agricultural production sector, food industries, and electronic marketing to identify them in a deductive manner. It has become clear that the most important obstacles facing the application of digitization are the legal legislation related to the application of digitization techniques, as well as digital illiteracy in rural society in particular, in addition to the deterioration of the infrastructure necessary for the application of digitization techniques. It recommended that a long-run strategy developed to apply digitalization techniques in agricultural production, food industries, marketing and electronic commerce. As well as developing human capital, especially in rural areas, to provide an appropriate technical environment to achieve development in agricultural production and food industries to contribute to economic growth.

Keywords: digitization. Agriculture. Food Industry. E- Marketing. Economic growth.

I. INTRODUCTION

The agricultural production sector is of great importance in achieving economic growth, whether in countries suffering from economic crises or economically stable countries, due to the link between agricultural production and the food security of the population. With the continuous increase in population, it is necessary to find the necessary means of development that help in developing agricultural production in light of future expectations, through optimal exploitation of resources and the introduction of modern innovations useful for agricultural production, including digitalization techniques that contribute to reducing production costs and increasing efficiency. In 1996, the American scientist (Don Tapscott) used the term digital economy for the first time to refer to the economic relations emerging after the emergence of the use of Internet technologies in some areas of life. (Tapscott, 1996: 11- 44) The digital economy is one of the means of achieving well-being for the population by increasing competitiveness among virtual markets. It also helps to alleviate the problem of misallocation of economic resources, and the importance of digitization in the elements of electronic commercial marketing through developing a promotion and pricing strategy via the Internet and consolidating commercial interconnection between commercial establishments. (Hilbert, 2001: 37) Some Arab economies are suffering from limited growth for various reasons, including security instability, which has resulted in a decline in the exploitation and application of modern technologies in agricultural production and other related industries. This has led to the creation of a digital gap in agricultural production and food industries. This gap means there is a disparity in the application of technologies. In many economic sectors and the field of information technology from one country to another. (Salah and El-Sayed, 2020: 30) The Arab agricultural production sector plays an important role in forming the domestic product of most Arab countries, as agricultural production in Saudi Arabia, for example, contributes (3.2%) to the value of the GDP, while in Egypt (13.4%) in 2020, and agricultural production in Iraq contributes by (3.9%) of the GDP for the same year. The application of digital technologies in agricultural production aims to manage and improve agricultural operations by monitoring various

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environmental indicators using remote sensing technology and GPS technology via satellite, as well as the Internet of Things (LOT) in electronic marketing operations, In addition to this, modern technologies in animal production projects. The most prominent goals of digitization in agricultural production are to increase the quantity and quality of food produced, improve production efficiency, as well as improve the environment by reducing the use of pesticides and chemical fertilizers by accessing the correct data as quickly as possible by adopting smart technologies and thus taking appropriate action as quickly as possible. (Arab Vision for the Digital Economy, 2020: 19-98) Digital agriculture can help meet future challenges, as the sustainable development goals include harnessing the interconnection between food, water, energy and climate. Moreover, using it in record time to produce healthy food for the population through a combination of factors, including reducing the costs of productive inputs, supporting farmers, and providing a degree of transparency to the consumer about how production it produced. Food. (Brini, 2023: 8) The research problem is evident in multiple points, most notably the lack of awareness in the application of digital technologies in agricultural production, food industries, and the infrastructure for technological applications. With the continued gradual depletion of economic resources and the increasing population despite the boom achieved by the economies of foreign countries in the field of digitization of the agricultural production sector.

Research problem:

In light of the results of the current technical revolution, that has affected industrial production in the world and the existence of great opportunities to develop agricultural production and secure food to confront the growing population, modern innovations can employed in agricultural production processes. This achieves efficiency in exploiting economic resources and efficiency in agricultural production and food industries to contribute to economic growth. The obstacles facing the application of digitalization techniques in agricultural production are complex, some of which lie beyond the researcher's capabilities to analyze and identify. However, the main research problem can identified as follows:

1 - Difficulty in applying modern innovations in agricultural production and food industries due to the presence of digital illiteracy, especially in developing countries.

2 - There is uncertainty about the expected results from applying digitalization techniques in agricultural production and related electronic marketing services, thus remaining in the traditional style, which causes high costs, inefficiency, and decreased competitiveness.

3 - Limited infrastructure that can exploited to implement digitalization programs in agricultural production and food industries, in addition to the lack of readiness of the rural community to apply modern innovations.

4 - The presence of an element of risk in electronic marketing due to the weak application of legal legislation that protects Internet users in the areas of production and data protection.

Research Goals:

In light of the problems to investigated, the objectives can be determined as follows:

1 - Read extensively the results of the latest Arab and international studies in applying digitalization techniques in agricultural production, food industries, and electronic marketing, and then identify the obstacles to achieving those results.

2 - Identifying the most important obstacles facing the application of digitization techniques in agricultural production, food industries, and electronic marketing, then using those results objectively to confront the obstacles to achieving digitization techniques.

Research Methodology:

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The research relied on two approaches through the results of studies that focused on employing digital transformation techniques in agricultural production, food industries, and electronic marketing:

The inductive approach: It consists of extracting the results reached by studies of digitalization techniques in agricultural production and food industries and marketing them via the Internet and identifying the most important conclusions reached by those studies globally and in the Arab world.

Deductive approach: This approach relied on interpreting the results reached by researchers about employing digital transformation techniques in agricultural production, food industries, and Internet marketing, which could be useful in achieving the research objectives and be applicable.

First: Digitization technology in agriculture:

Digital agriculture (smart agriculture) means a rapidly developing sector that relies on the use of technologies to enhance agricultural practices with the aim of increasing productivity efficiency and sustainability of food production systems. It includes employing and integrating digital technologies and relying on data in agricultural operations, from applying GPS to identify green spaces and insect pest populations, to labor-intensive robots and predictive analysis techniques to assess the health of agricultural crops. Digital agriculture technologies help reduce production costs by rationalizing the use of economic resources such as irrigation water. (Brini, 2023: 9) The importance of digitizing agricultural production emerges through the interconnected relationship between rationalizing the use of economic resources and preserving the environment's ecosystem, which together achieve agricultural and human development to achieve the global goals of sustainable development. In this way, information technology, agricultural data and communications are important enablers for achieving agricultural development in light of the digitization of agricultural production. Economic growth, environmental balance, and human development are the three basic dimensions of sustainable development to reduce the digital gap between societies. By exploiting the potential energy in information technologies, agricultural production problems can reduced, as information and communications technology can employed at the farm level to store predictive data as well as disseminate it. In the (farm management) system, which helps to adhere to the standards of resource use and achieve the highest quality product. (ITU and FAO 2020: 2)

Second: Digitization technology in the food industries:

Digitization of industrial production means improving business processes by adopting a range of new digital technologies such as operational technologies, artificial intelligence technologies, and the use of robotics. Integrating digital technologies into the food industries helps reduce the problems facing the food industries, such as regulatory and quality restrictions, in addition to the continuous increase in demand for the food industries. (Namara, undataed) Technical management in food manufacturing institutions is one of the most important factors in achieving comprehensive quality that helps the institution develop and avoid problems in it. It is within the framework of resource management in facilities, so the facility must take into account how to manage technical policies in production. (Khairallah, 2014: 33)

Third: Digitization technology in marketing and e-commerce:

E-commerce means doing business via the Internet, that is, exchanging and maintaining commercial information and conducting commercial transactions via international communications networks (the Internet). E-commerce is the place where commercial transactions and the sale and purchase of goods take place through approved communications via the Internet. It is present and available everywhere and the size of the electronic market it estimated at the size of Internet users and smart devices. (Joseph, 2005: 6) As for digital marketing, it is about understanding the market and knowing the consumer's needs and desires through market research and managing marketing information and data about buyers and the market. This marketing process extends to designing a marketing strategy based on the customer's needs and product development and design. To achieve consumer confidence in the marketed products, the

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website must contain all the signs that belong to the marketed establishment, such as the trademark. One of the advantages of global e- marketing is that it is broad and not affected by geographical borders; so that the customer or consumer can shop from anywhere through the establishment's designated website and using a computer. In addition to the presence of the element of excitement in promoting the products offered by establishments through the Internet, as well as the absence of paper documents between the two parties involved in electronic marketing, despite the international nature of this process, which reduces the effort and time required to complete the buying and selling process. (Al-Adili, 2015: 16-18)

Fourth: Indicators of the relationship between digitization and economic growth:

The impact of integrating digitization technology into agricultural production projects, marketing operations, and food processing can measured through some indicators that show the extent of success or failure of digitization technology in projects. As (El-Sherbiny et al., 2021: 195-201) concluded in a research study conducted in Egypt, that there was an increase in production quantities for the studied factories, which began working in them by integrating digitalization techniques in production, marketing, and manufacturing, In addition to an increase in promotion and sales volume in marketing and product sales. He also concluded (Ali and Al-Ghalbi. 2022) that it is possible to increase the company's market share and quickly identify opportunities and threats in record time, by adopting digitalization techniques and entrepreneurial behavior of the industrial facility manager. Also addressing the problem of allocating economic resources, including capital, by employing modern innovations in food industry projects, as (Pang, et al, 2023) concluded that improving the structure of industrial facilities by integrating digitalization technologies helps improve investment and employment of capital as well as labor from during human development. Economic growth it linked to production growth, capital formation, investment, and developing strategies for human development, thus achieving leadership. (Mustafa, 2022: 1437 – 1460)

Fifth: Enhancing economic growth with digital technology:

The introduction of the technical element into the processes of agricultural production and food industries, as well as marketing and trade, leads to achieving efficiency in production, then efficiency in food industries, expanding marketing through dealing via the Internet, then increasing sales, and thus moving towards increasing economic growth. Agricultural production and food industries it linked to achieving food security on the one hand and contributing to economic growth on the other hand. To demonstrate the impact of digitalization on productive sectors, the following research results can extrapolated:

1 - Indicators of digitalization in agricultural production:

Agricultural production is the focus that it directly linked to economic natural resources as the main production elements, which are soil and water. Employing modern inventions in agricultural production, marketing, and commercial transactions related to agricultural production achieves improved productivity, reduced costs, and reliance on technologies and innovations. The introduction of modern technologies into agricultural production helps in making sound decisions and forms a new pattern of green agriculture through the continuous and increasing use of technologies related to agricultural production, such as digital data, which ultimately leads to improving agricultural productivity. (Jiang, et all, 2022) The accumulation of technical information and useful knowledge for farm management and improvement of rural areas is the integration of the digital economy into agricultural production. As smart management, processes in agricultural production include providing forecasting and rapid detection of problems and risks surrounding the agricultural production process and thus making the appropriate decision in the event of applying management and work strategies. (Kundius & Pecuh, 2019: 310 – 314) The digitization of agricultural production depends on previously collected cumulative data from various sources. The farmer may not know how to access and benefit from digital data. It can take from the collection of agricultural companies, and depending on the available data and the level of farmers' knowledge about it, agriculture will transformed into a sustainable, environmentally friendly

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system due to digitalization. (Zscheischler et al. 2022) The digitization of agricultural production helps grow rural family income by increasing production efficiency and increasing crop sales channels by adopting technical means. This it achieved by developing digital culture among farmers themselves and improving production methods in line with innovative technologies. (Zhang & Fan, 2023) In order to achieve the success of exploiting digital technologies in agricultural projects. There is a need for coordination and joint work between the institutions responsible for managing agricultural projects, major suppliers of agricultural production requirements, and owners of agricultural companies to ensure the operation of a technical space for workers in the agricultural production sector and to benefit from these technologies and then achieve leadership in agricultural production. (Syria Digital Lab, 2019) The digitization of agricultural production reduces obstacles to the exploitation of economic resources, exchanges technical information at the international level, benefits from available data, and easily accesses markets, as it allows cooperation between active parties along the food value chain. (Elbehri, and Chestnov, 2021: 4) Digitization technology in agricultural production helps create environmental growth to achieve sustainable development, as the application of remote sensing technologies has contributed to identifying green spaces and thus a greater ability to make production decisions and thus move towards achieving environmental and agricultural sustainability. (Li, Jingdong and Lin, 2023) Despite the great goals that can achieved through the digitization of agricultural production, achieving the goal of economic development requires multiple inputs, the most important of which are the availability of technical infrastructure, eradicating digital illiteracy in developing countries, and providing an appropriate climate for local and international investment. These are the most prominent obstacles facing the digitization of agricultural production. (Abdullrada, & Waheeb, 2023: 96 – 112) Agricultural production projects in Arab countries still suffer from inefficient management in terms of the level of technology in agricultural production, agricultural mechanization, and management of irrigation water use. This has caused a waste of economic resources, their poor distribution, and a decrease in productivity for major crops. (Baker, et al, 2023: 174 – 192) The management of an agricultural facility requires double efforts to perform its functions, such as coordinating between workers, directing their efforts, and monitoring work performance. Performing these functions is easier through the introduction of the technical factor, which is the comprehensive control of the farm by adopting digital technologies, as it saves the farm manager time and effort and determines the time needed to complete the work in a short time. (Jiang et al, 2022) The digitization of agricultural production requires the availability of the material and intellectual capabilities, as well as the necessary equipment to integrate this technology, and knowledge plays an effective role in achieving the maximum benefit from digitization in agricultural production. (Alt, et al, 2022)

2 - Digitalization indicators in the food industries:

Digitization plays a role in economic growth as it helps the flow of foreign investments and thus achieves efficiency in allocating resources. However, this process requires infrastructure to generate the energy necessary for the continued operation of technical devices. (Beirne & Fernandez, 2022: 38) Integrating digitization into food industry projects plays a role in improving the value chain of food manufacturing, storage, and commodity quality. The transformation requires providing integrated information about factories, the market, the size of demand, and institutions related to the food industry. (Huang, Y. & Z. Liu, 2023: 37 - 42) Food industry establishments face some obstacles in implementing digital transformation, especially small and medium enterprises. These obstacles include government support for implementing digital transformation, in addition to the problem of workers' efficiency in terms of digital knowledge that allows them to interact digitally and access the Internet. (Ghobakhloo & Iranmanesh, 2021) There are also obstacles to the lack of scientific research that covers all aspects of the subject, as it is a modern technology in the food industry. In addition to the existence of a gap between the volume of production and the level of technologies used, as this causes pressure on the technical structure of the industrial facility because it is not compatible with the previously prepared administrative strategies. (Nasr al-Din and Al-Zahrani, 2023) Digitization techniques in the food industries achieve control over the safety of manufactured foods and facilitate the exchange of best practices in food manufacturing. It is also possible to develop the food value chain for agricultural crops, if there is accurate digital data. (Raheem, 2020: 496 – 508) The application of digitization also helps reduce costs

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and shorten the time required for production. It is important in increasing the number of customers through electronic dealings, in addition to making digital financial services available, thus influencing economic growth. (Abbas, 2023: 1565 – 1627) As well as achieving monitoring of stored food commodities through sensor technologies and the Internet of Things, which can be applied to monitor food items in terms of humidity level and temperature to ensure the quality of stored food. (Nugroho, et al, 2023: 774 – 790) Traditional strategies, lack of resources and inadequate infrastructure are some of the problems facing the implementation of digitalization in food industry facilities. (Yaqub, & Alsabban, 2023) As the generation of industries called (4.0), which it based on digitization technologies, is still suffering from societal readiness to implement them. Community readiness for this type of industry achieves the avoidance of digital illiteracy problems and the achievement of digital data security through the link between digitization techniques in industry and the human capital of during the achievement of human development. (Mourtzis, et all, 2022)

3 - Digitization indicators in trade exchange and marketing:

E-commerce has advantages for the market sector and the consumer, as it makes it easier for customers to deal with establishments in cases of buying and selling easily. (Al-Jadaiya and Khalaf, 2012: 37) Adopting digitalization techniques in commercial establishments helps to expand promotion further, increasing the number of customers, especially those who find it easier to obtain prices, locations of goods, and speed of arrival of the goods, as communication via the Internet achieves more efficiency in serving customers and consumers and greater responsiveness to electronic promotion. (Oliver, 2023) Although digitization technology in food production is a profit incentive by reducing marketing and promotion costs, it still suffers from some problems, such as switching to a new management strategy for facilities. (Demartini et al, 2018) Digitization technology improves the performance of the food value chain with minimal effort. (Block chain) technology can adopted to create smart contracts that are more secure in terms of ensuring the credibility of product information and the level of data security. This technology it characterized by reducing the interference of human factors in promoting and marketing products. (Yi, et al, 2021) The new marketing model with digital technology in dealing with business via the Internet requires the expertise of the dealers, whether they are producers or customers. An example of this is agricultural producers who suffer from the complexity of digital data at the level of managing agricultural facilities, food processing, and product marketing. (Heideveld, et al, 2019) Electronic marketing of manufactured foods plays a major role in speeding up the completion of the contract between the seller and the buyer, thereby helping to increase the volume of sales through the influence of the commodity brand, which is an attractive factor in electronic marketing. (Umair, et al, 2021: 1238 – 1247) Integrating digital technologies and employing them in the field of food trade and online delivery services requires following a promotion system that suits consumers, as the government is responsible for regulating these transactions by legislating appropriate laws, as well as encouraging these transactions. (Kraak, 2020:107 – 115)

Sixth: Obstacles to applying digitization techniques:

From a review of previous studies on integrating digitalization technology, the results of those studies showed the advantages and results of applying the technologies in agricultural production, food industries, and Internet marketing. It became clear that it some problems that hinder the application of these techniques, and they can extracted from the results of some studies on the subject, which were as follows:

1 - Legal legislation: To implement innovations in agricultural production and food industries, legal legislation related to these innovations must be available, as some of these innovations are machines or production requirements whose supply and use it not permitted for agricultural producers and owners of industrial facilities, as some technologies cannot used except with the approval of the state. Legally, such as drones, the creation of a digital database, which it considered the infrastructure for digital technology, requires legal legislation to regulate and protect it, so it must have a legal cover. (Beksultanova, et al, 2023)

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2 - Level of monetary income: Digitization technology affects middle-income and low-income agricultural producers due to the high costs of applying digitization and establishing the necessary infrastructure for it and the devices required to apply this technology in agricultural production projects, especially such as irrigation and fertilization techniques and techniques for monitoring climate factors within the farm or production fields. Animal, so the application of digitization it linked to the amount of monetary capital available to the agricultural producer or marketer via the Internet. (Wang, et al, 2024)

3 - Infrastructure for digitization technology: Infrastructure is necessary to apply digitization techniques in agricultural production projects, such as structures for installing solar panels, installing automated milkers, computerizing livestock and poultry feeding machines, and the digitization of food manufacturing facilities requires computerization of promotion and marketing processes and even manufacturing and management. Machines, there are some issues that must be studied before integrating digitalization technologies into the agricultural production sector and food industries, such as the difficulty of determining the necessary data that must be stored, such as data on arable land areas. (Alt, et all, 2021)

4 - Digital illiteracy: Many farmers and workers suffer from using the Internet of Things in farm management or production management and marketing, especially in developing countries, in addition to not feeling safe when making financial transactions via the Internet. Therefore, achieving the goal of integrating digitization into agricultural production and food industries requires training individuals specialized in technology. Information and computing to enable society to use and apply technologies, in addition to teaching workers in agricultural production and food industries the necessary skills to deal with techniques for applying digitization and organizing facility management by adopting modern technological means. (Alt, et al, 2020)

5 – The level of security of digital data in production: Preserving data is one of the most important factors that cause losses to establishments if the establishment's database is hacked, so dealing with it requires adherence to the technical principles specified in collecting and protecting digital data related to the establishments' commercial operations. Therefore, this matter requires determining the degree of importance of data and the method of transferring it between devices to eliminate the risks of hacking the database of commercial establishments. (Wilgenbusch, 2022: 2653 – 2668) In addition to the laws of digital data exchange and dealing between seller and buyer via the Internet, this is one of the obstacles to applying digitalization technology in agricultural production and food industry facilities. (Kaur, et all, 2022)

6 - The level of digital data security in electronic marketing: One of the obstacles facing ensuring data security in electronic marketing is the difficulty of applying the law to violators. Likewise, using the Internet of Things for marketing purposes requires sufficient knowledge to deal with the other party. (Wang, et all, 1998: 63 - 70) The electronic marketer must be highly skilled in dealing with potential threats regarding the security of digital data. To confront these threats, the marketer must invest in the presence of innovative electronic programs to protect his digital data, and this is a guarantee. For the cyber security of the facility for which he works. (Konyeha, 2020: 12 – 20)

Seventh: Conclusions: Through previous studies on employing digitalization techniques in agricultural production, food industries and electronic marketing, some conclusions became clear through extrapolating the results of this research over recent years, which are as follows:

1 - Employing digitization techniques achieves efficiency in identifying areas of green spaces and areas where agricultural pests spread through digitization techniques, which are the use of GPS and remote sensing systems (GIS). These techniques have already use, but the adaptation of the agricultural and industrial community still requires awareness of exploiting these Technologies.

2 - An increase in the efficiency of agricultural production through reducing production costs and shifting towards farm management through technology in irrigation and fertilization, as well as setting the

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harvesting and harvesting seasons in standard time, thus achieving technical efficiency in production and increasing the level of profits in the long run.

3 - It became clear that there are some obstacles, such as the inefficiency of the infrastructure for applying digitalization techniques in agricultural facilities and food industry facilities, in addition to the presence of digital illiteracy, which causes waste in the use of economic resources such as irrigation water and inefficient use of monetary capital.

4 - Weak government support in developing clear long-run strategies to integrate digitalization technology into agricultural production facilities and food industries, as well as electronic marketing. In addition, the societal environment, especially the rural environment, does not have sufficient knowledge to receive and integrate these technologies into agricultural production projects and food industries.

5 - Ease of monitoring agricultural areas as well as stored food in terms of humidity and temperature through sensors and weather devices, thus reducing the risks resulting from spoilage of stored food.

6 - The expansion of the electronic market, the ease of accessing it through mobile devices, and the ease of conducting an electronic contract through multiple technologies, including (Block Chain) technology, which it characterized by reducing the interference of human factors in promoting and marketing products.

7 - The need for legal legislation by governments to regulate the use of technology in agricultural production, food industries and electronic marketing to ensure cybersecurity for online customers and ensure safe payment via the Internet, in addition to ensuring the security of digital data.

8 - The need for infrastructure to effectively implement legal legislation that protects the security of digital data and hold violators accountable.

Eighth: Proposals and Recommendations: In light of the conclusions drawn from previous studies on digitalization techniques in agricultural production, food industries, and electronic marketing, the following can recommended:

1 - The necessity of developing a long-run strategy to integrate digitalization technologies in agricultural production, food industries, and electronic marketing, which are the most important axes for achieving sustainable development and developing economic growth.

2 - Implementing legal legislation related to the application and use of digitization technologies that help protect digital data and protect consumers and marketers, especially financial transactions.

3 - Developing human capital, especially those working in agricultural production and food industries, on how to apply digitalization techniques in the aforementioned sectors, in addition to electronic marketing.

4 - Developing the infrastructure for applying digitalization techniques in agricultural production, food industries, and electronic marketing, such as sites for generating solar energy, computerizing food industry production and marketing processes, and protecting the database of the aforementioned facilities.

5 - Developing human capital working in agricultural production, food industries and electronic marketing to provide an appropriate technical environment, especially in rural areas that depend on agricultural production and animal production projects.

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