

Importance of automation processes in the Colombian agricultural sector



Importancia de los procesos de automatización en el sector agrícola colombiano

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ABSTRACT

The agricultural sector is one of the pillars of the Colombian economy and is fundamental for the country's food security; therefore, the objective of this research is to analyze the importance of automation processes in the Colombian agricultural sector. By means of a qualitative descriptive analysis, it is intended to determine the barriers and opportunities for the adoption of these technologies through a documentary analysis. The findings of this research process allow identifying that the adoption of automation technologies in the Colombian agricultural sector is still limited, due to factors such as the lack of knowledge and training in the use of these tools, the low level of access to financing and the resistance to change on the part of some producers. It is concluded that process automation in the Colombian agricultural sector has the potential to improve the efficiency, productivity and profitability of agricultural activities. However, the need to overcome the above-mentioned barriers to encourage greater adoption of these technologies is identified. It is also essential

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and fundamental to provide training and access to financing so that producers can acquire and implement these tools effectively.

Key words: automation, agricultural sector, industrial processes.

RESUMEN

El sector agrícola es uno de los pilares de la economía colombiana y es fundamental para la seguridad alimentaria del país; es por ello, que esta investigación tiene como objetivo analizar la importancia de los procesos de automatización en el sector agrícola colombiano. Por medio de un análisis descriptivo de tipo cualitativo se pretende determinar las barreras y las oportunidades para la adopción de estas tecnologías, esto a través de un análisis documental. Los hallazgos de este proceso investigativo permiten identificar que, la adopción de tecnologías de automatización en el sector agrícola colombiano es aún limitada, debido a factores como la falta de conocimiento y capacitación en el uso de estas herramientas, el bajo nivel de acceso a financiamiento y la resistencia al cambio por parte de algunos productores. Se concluye que la automatización de procesos en el sector agrícola colombiano tiene el potencial de mejorar la eficiencia, la productividad y la rentabilidad de las actividades agrícolas. Sin embargo, se identifica la necesidad de superar las barreras mencionadas para impulsar una mayor adopción de estas tecnologías, además es esencial y fundamental brindar capacitación y acceso a financiamiento para que los productores puedan adquirir e implementar estas herramientas de manera efectiva.

Palabras clave: automatización, sector agrícola, procesos industriales.

Introduction

Automation plays a fundamental role in industrial processes, as a system capable of responding automatically without the mediation of the operator, to the changes that occur within it, performing the appropriate actions to fulfill the designed function (Sanchis et al., 2010). Systematization can increase productivity and efficiency in the use of resources, which is why the following data presents a broad overview showing a vision from an economic, social and cultural point of view. Technological advances have begun to transform various aspects of the agricultural industry, with which it has been possible to streamline and reduce food production times, hence, the cultivation area must increase annually by 3% to keep pace with population growth; therefore, technological advances have begun to transform various aspects of the agricultural industry. For example, a farmer who produces under normal conditions 2500 kilograms of wheat per hectare on average would be able to triple this figure with the use of technology (Syngenta, 2018). Analyzing the progress of agricultural technology from another point of view, finding that the implementation of automation generates distrust and workers in this field need time to adapt to these innovations. On the other hand, “as a negative aspect, at least on the social level, the machines that perform these jobs can replace people who, in this way, lose their jobs” (García Ramírez, 2020). Likewise, other disadvantages are that “it generates technological dependence; it requires a large initial investment; there is a lack of trained personnel to handle the equipment; there is susceptibility to technological obsolescence; resistance of operators to change” (Camara de Comercio de Medellín, 2019). In addition to the uncertainty caused by the replacement of human activities by machines, from an economic point of view, the large expenditure of resources for the implementation of systems with these capabilities is analyzed, so it only seems to be viable in larger companies. Limits are usually placed on new technologies not because they are dangerous, but because they are unknown. Tapia et al., (2017) make a brief description and contextualization of what is a low-cost agricultural machine deepening in its elaboration and composition analyzing factors of which when making use will simplify such tasks with a simple tool as it is such a machine is so simple, but allows to technify the operation to a point of being able to effectively surpass to perform this operation in a critical way in the harvest. In an investigative process a complete analysis of the implementation of harvesting

machines is performed for which a large group of people trained to perform a good analysis from teachers students to technicians and professionals in specific the KTP harvesting machine was analyzed through photo timing methods this information is taken and managed to validate subprojects that use the results obtained from its theoretical aspect and can be applied to other companies machines and agricultural implements (Salazar, 2017).

Castro (2017) proposes an analysis of the different risks that may occur at the time of using an agricultural machine as he collects different accidents that have occurred and observes the reason for these, with which he seeks to mitigate these accidents through the generation of changes as necessary by adding insurers or mechanisms that allow the protection of the operator, thus seeking to return the agricultural machines as a safe and reliable space maximizing safety and maintaining the quality of production, thus making the transfer to processes with machines profitable. Dean et al., (2018) present a research, in which they explored and generated alternative designs for tools for agricultural applications, especially, of a pumping system to extract shallow water from rivers, lakes and canals, applying appropriate design methods for the conceptual design stage, an agricultural machine, is of particular importance to perform irrigation and contribute to the drainage of flooded areas, in the conceptual design phase, they managed to determine feasible combinations of system configurations.

This system wants to develop a Geographic Information System based on free software with the ability to manage information related to advanced farming techniques, due to the growing demand for food and the increasing demand for sustainable use of natural resources. Leading to the emergence of new agricultural management technologies based on the development of existing technologies in the fields of communications. In this sense, geographic information systems have played an important role by enabling through analysis, visualization and integration with geospatial data (Garcia, 2019). Pedraza (2017) presents a research, where he shows that, in the agricultural sector, technology takes longer to arrive than in other fields, but whose transformation potential has an undeniable importance. “compared to other areas, agriculture lags behind and advances slowly. But it can become the leading example of what technology can do for society,” Albert, CEO of Deepfield Robotics, a Bosch-owned startup that develops products and services for the agriculture of the future, emphasizes that “more is produced with less, there are economic savings and better environmental management.”

This article points out that agricultural mechanization wiped out many jobs in the countryside, in 1948, Norbert Wiener, considered the father of cybernetics, warned of

the conflict between technology and employment, suggesting to compensate citizens, Paul Mason said that in 30 years “between 40 and 50% of jobs will disappear and will be automated, especially in commerce and office jobs”. Other reports reflect that throughout the world today, work is being automated and much of the work that cannot be automated is being taken to countries with less demanding labor or environmental relations or where labor and taxes are cheaper (Galindo, 2017). FAO (2022) estimates that without technological development and higher productivity, it will be impossible to lift millions of people out of scarcity, food insecurity and malnutrition. FAO Director General expressed “what matters is how the automation process is carried out in practice, not if it happens. It must be ensured that systematization is implemented in a comprehensive manner and drive sustainability”. The confinement by coronavirus disease (COVID-19) has created labor shortages for many agribusinesses, forcing them to adapt to a sudden crisis that disrupts the labor market by resorting to automated processes at the same time, this can contribute to decent employment and income and reasonable working conditions. The transformation to autonomous processes requires an immense economic expenditure of resources that the vast majority of own crops without links to companies do not have, so that to make this transfer is something complex, the expenditure of resources for the proper functioning which shows how little accessible this change is, along with the lack of knowledge of this transfer of functions. From a cultural point of view, there is a great distrust of machines, unemployment, uncertainty of replacement and adaptation to autonomous processes, since they will require intensive training that is difficult to achieve by people used to rudimentary processes.

From the economic benefits, there is another vision, one more centralized in managers or bosses, since they are the ones who benefit the most, thus achieving a minimum salary payment and a personalized hiring process, above all, what would benefit the most would be the production times, since the use of machines the production would be ready in a shorter time, benefiting the sale and distribution of food. The advantages at a cultural level would be the low contamination and in the use of fertilizers due to the fact that by making the process more precise, the use of these aggregates would be reduced, improving health and environmental conditions. In addition to greater safety in the processes since the use of machines minimizes the number of accidents. As stated by Tejada et al., (2020) the robotic systematization of processes arises as a solution, based on software, to systematize established processes that involve routine activities, ordered data and definitive results. In other words, it has confirmed the benefits of RPA in production methods, costs, speed and reduction of faults.

Taking into account the above, this research aims to answer the following question: What is the importance of automation processes in the Colombian agricultural sector? In this regard, it is necessary to generate a conceptual approach to automation processes in the agricultural sector, to analyze aspects of automation related to modern processes and its differences with contemporary agriculture, and to describe the impact of automation processes in the Colombian agricultural scenario. For Irreño (2021) robotic automation of processes is a software technology that allows companies to automate repetitive and tedious tasks that are normally performed by humans; therefore, automation is of great importance for the development of an effective marketing strategy, since it allows companies to reduce their costs, improve their productivity and optimize the use of their resources (Chiliquinga-Baquero et al., 2021). Robotization or automation is classified into two main typologies: prior notice of affected workers, to ensure fair treatment, a consultation period with workers and a training plan (Segovia, 2020).

Automation is a pillar in content marketing innovation in service companies, which involves the use of automation tools to maximize productivity (Chiliquinga-Baquero et al., 2021). Thus, from the perspective of Segovia (2020) automation is a redundancy practice, which involves the use of robots and other automated technologies to replace workers, in order to reduce labor costs and improve productivity, it highlights the importance of considering the social and cultural context of the workplace when implementing automation, to ensure that workers are prepared for the changes ahead (Inzunza Acedo et al., 2020).

Encalada et al., (2019) state that information systems are an important tool to improve the efficiency of manufacturing processes, allowing them to make optimal decisions to improve productivity and efficiency; business processes in business management allow companies to optimize their operations, improve productivity, reduce costs and increase efficiency (Velázquez et al., 2019). Hondares & Lorenzo (2019) consider the model to estimate the effort demanded by the automation of business processes is based on a qualitative approach to evaluate the requirements and the selection of tools, and a quantitative approach for the implementation of the solution and the validation of results.

According to Vizalote Rodriguez (2022) SMEs must implement information technology tools to optimize their processes, increase productivity and improve the quality of their products and services, entrepreneurs must have knowledge of information technologies to make the most of the available tools; in business processes, the importance of having a good understanding of the models is

highlighted, as well as implementing and improving them, the benefits of a strategic approach to decision making and the advantages are discussed (Velazquez et al., 2019). Mejia-Neira et al., (2019) mention software engineering is important because it examines how this discipline can improve production outcomes and improve process efficiency.

Robotic automation of processes is important because it examines how this software technology can be used effectively, explains the benefits it offers to companies, including cost reduction, increased efficiency and improved process quality (Irreño, 2021). In this regard Chiquinga-Baquero et al., (2021) refer to the main characteristics of automation as a pillar of innovation in content marketing in service companies are: the automation of distribution to reduce costs and improve productivity, the use of artificial intelligence tools for efficiency; Ansible's automated administration and configuration strategy is classified into four main typologies: automated task development, network management, configuration management and resource management (Enciso & Morales-Iñíguez, 2021).

As stated by De La Espriella-Babiloni (2019) industrial automation and instrumentation refers to the use of technologies to control and optimize industrial processes to improve efficiency and product quality; it shows the diversity of imaginaries that workers have about robotization, from anxiety of the possibility of a reduction in employment to a more positive view of improved productivity (Inzunza Acedo et al., 2020). Encalada et al., (2019) describes how information systems can improve the efficiency of manufacturing processes by providing accurate information to decision makers.

The implementation of an enterprise architecture develops online courses for online education as it shows how these architectures can be implemented by offering high quality courses to a variety of learners (Peñafiel & Guzman, 2019). As shown by Encalada et al., (2019) classifies information systems into, enterprise, designed to manage business processes at the enterprise level, manufacturing, specific processes such as production planning, distribution and inventory management and quality, to control the quality of products and improve manufacturing processes; optimizing the information collected allows companies to evaluate the effectiveness of their information (Chiquinga-Baquero et al., 2021).

For Velázquez et al., (2019) business processes can contribute to the improvement of company results, they offer a holistic and useful look at business management and how business processes can improve company results; it is important the model to estimate the effort demanded by business process automation as it helps organizations to plan

and execute successful automation plans (Hondares & Lorenzo, 2019). From the perspective of Inzunza Acedo et al., (2020) the automation of work processes affects employees from a sociological perspective.

The enterprise architecture shows an online learning platform, content management, user management, resource management and quality management (Peñañiel & Guzmán, 2019). For De La Espriella-Babiloni (2019) industrial automation and instrumentation include traditional technologies, such as programmable control systems, data acquisition systems, safety devices, and emerging technologies, such as cloud computing and artificial intelligence; the main characteristic of robotization or automation can be captured as follows: technology used to replace workers, such as robots or other automated technologies (Segovia, 2020). Segovia (2020) refers to the great importance of robotization for the management of human resources today; he classifies the imaginaries of threat, the imaginaries of technophobia, the imaginaries of productivity improvement and the imaginaries of resistance, these are the different imaginaries that workers have of robotization (Inzunza Acedo et al., 2020). In this regard Velázquez et al., (2019) classify business processes in business management into two main typologies: strategic processes that include the operation of human resources management, and operation processes that include the management of the value chain.

Robotic automation of processes classifies this software technology according to several different aspects, including existing systems, potential uses, benefits offered to companies and existing challenges (Irreño, 2021). For Vizalote Rodríguez (2022) it is of vital importance as it helps SMEs, to improve their efficiency and productivity, which will result in greater success in the long term; the importance of industrial automation and instrumentation is highlighted when considering the economic and technological context when implementing emerging or traditional technologies (De La Espriella-Babiloni, 2019).

Materials and methods

The present research is characterized by having a descriptive scope, which is based on the total description of autonomous processes, with which both the properties and main characteristics of the subject are defined, thus obtaining information. The descriptive scope consists of measuring or collecting information on the properties, characteristics and profiles of people, groups, communities, processes or objects, without seeking to analyze how they relate to each other (Hernández-Sampieri et al.,

2017).

Considering the research is characterized by a qualitative approach, it is based on identifying how people react to a change of autonomous processes, analyzing the mentality that represents the transformation of their activities from something so rudimentary to something new and that produces uncertainty, taking into account from social, cultural and economic aspects raised, from a humanistic vision and autonomous development. From the point of view of Sampieri et al., (2014) it is a set of interpretative techniques aimed at making the world visible and transforming it into representations, such as observations, records and documents. The population of this research is made up of the population of the Colombian agricultural sector, it is responsible for providing employment to a large number of workers, who are immersed in cultivation, harvesting and production work, being this a population of infinite character, for the ILO (2022) workers face serious work deficits, especially inadequate security, low wages, lack of stability and job security, and too much working time.

The instrument used in the research is documentary analysis, a technique characterized by the operations performed to represent both the form and content of documents (Martín-Gavilán, 2009). The benefits of this technique were used for this reason, at the time of analyzing a topic as extensive as automation, subtypes were chosen that were in accordance with the research and had a close relationship with the main topic, different types of content were chosen and classified to establish the base topics of the study, selecting influential and unnecessary topics. The search obtained from the analysis of the information was the use of journalistic information, where different research sources were used, taking as the most relevant research articles and magazines, written information media from the experiences of third parties which present an analysis and a conclusion of a certain topic.

Results

Aspects of automation related to modern processes

Process automation has revolutionized the way companies operate and has enabled greater efficiency and productivity in different areas of the company. Currently, there are several automation technologies and tools available that allow the automation of repetitive and manual tasks, as well as the optimization of more complex business processes through the use of artificial intelligence and data analysis; therefore, Table 1 shows a detailed comparison between two process automation approaches: robotic process automation and intelligent process automation. Both resources are useful to

understand the importance of automation in business process management and its potential to improve efficiency, productivity and quality of services offered.

Impact of automation processes in the Colombian agricultural scenario

The impact of automation processes in Colombian agriculture is a topic of great interest today, since the implementation of automation technologies can improve the efficiency and productivity of agricultural activities; therefore, the impact of automation on the production of specific crops in Colombia is shown. The results indicate that automation can significantly increase the productivity and profitability of these crops by reducing production costs and improving product quality.

The results of a study on the impact of automation on employment in different sectors of agricultural production in Colombia are observed. The results indicate that, in general, automation has led to a reduction in employment in the agricultural sectors analyzed. Flower cultivation was the sector with the greatest loss of jobs, with 17.8%, followed by coffee cultivation with 15.4% and fruit cultivation with 12.6%. On the other hand, precision agriculture showed a net job creation of 7.6%. Automation has become a growing trend in the world economy. In the last five years, the country has experienced a significant implementation of automation technologies in different economic sectors, as shown in Figure 2, the manufacturing industry leads in the implementation of these technologies, with 52% of companies that have opted to automate their production processes. Agriculture, on the other hand, has implemented automation technologies in 34% of companies, followed by commerce with 18% and services with 10%. This implementation of automation technologies has had an impact on the demand for labor.

Manufacturing and agriculture have suffered a significant decrease in the demand for manual workers in the last 5 years, with a decrease of 12% and 9%, respectively. On the other hand, the service sector has experienced a 5% increase in the demand for manual workers. The implementation of automation technologies has had a negative impact on the demand for manual workers in Colombia, especially in the manufacturing industry and agriculture.

The development of this research allowed us to learn about the advances and implications of process automation in different business areas, including the Colombian agricultural sector. Within the literature reviewed, it was possible to understand the importance of automation to improve the efficiency and productivity

of companies (Daza Cantor et al, 2021; De La Espriella-Babiloni, 2019; Vizalote Rodríguez, 2022), as well as the benefits and challenges associated with its implementation. These findings are relevant for a more complete understanding of the implications of automation and provide useful insights for business decision-making (López-Rodríguez et al., 2023; Velázquez et al, 2019; Inzunza Acedo et al, 2020). Likewise, it was revealed that automation can have a positive impact on agricultural production, increasing efficiency, reducing costs and improving product quality. However, it also revealed a loss of jobs in certain agricultural sectors due to the implementation of automated technologies. These encounters highlight the need to find a balance between the adoption of automation and the preservation of jobs, considering both the benefits and the possible negative impacts on the labor environment.

The methodological strategy used in this research was successful and the objectives were fully met: a conceptual approach to automation processes in the agricultural sector was analyzed. Through the review of relevant theoretical references, a deeper understanding of the fundamentals and key concepts related to the automation of processes in the agricultural field was obtained. This has allowed establishing a solid knowledge base that has served as a starting point to address the other aspects of the research.

Secondly, the aspects of automation related to modern processes were analyzed. By comparing robotic process automation and intelligent process automation, it was possible to identify the functions, necessary skills, benefits, flexibility and implementation time associated with each approach, allowing to understand the importance of automation in business process management and its potential to improve efficiency, productivity and the quality of the services offered.

Conclusions

Se analizó el impacto de los procesos de automatización en el escenario agrícola colombiano. Mediante la implementación de tecnologías de automatización con un impacto positivo en términos de aumento de la eficiencia, la productividad y la rentabilidad de los cultivos, sin embargo, también se identificó un impacto negativo asociado a la pérdida de empleos en los sectores analizados, se contribuyen a una comprensión más completa de los efectos de la automatización en el sector agrícola colombiano y brindan información valiosa para la toma de decisiones en este ámbito.

La investigación sugiere la necesidad de realizar futuros estudios para profundizar en diversos aspectos relacionados con la automatización de procesos en el sector agrícola

colombiano. Es importante investigar más a fondo los impactos sociales y laborales de la automatización, así como explorar estrategias para mitigar los efectos negativos, como la reubicación laboral, las barreras y resistencias que enfrentan los productores, estas investigaciones proporcionarán información valiosa y orientación para una implementación más efectiva y sostenible de la automatización.

Dentro de las limitaciones de la investigación se resalta la falta de información primaria a través de un instrumento, como entrevistas o encuestas, que podrían haber enriquecido los resultados obtenidos. Otra limitación Es la escasez de información disponible sobre el tema de investigación. Estas limitaciones destacan la necesidad de futuros estudios que utilicen enfoques metodológicos más amplios y diversificados para obtener una comprensión más completa y rigurosa de los procesos de automatización.

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