Digital technologies in Smart farming: resistances and changes in the organization of agricultural industry

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Digital technologies in Smart Farming: resistances and changes in the organization of agriculture industry

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Abstract. Digital technologies are essential in the agricultural industry, and they affect organizational changes. Indeed, they modify the way of working of the agricultural industry, which reviews their rules. Digital technologies transform the agricultural industry, introduce innovative knowledge, and improve business performance. The innovation has new challenges involving agriculture consultants and farmers. Furthermore, it introduces new techniques and devices to create value and profitability.

These digital technologies impact the agricultural industry, such as to improve business performance and environmental impacts. Some studies talk about organizational changes in the agricultural industry, but there is not yet a substantial contribution of the literature that proposed to identify the main changes and organizational resistances in the agricultural industry. For this reason, we have decided to focus on the organizational changes and resistances resulting from digitization in the agricultural industry. The paper aims to show the concepts of smart farming and digital technologies, how the agricultural industry uses them, and their impacts. This paper contributes to a literature review regarding digital technologies in smart farming based on these concepts. We try to identify the main organizational changes and resistances generated using digital technologies. We focus on a theoretical analysis of the changes and resistances caused by digitalization in the industries and agricultural industries.

Keywords: Digital Technologies, Organizational change, Digitalisation

1 Introduction

Unlike the manufacturing sector, the agricultural sector suffers from many risks related to the production cycle. One of the most important is a natural or environmental risk, where adverse weather conditions contribute to the production cycle [1, 2]. Other risks depend on cultivation, harvesting, storage, inability to optimize processes, and finally, lack of progress in productivity [1]. The agricultural sector is sensitive to climate change, and the agricultural industry faces many difficulties. Climate change reduces agricultural activity and affects profitability. To solve this issue, the adaptation of the agricultural sector is necessary through the management of the issues to the effects that may occur. Digital technology can be a solution to these issues [3]. The use
of digital technologies starts a digitalization process in agriculture which moves from traditional tools to the use of digital technologies that allow the agricultural industry to be wise [4]. Digital technologies address challenges in the agricultural sector, especially related to natural hazards [5]. Digital technologies transform the agricultural industry, introducing innovation and tools to improve farm performance and generate and accumulate knowledge. Digitalization in the agricultural industry is not a novelty. Preliminary studies date back as early as the ‘80s with original thoughts about "Precision Agriculture" (PA) which explored how digital technologies could be used to improve farming operations to increase profitability [6]. Over the years, the concept of PA has evolved into Smart Farming that encompasses a holistic application of digital technologies for fine-grained data collection and continuous process planning, optimization, and decision making [7].

Even if digitalization brings innovation to the agricultural industry, it also produces challenges as it brings new competencies, techniques, tools, and professionals to the organizations of this industry. Digitalization impacts agricultural industry organizations affording production with fewer inputs, reduced environmental impacts, efficient transport and logistics, improved product quality, and better customer satisfaction [8]. Digital technologies in agriculture produce information for organizational decision-making [9, 10]. Organizations can aggregate data but often combine agricultural data with public or private data or sensors onboard machines [11]. Therefore, digital technologies can simplify and automate the process and reduce hard labor resulting in improved economic and environmental performance [12]. Digital technologies create innovative, efficient, effective, and economically successful farmers, but they also offer the opportunity to address persistent problems in the agriculture industry. [13]. Digitalization is a driver of organizational change in the agricultural industry [14].

Although many studies define digital technologies and their applications to the industry, few explore how digital technologies generate organizational change and resistance in agricultural organizations. Therefore, we propose to investigate the changes necessary by the agricultural industry to exploit digital technologies and the potential forms of resistance that can arise. This paper aims to contribute towards this direction by exploring the following research questions:

• Which organizational changes produce the digital technologies in the agricultural industry? How do Technologies affect organizational change?
• Which resistance to change can encounter the agricultural industry?

We respond to these questions by presenting the preliminary results of a literature review in this paper. The article is structured as follows: Section 2 presents a theoretical framework about organizational and resistance changes. Section 3 shows the material and method used in the literature review. Section 4 shows the result, and Section 5 discusses the results obtained from the literature review, answering the research questions. Finally, in section 6, we realize the conclusion and identify limits and recommendations for future research.
2 The organizational and resistance changes

Digitalization enables new ways of understanding and addressing the agri-food supply chain problems. Natural resources use productivity improve food safety and enable the collection and interpretation of data collected by industries.

Digitization generates impacts when data collection, value chain, and knowledge creation are interconnected [8].

The digitalization of industries leads to organizational changes and resistance to change. To get a clear view of the concepts of change and resistance, we describe them in a general context below, showing what organizational changes digital technologies can generate and what resistance to change can occur.

2.1 The organizational changes

For many authors, organizational changes are evolutions of human behavior and the penetration of pieces of technologies into the lives of human beings [15]. Digital technologies change organizations, which are constantly evolving, and they only change if they understand what needs to be changed. Changes in industries are primarily incremental, that is, changes that make slight improvements to existing products, services, and processes. In past years, in a general context, incremental organizational changes were tied to improvements in ITC, leading to greater control and coordination of the organization. Now, digital technologies change how an organization operates and require greater collaboration to use them. Collaboration enables the use of digital technologies throughout the organization because they require various sources of knowledge and the incurring of a development cost. Collaboration is a necessary element, which is difficult to achieve. [16], Moreover, it is essential because it identifies problems and needs present in the organization so that technologies specific to the industry can be implemented and used. Collaboration occurs through research programs or projects to innovate the agricultural industry. In agricultural industries, the organization must adapt to a changing environment while maintaining stability in the internal organization [17].

The organization must identify a balance and do this. It is necessary to understand what needs to be changed and what drives change. Thus, organizational changes in agricultural industries include various stages of the digitization process, which begins with replacing analogy technologies and ends with digital data useful for decision making [16]. Several interviewees think digitization could help train younger (independent) advisors and make the profession more attractive. For industries to succeed in change and improve their skills, they must also understand technological requirements, which leads to identifying a new way of communicating.

Digital technologies, such as the cloud or robots, create an agile work environment using virtual teams [18]. To change and apply technologies, the organization needs to have workers with specific skills and knowledge about digital technologies as old skills are obsolete [10]. Therefore, the agricultural industry may hire new employees or retrain existing employees [16]. Employees must follow digital learning, which involves
developing an individual who interacts with others. In some cases, digital learning occurs spontaneously and still prepares workers to solve problems, work collaboratively, and communicate effectively and independently. It is possible to define and plan digital learning, but it depends on spontaneous learning activities.

Competencies are different from skills. Skills are a set of abilities exercised through organizational processes that enable people to coordinate activities and use resources. Skills are demonstrated through typical business activities. Organizations need new skills and investing in employees helps retain them and generate competitive advantage [19]. Digital technologies also lead to the change of jobs within industries. For example, the robot helps the farmer perform work [10].

Digital technologies also change organizational culture, making value more people-centric, collaborative, and agile. Finally, changing organizational practices is one of the most complex because it requires the collaboration of everyone involved [18].

2.2 The resistance to changes

Digitalization is not yet at the core of all industries, and organizations find it difficult to think along these lines. Digitization still offers limited and still developing services for many agricultural industries. Digitization is not applied radically yet. Changes happen gradually and take a long time. Suppose the changes do not occur, attitudes of resistance to change. Digitization involves introducing digital technologies, which generate organizational changes, including a review of workers’ roles and increasing the skills needed for their adoption. In the first case, the adoption of digital technologies leads to a reduction in the number of workers as machines replace employees’ work [20].

Many agricultural industries are difficult to change. Very few industries manage to remain fluid in a changing environment. It is impossible to say that a complete organizational identity change occurs as this is constantly evolving. Such changes are not always possible to implement, mainly because they change the way industries operate. Therefore, industries are resistant to change, as organizations are not interested in using technology, as they prefer to make decisions in the traditional way rather than with the help of digital technologies [16].

Lack of trust and concerns about data transparency in digital technologies are two other causes that hinder their adoption of technology and limit organizational change. In developing countries, farmers do not use digital technologies because they do not have the resources to purchase them. Therefore, farmers join a partnership to access digital technologies even in a small agricultural industry [21]. However, two significant problems arise communication [22], and the second is related to the lack of skills [23]. The problem of communication stems from the exclusion of small enterprises from the partnership [22], on the other hand, the problem of lack of skills affects not only small agricultural industries but also large agricultural industries, the use of digital technologies depends on the lack of background and skills [23]. Skills are another element that distinguishes the possibility of change in an organization. Not all industries are ready to implement change as accelerated change requires workers with the necessary skills
to help organizations overcome challenges [19] and increased dependency during decision-making [8]. The lack of a strategy of the organization is a resistance to change. The change will only occur if the industry has a strategy and the will to change it. Otherwise, it will not be possible to implement the changes [17]. The digitization strategy makes it possible to face challenges, guide the processes of the industries, solve problems, and identify new techniques and skills for the workers.

Organizations often cannot achieve or see improvements in efficiency and effectiveness due to high investments in digital technology. In addition, it will be difficult to change industries that want to maintain a hierarchical organization, as the latter is effective in stable and predictable environments where there is no change [16]. As digital technologies are complex to use, they require new ways of working, moving from experiential decision-making to data-driven processes, generating uncertainty about the costs and impacts of digital technology [24].

3 Methodology

We conduct the literature review following specific theories [25, 26], which identify ways and techniques, and tips to follow to conduct a good review. Through the literature review, we identified information about the concept of smart farming, extracting information needed to conduct our review. The literature review is systematic, which allows us to identify, evaluate, and synthesize the research. We identified research questions, which we could answer through information gathering, extraction, and aggregation. We conducted an iterative search, where we initially looked for information on the topic in general, then identified new themes and concepts that led to extending the initial search.

We use Scopus and Web of Science (WoS) to research materials. We choose these two databases because they are the most important in our field of study and allow us to search by a query. We use a search through the query to properly link topics together but, above all, to obtain an exhaustive search. We formulate a query to research the digital technologies in the agricultural industry. We report the query in the following table.

"Title, keywords, Abstract" is the research criteria. We limited the results to "Articles." We chose only "Journal." Then we identify subject areas like Scopus and WoS. We use in Scopus: "agriculture and Biological Sciences," "Social Sciences," and "Business, Management, and Accounting." We use these research areas in WoS: "Agriculture," "Business Economics," and "Social Sciences topics."

We select only English articles and perform the research from the 1st of January 2021 to the 15th of February 2021.

We read the obtained articles and tried to select only the most relevant research, excluding those that would not add value to the research. We read the abstracts of all the articles found and selected only the most relevant, excluding duplicates found. Next, we read the selected articles thoroughly and removed those that would not benefit the search. The articles we obtained are likely to satisfy our search. While reading the articles, a forward and backward search identified articles important for our analysis. For
writing the paper, we consider the articles from the last ten years, but for having a clearer vision of topics, we read all articles since 2000. We chose to select only this time frame because the concept of Smart Farming was born in recent years, and therefore in the past years, we would not have found helpful information for research.

Based on the information identified from the articles, we created a conceptual matrix, which encompasses the main concepts that characterize intelligent agriculture. We reported the review process in the table below.

<table>
<thead>
<tr>
<th>Phases</th>
<th>Description of actions</th>
<th>N° of Articles</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>((agriculture farm) AND (&quot;agriculture 4.0&quot; OR &quot;industry 4.0&quot; OR &quot;digital farm*&quot; OR &quot;Digital agricultural&quot; OR &quot;smart farm*&quot; OR &quot;Smart agriculture&quot; OR &quot;precision farm*&quot; OR &quot;precision agriculture&quot;) AND (digital* OR &quot;ITC&quot; OR &quot;digital* information technology&quot;)).</td>
<td>85 Scopus 91 WoS</td>
</tr>
<tr>
<td>2</td>
<td>Duplicates articles</td>
<td>42</td>
</tr>
<tr>
<td>3</td>
<td>The final number of articles from the literature search</td>
<td>13</td>
</tr>
<tr>
<td>4</td>
<td>Abstract read selection</td>
<td>46</td>
</tr>
<tr>
<td>5</td>
<td>Full-text read selection</td>
<td>37</td>
</tr>
<tr>
<td>6</td>
<td>Relevant article cited</td>
<td>11</td>
</tr>
<tr>
<td>7</td>
<td>Total number of articles in the literature review</td>
<td>48</td>
</tr>
</tbody>
</table>

Through literature review, we identify 48 articles and analyze these. We note that the study regarding smart farming and digital technologies is growing with the number of publications in 2020 (Figure 1).

![Fig. 1. Number of publications for years](Image)

4 Smart Farming and Digital Technologies

This section discusses the literature review on the concepts of smart farming and digital technologies used. Together, we present the concepts for our study.
Table 2 below defines the main topics obtained from the literature review. The topic identified is Smart Farming, Digital Technology, Organization, Innovation, Sustainability, and Digitalisation. From the table, we notice that all topics have relevance within the conducted review and that all concepts have important numerosity in the research. We have listed the authors that deal with one or more topics for each topic to have a complete view. We have indicated the number of contributions for each topic, and based on this numerosity, we have ordered the following Table 2.

Table 2. Main topics from literature review

<table>
<thead>
<tr>
<th>Topic</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Innovation (22 papers)</td>
<td>Ingram et Maye, 2020[6]; Michels et al., 2020[7]; Jakku et al., 2020[27]; Relf-Eckstein et al., 2019[13]; Krieger et al., 2019[15]; Snow et al., 2017[17]; Rijswijk et al., 2019[16]; Eastwood et al., 2017[24]; Wolfert et al., 2017[36]; Ayre et al., 2019[29]; Munz et al., 2020[37]; Regan 2019, [30]; Sarker et al., 2020 [38]; Kernecker et al., 2020 [39]; Shang et al., 2021[40]; Kernecker et al., 2021[39]; Janc et al., 2019 [41]; Rotz et al., 2019[31]; Bellon-Maurel et al., 2017[33]; Klerkx et Rose, 2020[34]; Fresco e Ferrari, 2018[42]; Bucci et al., 2018[43].</td>
</tr>
<tr>
<td>Digitalization (12 papers)</td>
<td>Ingram et Maye, 2020[6]; Michels et al., 2020 [7]; Shepherd et al., 2020 [8]; Sousa et Rocha, 2019 [19]; Rijswijk et</td>
</tr>
</tbody>
</table>
Based on the main topic identified in the literature, we decided to analyze the concepts of smart farming and digital technologies. We define the smart farming concept, identify definitions and characteristics, and list a series of digital technologies used in smart farming. These concepts allow the answer to research questions.

### 4.1 The concept of Smart Farming

Agricultural industries over the years have undertaken progress using ICT, which has promoted changes and developments in the agricultural industry becoming digitized. The activities of agricultural industries become interconnected, and it is possible due to several factors, such as the level of education and the characteristics of the agricultural industry. The change process began in the late 1980s and early 1990s, when the concept of precision agriculture began to develop, bringing organizational, productive, and technological change to agricultural industries that had focused primarily on the family until then farming [41]. Precision agriculture, unlike smart farming, considered the variability in the field, with digital technologies, in addition to the location, acquire information, even in real-time, to make informed decisions [11].

The digitization of agricultural industries is a revolution because it tends to change the way businesses work, especially changes in the roles and skills that farmers must have [46]. Smart farming involves the use of digital technologies. This last involves managing the farm through collected data to improve the context and awareness of the industry. Capturing data in real-time allows for the resolution of any that may arise, but more importantly, digital technologies allow for the identification and resolution of problems instantly [14].

Smart farming is the application of digital technologies in agriculture, and it is also called digital agriculture, e-agriculture, precision agriculture, agriculture 4.0 [28], and digital farming and precision farming [12]. Shepherd et al. [8] define smart farming as "the use of detailed digital information on decisions along with the agriculture value chain." Academics define smart farming as "a development that emphasizes the use of digitalization and communication technology in the cyber-physical farm management cycle" [36]. Ayre et al. [29] define smart farming as "the use of information and communication technologies (ICT) to identify, monitor, analyze and represent spatial characteristics of agricultural production in digital formats (such as digital data and devices)." For other academics, smart farming is a knowledge-based approach where machines autonomous decisions in collaboration with the management system [37].
Therefore, according to our definition, smart farming involves the application of digital technologies the agricultural industry to collect large amounts of data to be used in processes decision-making ones, to improve profitability and agricultural production.

Smart farming brings about a radical change in efficiency, activity, and sustainability in the agricultural industry and production chain [6], and it involves various stakeholders such as the agricultural industry, farmers, universities, and public institution.

Smart farming uses data and software to transform agriculture, and it uses digital technologies such as cloud computing, sensors, the Internet of Things (IoT), and fast internet [44]. According to Ayre et al. [29], smart farming aims to support the entire decision-making, and it is an innovative challenge for farmers and agriculture consultants.

Smart farming uses certain digital technologies to integrate knowledge and use them in decision-making and the supply chain. Farm management becomes optimized, customized, real-time, hyper-connected, and data-based, indeed it achieves precision processes, optimizes and plans using real-time data, and automatically analyses data[51].

4.2 Digital technologies in Smart Farming

Digital technologies used in smart farming are as follows. Drones, also called unmanned aerial vehicles (UAV), are a digital technology used in agriculture to help farmers collect data. Drones can monitor and collect data to reduce search costs and increase data retrieval through time and space resolution. One of the aims is to assess the crops and identify damages by pesticides [44]. Nowadays, drones are integrated with machine learning platforms, such as sensors, and can collect data in real-time to influence decision-making [8].

Internet of Things (IoT) is a set of technologies that can integrate real and digital things. The IoT is a network system of physical objects that incorporates pieces of technology, and the latter allows a network of objects or interacts with the internal environment or their internal state. The IoT allows people, animals, and objects equipped with identifiers to transmit data over the internet without the aid of humans [43]. IoT has a physical entity with digital counterparts, which receives, communicates, and interacts with its digital counterpart to exchange data, information, and pieces of knowledge [23].

Sensors are digital technologies used to collect animals, soil, and water monitoring data. These technologies integrate drones or machinery and provide raw data [6].

Big data is a technology that identifies an extensive set of data and requires techniques and technologies integrated with new tools to reveal information from different, complex, and extensive data sets [36].

Cloud is a technology for data storage and processing and comprises a set of IT resources and services that communicate through Web technologies. The cloud works with an internet connection.

Analytics is data analysis available in the agricultural industry and uses descriptive and diagnostic analysis to showcase the actions and why they occur. In the future, the analysis will become predictive and prescriptive. The agricultural industry will try to make future forecasts [8].
Robotics is a technology that replaces farmers' jobs with cost savings and removes unnecessary activities.

Blockchain "is an incorruptible electronic ledger that can track each transaction of a food item's journey through the food chain." Blockchain is a digital technology that tracks each transaction along the supply chain and shows consumers the product's origin [8].

ICT enables the exchange of information, comparing production with other farmers, and definition cooperation [6, 36]. ICT may cause an indirect cease in production or reductions in agriculture costs, improve farmers' access to data and information, and use it for management [7]. ICT improves and increases productivity and efficiency and contributes to sustainable development [38]. Among these is mobile internet, a piece of digital technology that allows access to the internet with the mobile device and implements smart farming [18]. In addition, ICTs are linked to software to collect and show data to farmers to make informed decisions [29]. Digital devices can repeat or replace some cheap digital technologies at a low cost, for instance: calculations for all forms in agriculture, crop diseases detection, plant diagnosis, fertilizer calculation, access to market data, prices, scouting geo-referencing, and documentation [7].

5 Discussion

The digitalization of the agricultural industry improves the way farmers work and involves the transformation and use of digital technologies in the agricultural industry to improve the way farmers work, and it involves the transformation and use of digital technologies [33]. The literature review shows that the concept of smart agriculture has been growing in recent years because agricultural industries introduce innovations in their organization. Digitalization in the agricultural industry must be efficient, effective, solve problems, and produce success to generate incremental changes in all processes, especially in agricultural industries [31].

Smart agriculture uses digital technologies, such as sensors, to collect data and IoT to monitor and control farming activity remotely, in real-time and limiting field presence and direct observation. Digital technologies advise farmers on how to improve their performance and activities [52], but their adoption is not a short-term commitment as it requires changes in input use and farm management [40].

The concept of smart agriculture represents the agricultural industry's future because of the application of digital technologies, which generate changes within the organization. Several authors suggest that the changes come from the evolution of human behavior and digital technologies in the agricultural industry [13] although not all agricultural industries decide to use digital technologies due to their limitations [16]. Therefore, in Table 3 below, we list the main limitations that hinder agricultural industries' adoption of digital technologies. The literature review identifies each limitation in the table, and we associate it with each related author. The table aims to identify the limitations and show that the authors share these limitations more importantly.
Table 3. Limits of digital technologies

<table>
<thead>
<tr>
<th>Limits</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transparency of data</td>
<td>Shepherd et al., 2020 [8]; Van der Burg et al., 2020 [10]; Relf-Eckstein et al., 2019 [13]; Rijswijk et al., 2019 [16]; Newton et al., 2020 [28]; Regan 2019, [30].</td>
</tr>
<tr>
<td>Complexity</td>
<td>Ingram et Maye, 2021 [6]; Knierim et al, 2019, [15]; Newton et al., 2020 [28].</td>
</tr>
<tr>
<td>Lack of user involvement in technology design</td>
<td>Knierim et al, 2019 [15]; Rijswijk et al., 2019 [16]; Hedley , 2015 [51].</td>
</tr>
<tr>
<td>Ethics-social problems</td>
<td>Ingram et Maye, 2021 [6]; Shepherd et al., 2020 [8]; Relf-Eckstein et al., 2019 [13]; Rijswijk et al., 2019 [16]; Eastwood et al., 2017 [24]; Newton et al., 2020 [28].</td>
</tr>
<tr>
<td>Lack of loyalty</td>
<td>Shepherd et al., 2020 [8]; Van der Burg et al., 2020 [10].</td>
</tr>
<tr>
<td>High investment cost</td>
<td>Shepherd et al., 2020 [8]; Knierim et al, 2019, [15]; Kernecker et al, 2021[45]; Rotz et al., 2019 [31].</td>
</tr>
</tbody>
</table>

We divided them into two different groups to get a more detailed view of the identified limits. The limitations identified and our knowledge of theory led to the creation of the table. We divide the limits into two groups. In the first group, there is data transparency, complexity, and lack of user involvement in the design of the technology. There are social-ethical issues, high investment costs, and a lack of loyalty in the second group. The first group includes limitations related to the technological factor that characterizes the research objective. We find the social and ethical aspects that characterize the agricultural industries in the second group. The limitations identified through the literature review are fundamental because they limit the application of digital technologies in agricultural industries. Digital technologies can help overcome limitations. For instance, complexity and technology design are two relevant limitations because complexity stems from the lack of farmer experience using digital technologies.

Conversely, not involving end-users in developing technologies may limit their use due to implementation difficulties. These two limitations are interconnected because if the farmer has not had enough skills, he/she will not be able to use the digital technologies developed. For this reason, it is essential to find solutions to these problems, such as training courses for farmers or having competent staff on farms. Digital technologies also have a significant impact on agricultural industries. Table 4 identifies the impacts of digital technologies in the agricultural industry, and again, in table 4, we find the impacts identified in the literature review and associated with the respective authors.

Table 4. Impacts of digital technologies

<table>
<thead>
<tr>
<th>Impacts</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increase productivity</td>
<td>Michels et al., 2020[7]; Khanna M., 2020 [11]; Groher et al., 2020 [12]; Wolfert et al., 2017, [36]; Regan 2019, [30].</td>
</tr>
</tbody>
</table>
We divide the identified impacts into two different groups for better understanding. We collected all the impacts identified through the literature review in the first group, excluding "Environmental Sustainability," included in the second group. These two groups have differences because the first one is about the management of agricultural industries and changes, while the second one is about the environmental impacts that digital technologies can generate. There is an increase in productivity, change in society, agribusiness, agriculture, and rural communities in the first group: improved business management and process optimization. In the second group, there is the environmental impact.

The first group, the most numerous, identifies the significant impacts that digital technologies can create. Because digital technologies are helpful tools for industry, they are interrelated impacts. A more detailed view of the impacts will allow it to analyze their presence in the agricultural context and further constraints related to them. Environmental impacts are the only ones derived from the literature regarding the second group. Additional impacts in the social and economic spheres will need to be identified to get a detailed view and expand the group to the entire concept of sustainability. Based on the impacts generated by digital technologies in the agricultural sector, we try to answer the proposed research questions. Regarding the first research question, we can see that agricultural industries are changing the way they work by applying digital technologies.

According to [16], changes in agricultural industries concern the skills and practices farmers must have to use digital technologies. Farmers are the leading players in agricultural industries, and they are the first ones who need to change. Change the change only farmers but also the agricultural industry, employees, and farm advisors, and change can occur in various ways. For example, improving the customer experience, streamlining processes with cloud computing or robots, developing digital services, using data, and creating a comfortable work environment [41].

Individual or team skills are among the most significant changes; in fact, the effectiveness of digital technologies depends on the level of education, characteristics of the agricultural sector, and knowledge networks. Digital technologies make it possible to combine various forms of knowledge possessed by several people, resulting in new

<table>
<thead>
<tr>
<th>Impacts</th>
<th>References</th>
</tr>
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<tbody>
<tr>
<td>Changes in society, agricultural industry, and rural communities</td>
<td>Van der Burg et al., 2020 [10]; Wolfert et al., 2017, [36]; Ayre et al., 2019 [29]; Munz et al., 2020, [37]; Sarker et al., 2020 [38]; Tsolakis et al., 2019 [32].</td>
</tr>
<tr>
<td>Improve farm management</td>
<td>Ingram et Maye, 2021 [6]; Michels et al., 2020 [7]; Khanna M., 2020 [11]; Munz et al., 2020 [37]; Kernecker et al., 2020 [45].</td>
</tr>
<tr>
<td>Optimize process</td>
<td>Ingram et Maye, 2021 [6]; Michels et al., 2020 [7]; Khanna M., 2020 [11]; Munz et al., 2020 [37]; Kernecker et al., 2020 [39].</td>
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</table>
operational methods adopted in the agricultural industry [31] that explain the differences in productivity present between industries [48]. The changes could significantly impact the culture of the agricultural industry and what it means to be a farmer [12].

Digital technologies only change the organization if farmers accept them in the agricultural industry [31]. The acceptance of digital technologies is also because of the role played by farm advisors, who mediate between farmers, additional information sources, skills, and digital technologies. Farm advisors can cope with the difficulties arising from smart agriculture, as digital technologies represent a departure from usual practices. Finally, the collaboration between individuals and the public is also considered important in addressing the challenge of digital agriculture [29].

We now respond to the second research question, identifying the primary resistances to change that we can find when the agricultural industry adopts digital technologies.

Organizational changes are not always possible because many agricultural industries resist change. As we see from the literature, digital technology changes decision-making, leading to uncertainty about the costs and impacts of digital technology. Digital technologies are developed and provided by private industries, and the organization has uncertainties about their implementation. It is essential to have support structures that can facilitate learning and reduce uncertainty in the implementation and adaptation process. Problems arise because they do not adopt digital technologies introduced to the context and logic of those who are supposed to use them [14, 27].

Farmers do not change their business because they consider digital technologies complex to use, even for lack of skills [51]. Digital technologies must be user-friendly through the integration of farmers into the creation process [23].

Farmers decide not to use digital technologies due to the high cost, especially for small agricultural industries [27]. The investment cost, complexity, perception of digital technologies, and farmers’ mindset are difficult to achieve and change [13].

Implementing a change also requires changing the strategy of the agricultural industry, and without it, resistance arises. The literature notes that the organization only changes if it changes its strategy; otherwise, there can be no organizational change but resistance [16, 28].

We could answer the second question by identifying the primary resistances to change caused by digital technologies in the agricultural industry.

6 Conclusion

Digitalization in the agricultural industry is a progress that will lead to improvements in all farms that decide to implement smart agriculture. For now, smart agriculture is still in its infancy, and few agricultural industries are adopting digital technologies in their processes. The application of digital technologies changes the way farmers operate and beyond, generating changes throughout the organization. The changes depend on the significant impacts of digital technologies, such as increased productivity, reduced environmental impact, and streamlined decision-making. Agricultural industries must leverage the impacts of digital technologies to generate change in the organization and initiate a digitalization process. This research aims to identify the main organizational
changes and resistances digital technologies bring to agricultural industries. The results show that the main changes relate to farmers' skills, decision-making, and farm management. In addition to the changes, the research identifies resistances to change, which may occur because the agricultural industry has not had enough skills, does not want to change its strategy, or because digital technologies are incompatible with their business. The research has limitations; we have only taken a preliminary view of the organizational changes and resistances without investigating them in detail. We have not analyzed it. We have not analyzed every change or resistance in detail, but we have focused only on extrapolating the main reasons from the literature. To have a clear picture of organizational change and resistance, more studies, not only theoretical but also exploratory, will be needed not only to understand changes and resistance but also to clarify whether the industry adopts digital technologies, whether it has started a digitization process, what digital technologies it uses and what are the impacts of these digital technologies. Based on what we have said, we need more information about the organization; we need to compare traditional agricultural industries with new agricultural industries to understand the impact of digitization. Future research needs to look more closely at the changes and resistances that each digital technology can bring to agricultural businesses.

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