International Journal of Innovation

e-ISSN: 2318-9975
https://doi.org/10.5585/2023.24034
Received: 08 Mar. 2023 - **Approved:** 17 Mayo 2023

Evaluation Process: Double Blind Review
Editor in Chief: Priscila Rezende da Costa
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LEAN THINKING IN VALUE CO-CREATION:A BASIS FOR INNOVATION IN AGROINDUSTRIAL SECTOR

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Cite as – American Psychological Association (APA)

Bonamigo, A., Corrêa, A. G. A., Oliveira, G. S C., Silva, P. V. A. C., & Andrade, H. S. (2023, Sept./Dec.). Lean thinking in value co-creation: a basis for innovation in agroindustrial sector. *International Journal of Innovation - IJI*, São Paulo, *11*(3), 1-38, e24034. https://doi.org/10.5585/2023.24034

Abstract

Objective: The goal of this paper is to identify both the opportunities and barriers to adopting Lean Thinking for value co-creation in agro-industrial services.
Design/methodology/approach: This research paper comprises a methodical review of the literature on value co-creation in agro-industrial services, with a specific focus on Lean Thinking. The authors utilized Bardin's (2011) content analysis approach to examine the resulting portfolio and derive insights into the prospects and challenges of implementing Lean Thinking in value co-creation within the agro-industrial services sector.
Findings: The opportunities and barriers for the adoption of Lean Thinking in value co-creation in agro-industrial services were identified by the authors, who also proposed ways to overcome the obstacles. In total, five opportunities and five barriers were recognized.
Originality: This study represents a novel effort in identifying the opportunities and barriers of implementing Lean Thinking in value co-creation for agro-industrial services. The findings may guide decision-making processes and strategic actions aimed at enhancing the agro-industrial market.
Practical implications: The identified opportunities and barriers can provide a foundation for guiding strategies that direct agribusiness players in making informed decisions, while also mitigating waste through collaborative efforts among multiple companies. It can also guide players towards value aggregation in their products and/or processes by promoting co-created services among players, in line with the principles of Lean Thinking.
Social implications: Efficient value co-creation in agro-industrial services can result in improved well-being, convenience, and service offerings for society. It can also add value to products through services and create more employment opportunities in the agro-industrial sector.

Keywords: Lean agribusiness; Value co-creation; Cooperation B2B; Lean Thinking.

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LEAN THINKING NA COCRIAÇÃO DE VALOR: UMA BASE PARA A INOVAÇÃO NO SETOR AGROINDUSTRIAL

Resumo

Objetivo: O objetivo deste artigo é identificar oportunidades e barreiras para a adoção do Lean Thinking para a cocriação de valor em serviços agroindustriais.
Método: Este trabalho de pesquisa compreende uma revisão metódica da literatura sobre cocriação de valor em serviços agroindustriais, com foco específico no Lean Thinking. Os autores utilizaram a abordagem de análise de conteúdo de Bardin (2011) para examinar o portfólio resultante e obter insights sobre as perspectivas e desafios da implementação do Lean Thinking na cocriação de valor no setor de serviços agroindustriais.
Resultados: As oportunidades e barreiras para a adoção do pensamento Lean na cocriação de valor em serviços agroindustriais foram identificadas pelos autores, que também propuseram caminhos para superar os obstáculos. No total, foram reconhecidas cinco oportunidades e cinco barreiras.
Originalidade: Este estudo representa um esforço inovador na identificação das oportunidades e barreiras da implementação do Lean Thinking na cocriação de valor para serviços agroindustriais. Os achados podem orientar processos decisórios e ações estratégicas voltadas para o fortalecimento do mercado agroindustrial.
Implicações práticas: As oportunidades e barreiras identificadas podem fornecer uma base para orientar estratégias que direcionem os atores do agronegócio na tomada de decisões informadas, além de mitigar o desperdício por meio de esforços colaborativos entre várias empresas. Também pode orientar os players para a agregação de valor em seus produtos e/ou processos, promovendo serviços cocriados entre os players, alinhados aos princípios do Lean Thinking.
Implicações sociais: A cocriação eficiente de valor em serviços agroindustriais pode resultar em maior bem-estar, comodidade e oferta de serviços para a sociedade. Também pode agregar valor aos produtos por meio de serviços e criar mais oportunidades de emprego no setor agroindustrial.

Palavras-chave: Agronegócio enxuto; Cocriação de valor; Cooperação B2B; Pensamento Enxuto.

PENSAMIENTO LEAN EN LA CO-CREACIÓN DE VALOR: BASE PARA LA INNOVACIÓN EN EL SECTOR AGROINDUSTRIAL

Resumen

Propósito: El objetivo de este artículo es identificar oportunidades y barreras para la adopción de Lean Thinking para la co-creación de valor en los servicios agroindustriales.
Método: Este trabajo de investigación comprende una revisión metódica de la literatura sobre co-creación de valor en los servicios agroindustriales, con un enfoque específico en el Pensamiento Lean. Los autores utilizaron el enfoque de análisis de contenido de Bardin (2011) para examinar la cartera resultante y obtener información sobre las perspectivas y los desafíos de implementar Lean Thinking en la creación conjunta de valor en el sector de servicios agroindustriales.
Resultados: Las oportunidades y barreras para la adopción del pensamiento Lean en la co-creación de valor en los servicios agroindustriales fueron identificadas por los autores, quienes también propusieron formas de superar los obstáculos. En total, se reconocieron cinco oportunidades y cinco barreras.
Originalidad: Este estudio representa un esfuerzo innovador para identificar oportunidades y barreras para implementar Lean Thinking en la co-creación de valor para los servicios agroindustriales. Los hallazgos pueden orientar procesos de toma de decisiones y acciones estratégicas encaminadas al fortalecimiento del mercado agroindustrial.
Implicaciones prácticas: Las oportunidades y barreras identificadas pueden proporcionar una base para orientar estrategias que guíen a los actores de la agroindustria en la toma de decisiones informadas, además de mitigar el desperdicio a través de esfuerzos colaborativos entre varias empresas. También puede guiar a los jugadores para que agreguen valor a sus productos y/o procesos, promoviendo servicios co-creados entre los jugadores, en línea con los principios de Lean Thinking .

Implicaciones sociales: La co-creación eficiente de valor en los servicios agroindustriales puede redundar en mayor bienestar, comodidad y prestación de servicios para la sociedad. También puede agregar valor a los productos a través de los servicios y crear más oportunidades de empleo en el sector agroindustrial.

Palabras clave: Agroindustria Lean; Co-creación de valor; Cooperación B2B; Pensamiento esbelto.

1 INTRODUCTION

Lean Thinking implementation relies on identifying customer value, mapping the value stream, eliminating waste, establishing a pull flow, and pursuing perfection (Garnett et al., 1998; Thangarajoo and Smith, 2015; Ferenhof et al., 2018). These principles have been applied in the primary sector's services, resulting in business development opportunities for agro-industrial actors (Brown, 1994; Boyt and Harvey, 1997). It has also been an excellent opportunity for agro-industrial actors to develop their businesses (Núñez, 2020).

Lean principles can increase the value of the outcomes through quality improvement, reduce lead time, eliminate waste, enhance competitiveness, and mitigate product fragility risks (Villarreal et al., 2017; Dora et al., 2015; Bonamigo et al., 2022). Lean Thinking is considered by some authors as a philosophy in which the actors seek to change their thinking in search of adherence to Lean principles, identifying value, eliminating waste in the process, establishing a flow without wasting time, producing according to the market demand, and seeking for continuous improvement of their business processes, thus allowing them to achieve the good results mentioned in the above excerpt (Womack and Jones, 1996).

Agribusiness significantly contributes to the global economy, providing employment opportunities and income for a significant portion of the world's population (Kruja, 2020; Savić et al., 2020; Brenes et al., 2020; Satolo et al., 2017). However, inadequate management, limited access to technology, and low competitiveness in some countries pose challenges to the sector's development and sustainability, leading to a decreasing share in those countries' GDP, consequently limiting their sustainable development (Keshelashvili, 2018; Beierlein et al., 2013). One way of crossing some of the challenges that the agribusiness faces is through implementing Lean Agribusiness (Satolo et al., 2016), which in this paper is defined as the set of Lean Thinking principles applied to the agribusiness.

In addition, cooperation among farmers and stakeholders is another strategy to provide viable financial opportunities and business continuity for actors in the agricultural sector (West et al., 2018, Handayati et al., 2015, Dolinska and d'Aquino, 2016, Saucier et al., 2016, Poláková

et al., 2015, Minh and Hjortsø, 2015; Bonamigo, 2017). Such collaborations can offer benefits such as access to information and techniques, sharing of physical resources, new markets, reduced production costs, creation of new products, and optimization of economic gains that would otherwise decrease without cooperation (dos Santos et al., 2018, Ferenhof et al., 2019, Prakash et al., 2017, Lambert and Enz, 2012, Bonamigo et al., 2022).

In this sense, the interaction among agricultural actors should not be limited to resource exchange: it should seek to create new values through value co-creation (Bonamigo et al., 2020a, West et al., 2018). Value co-creation is a form of cooperation that aims to generate mutual benefits for the parties involved, the customer and supplier (Skjølsvik, 2016; Kohtamäki and Rajala, 2016). The benefits of value co-creation include improved offerings, trust, brand value, risk sharing, innovation, and knowledge sharing (Zacchi et al., 2017; Franklin and Marshall, 2019).

However, even though Lean Thinking can help in the optimal usage of resources before investing in new technologies (Junior and Pinto, 2020), there are yet challenges to its application (Satolo et al., 2020). Value co-creation can help in the Lean application beyond the benefits obtained from this strategy. The exchange between suppliers and customers can help to achieve lean goals, increase efficiency, productivity and improve employee and machine performance (de Aro, 2016; Poláková et al., 2015; Clarysse et al., 2014; Trienekens, 2011; Poppendieck, 2011; Shrivastava et al., 2015).

Although beneficial to the agribusiness environment, there is a lack of cooperation among its players in such a context (Enz and Lambert, 2012, Roser et al., 2013, Chowdhury et al., 2016, Schwetschke and Durugbo, 2018). Along with co-creation, Lean Thinking in agribusiness is still an under-researched theme in academia, with Jasti and Kodali (2014) finding that only 2.8% of Lean Thinking research covered agribusiness.

Nonetheless, Lean Thinking is a concept consolidated in some areas of the economy, such as manufacturing, supply chain, construction, etc, but in agriculture is an emergent approach to stimulate innovation, mitigate waste, and improve the experience for the consumers and clients (Borota et al., 2023). But, to improve the agribusiness sector, cooperation among the players is crucial for the development of the agriculture chain (Michel et al., 2008; Bonamigo et al., 2022; Bonamigo et al., 2023), and Lean Thinking can be a strategy for achieving improvement in continuous performance in agro-industrial systems (Ahmed et al., 2021).

Based on the exposure, this study aims to identify the opportunities and barriers to adopting Lean Thinking for value co-creation in agro-industrial services. Through our finds,

we hope to provide practical recommendations to decision-makers based on successful characteristics of Lean implementation in the agro-industrial sector (Bonamigo, 2017; Bonamigo et al., 2020). By doing so, this research can help to promote growth in the agribusiness sector by addressing this relevant research gap.

To achieve the study's goal of identifying obstacles and opportunities for applying Lean Thinking in agro-industrial services for value co-creation, we reviewed the literature finding the five main barriers and five opportunities. The barriers, listed in order of frequency, are the lack of incentives, industry characteristics, resistance to change, limited knowledge about Lean Thinking, and the complexity of agro-product fabrication. Conversely, the opportunities include increasing productivity through cooperativism, adopting new technologies, improving productivity, strengthening public policies, and enhancing profitability. By recognizing these elements from the literature, we aim to encourage cooperation among agribusiness players.

2 Theoretical reference frameworks

2.1 Lean Agribusiness

Womack and Jones (1996) define Lean Thinking as a way to specify the value, line up value-creating actions in the best sequence, conduct these activities without interruption whenever someone requests them, and perform them more and more effectively. Thus, Lean Thinking is a way of generating value in the agribusiness context and represents a competitive differential (Gobinath et al., 2015, Hakimi et al., 2018). Furthermore, specific research is crucial to attaining success in lean implementation (Manzouri et al., 2013).

Aguiar et al. (2020) consider that some farmers have already applied some Lean principles without training or standardization in an attempt to grant that every produced item is going to be sold, reducing risks, and waste. In this sense, many opportunities and barriers are identified to implement Lean Thinking in value co-creation in the agribusiness sector.

To achieve innovation in management and production processes, a consistent link with continuous improvement practices must be established (Satolo et al., 2017). Therefore, to stay competitive, agribusiness organizations need to improve their process management and their means of production through practices and strategies aimed at the continuous improvement of products, processes, and services (Ortega and Valencia, 2014, Zokaei and Simons, 2006, Powell et al., 2017, Ussuna, 2019).

Based on that premise and considering the principles of waste reduction, Liker (2016) and Van-Beers et al. (2022) define Lean as a model that aims to reduce the time between customer order and product delivery by eliminating waste and continuously improving the production system, establishing value through the customer's perspective. In this perspective, Machado et al. (2013) applied Lean principles in the soybean production chain, considering the many stages connected by logistic operations (production, distribution, and marketing). The opportunities for improvement impacted the various links of the production chain. Furthermore, Nielsen and Pejstrup (2018) exposed the Lean application in multiple types of farms, including crops, pigs, and dairy cattle. Through this exposure, it was possible to characterize the potential contributions in different scenarios of agribusiness.

Gunderson et al. (2014) and Behzadi et al. (2018) state that the competitive environment of agribusiness is different from other sectors, as it directly deals with raw materials with a shorter shelf life and seasonality, affecting demand and consumption. Therefore, this creates an imbalance in the social, economic, and environmental dimensions of agribusiness.

Forrester et al. (2010) indicate that Lean concepts, practices, and applications in business processes and industry sectors have grown and evolved since 1990 and are now generally accepted as the "best practice" for management manufacturing in developed industries. Hartini et al., (2020) affirm that lean manufacturing is a tool that continuously improves the business, bringing solutions so that industries can consider environmental, economic, and social aspects.

Therefore, the management based on eliminating waste proposed by the Lean Production System (LPS) can play an important role, especially by mitigating the effects intrinsic to the agro-industrial system (Satolo et al., 2017).

So, in agribusiness, Lean presents itself as an alternative to eliminate inefficiencies related to management, including waste control, inventory administration, development of new services, and generating benefits for customers linked to the agro-industrial system (Satolo et al., 2017, Gobinath et al., 2015, Aguiar et al., 2020, Mittal et al., 2016, Muñoz-Villamizar et al., 2019, Praharsi et al., 2021).

2.2 Agro-industrial services

According to Paulillo (1996) and Nurmaganbetova et al. (2019), the agro-industrial service is characterized by the mechanization of various steps of the production process, the adoption of modern inputs, the standardization of certain crops, and the advances of IT in the

field. These changes brought new forms of work organization and management, which provided shifts in the social order, work relations, and the families' behavior towards the agro-industrial economy.

Since the agroindustry compounds a set of activities related to the transformation of raw materials into products that are mainly intended for the production of food to the final consumer, the agroindustry deals with adding value to its products from other segments such as slaughterhouses, dairy products, biofuels (Silva, 2021).

From this perspective, the management of information on products, processes, and technologies is fundamental in the context of agro-industrial services, as well as enabling training for modernity, technology, productivity, and competitiveness based on the service economy (Gontow, 1997, Carvalho et al., 2012, Torres and Lima, 2012). However, the lack of appropriate management in the supply chain represents a problem while improving the agricultural sector informatization and mechanization process (Liu et al., 2020).

To Shanoyan and Briggerman (2014b) the improvement of agro-industrial products and services is linked to creating farmer cooperatives, as it allows players to achieve new markets and sharing risks. However, some small agro-industrial companies prefer to manage their business alone due to the lack of trust in other organizations, possible changes in legislation, and the many requirements that hinder the development of these companies (Mishina, 2020).

The cooperatives' ability of risk mitigation is gradually becoming a crucial aspect of their value proposition to their partners. As a result, modern cooperatives are continually looking for new ways to help producers in assertive decision-making, improvement in management techniques, and risk analysis, among other services. Thus, it results in higher profits and enables the agro-industrial players to produce with fewer resources (Shanoyan and Briggeman, 2014b, Zanin et al. 2020).

In the Brazilian agro-industrial scenario, family labor predominates. Characterized as the weakest link in the chain, it lacks technical support, knowledge, resources, and policies based on equity and social inclusion (Carneiro and Maluf, 2005). Through this lens, Paulillo (1996) noted the citrus sector as an example: the growing participation of rural labor cooperatives and agro-industrial outsourcing reveals the importance of changes in production management and the work process. In addition, the Lean implementation helps these producers to reach some of the changes that these organizations need, while results show that this methodology is adaptable to organizations of every size (Panayiotou and Stergiou, 2020).

2.3 Value co-creation in agro-industrial services

Value co-creation can be defined as the practice of developing systems, products, or services through collaboration with customers, managers, employees, and other stakeholders (Ramaswamy, 2011), assuming that customers and suppliers work together to improve a product or service (Silva et al., 2015), serving as a method to increase value (Michel et al., 2008; Bonamigo et al., 2022) for customers and service companies (Michel et al., 2008; Bonamigo et al., 2022).

The value co-creation proposes that customers and companies work together to create value in a collaborative relationship. According to Ballantyne and Varey (2006), value co-creation requires a direct, two-way interaction between customers and suppliers. Vargo and Lusch (2010) argue that in the service ecosystem, many economic actors interact through institutions, technologies, and languages to co-produce service offerings, engage in mutual service provision, and co-create value. For Terblanche (2014) customers become co-creators of value with suppliers when the concept of value-in-use is utilized. Thus, the value-in-use is how the customer assesses the service and its usefulness (Macdonald et al., 2011).

For Handayati et al. (2015), the value-creation process focuses on individuals and their co-creation experiences. In other words, the company must pay attention to the quality of its products and processes and to the co-creation experience. This means that the quality that a company delivers depends on the interactions between the company and customers by which they focus on the ability to create a variety of experiences and access the information, and knowledge among the partners that together cooperate (Aarikka-Stenroos and Jaakkola, 2012). However, the absence of factors that facilitate value co-creation might hinder its gains for the involved organizations. De Aro and Perez (2016) point out the barriers observed by managers regarding value co-creation like the failure in exchanging knowledge and capabilities, as well as a weak manner of analyzing together the indicators of the partnership.

Some facilities might be useful to overcome such barriers. One such example highlighted by Mansano and Pereira (2016) are business incubators mediated between the academia and the productive sector, which facilitated the knowledge transfer and spread of technological innovation throughout the business environment.

Currently, the consumer's behavior toward agricultural products changes to add more ethical considerations to their purchasing decisions. The question that arises is how the traditional way can efficiently interact with increasingly sophisticated food consumers (Handayati et al., 2015). In this sense, Troccoli and Altaf (2012) point out that in the agro-

industrial sector, it is no longer enough to propose a product or service that meets the perceived customer's needs, as their desires go beyond institutional aspects, that is, they agglomerate social, psychological, environmental, political and technological factors that ultimately define the consumption decision. Thus, the value co-creation among the multiple players that make up the agro-industrial ecosystem becomes a way to promote social, economic, and environmental development (Assis, 2006).

Therefore, value co-creation is a beneficial activity among its players (Troccoli and Altaf, 2010). Concerning the benefits, one can list innovation and competitiveness among multiple actors, which go beyond the supply chain view but extends to a holistic perspective of the agro-industrial ecosystem, which involves cooperatives, universities, unions, government, producers, transporters, among other players (Fernando and Las Casas, 2018, Gawer and Cusmano, 2014, Valkokari, 2015).

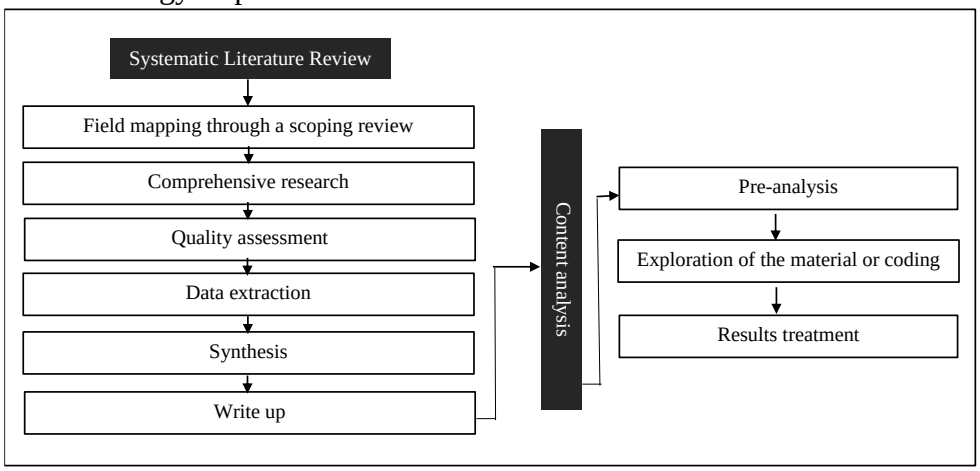
Based on the findings of Bonamigo et al. (2020b), for a B2B co-creation process to take place, previously there must be a resource integration and mutual benefit for all participants. Some facilitators identified in this process are compatibility of values, information exchange through technology, synergy among participants, involvement among actors, and mutual trust. The findings of Bonamigo et al. (2020b) also highlight techniques such as Jobs To Be Done (JTBD) that are used as a tool to support the opportunities identified for value co-creation (Ribeiro et al., 2019).

3 RESEARCH METHODOLOGY

The present study aims to recognize the opportunities and barriers to Lean Thinking adoption in value co-creation for agro-industrial services through a qualitative approach to our systematic literature review (Donthu et al. 2021). To achieve this goal, the authors performed two stages, according to Figure 1.

Figure 1

Methodology steps



Source: The authors

In the first stage, the Systematic Literature Review (SLR) was conducted to recognize the state-of-the-art of opportunities and barriers to Lean Thinking adoption in the value co-creation in agro-industrial services. The methodological strategy was based on Bonamigo et al. (2020a).

After that, the content analysis proposed by Bardin (2011) was carried out to analyze the resulting portfolio from the SLR. The SLR adopted in this study follows the six-step process recommended by Jesson et al. (2011) and Ferenhof and Fernandes (2016), which is described here:

(1) Field mapping through a scoping review;

(2) Comprehensive research;

(3) Quality assessment, which includes the reading and the selection of papers;

(4) Data extraction, which relates to the collection and capture of relevant data into a pre-designed spreadsheet;

(5) Synthesis, which comprises the synthesis of extracted data to show the known and to

provide the basis for establishing the unknown; and

(6) Write up

First, to perform the mapping of the literature, we define the question research interest, the keywords, and the search strings. In addition, the criteria for inclusion and exclusion of works. The research question was: "Is the job related to B2B relationship?", "Does the job have any relation to the concept or tools of Lean Thinking?", and “Does the work present any

opportunity(s) or barrier(s) to Lean thinking adoption in the value co-creation in the agro-industrial services?". We did not apply any criteria of exclusion regarding the year of publication of the articles we have researched.

Once the keywords were defined through brainstorming by the researchers and exploratory research, the search string was built. In this phase, Boolean operators were added to the search string. After multiple combinations and tests, the string was calibrated. Resulted in the: ((Service) AND (“value co-creation” OR “industrial service” OR “cooperation” OR co-production) AND (agribusiness OR farming OR agriculture OR food) AND (“lean service” OR “lean system” OR “lean thinking” OR “lean production” OR “lean manufacturing” OR “lean enterprise” OR “Toyota production system OR STP”)).

Regarding the criteria for selecting the databases and Journals, the following criteria were considered: Engineering Village; Emerald; Science Direct; Web of Science; ProQuest; EBSCO; and Scopus. Thus, "gray literature" such as reports and non-academic research, other languages than English, other databases than previously mentioned, and B2C relationships were considered as exclusion criteria. We took an approach based on Serra (2019) to sort, organize and simplify the literature review step, as well as to remove the papers that were duplicated. Also, we created an electronic spreadsheet consisting of critical aspects related to the research objective.

The aspects considered were: the author (s) name, publication year, and journal name. Key findings and the classification between opportunities or barriers to lean thinking adoption in the value co-creation in the agro-industrial services (i.e., opportunities: factors that expose contribution/advantage for the adoption of the Lean on value co-creation in agro-industrial services) or (i.e., barriers: factors that jeopardize/constrains the value co-creation in agro-industrial services).

Second, the seven databases via the search strings were consulted. The collection was made on January 10, 2022, and returned 2261 documents, 877 were duplicates, it resulted in 1,384 papers. Table 1.

Table 1

Resulting SLR Papers

Database	Number of publications
Engineering Village	679
Emerald	496
Science Direct	477
Web of Science	442
ProQuest	99
EBSCO	52
Scopus	16
Total	2261
Duplicates	-877
Resulting SLR total	1384

Source: the authors

Third, the authors individually examined the title, abstracts, and keywords of the 1,384 papers, which reduced the number of relevant documents to 103. Then, each author read the introduction and conclusion sections of the respective articles to ensure that they fell within the pre-defined scope. This evaluation yielded a final selection of 55 papers, which could potentially fulfill the research criteria and were analyzed in their entirety. The complete inspection of the 55 papers revealed that only 31 articles fell within the original scope and were further analyzed as described in the fourth step below.

Fourth, to analyze the remaining 31 documents, the authors carried out the content analysis recommended by Bardin (2011). According to this author, the content analysis comprises the following three phases:

(1) Pre-analysis, which involves the material (corpus) selection to be analyzed (e.g., articles) and its careful reading;

(2) Exploration of the material or coding, in which the recording unit (i.e., sentences, words, or themes repeated throughout the corpus), the context unit (i.e. phrases or paragraphs taken from the corpus that frames the recording unit, and clarify its meaning) and rules to compute the register unit (e.g., presence, absence, frequency or intensity) are defined;

(3) Results treatment, inference, and interpretation, in which the findings are summarized in diagrams, tables, models, and figures, to highlight the results from the analysis.

For conducting the pre-analysis, each author read the 31 previously selected articles in full and inserted and entered the main findings and the classification of the opportunities and barriers to lean thinking adoption in the value co-creation in the agro-industrial services. Based on this, the authors found out that among the documents, 25 addressed opportunities (Table 3), and 25 also approached the barriers (Table 4) to lean thinking adoption in the value co-creation in agro-industrial services.

In the coding phase, the tasks were divided among authors; thus, one team analyzed the opportunities and the other the barriers. To define the context units, the author who was responsible for the opportunities gathered and listed citations from the 25 papers presenting the elements that contributed to the adoption of Lean Thinking adoption in the value co-creation in agro-industrial services. The same process was followed for the barriers to the adoption of Lean Thinking in value co-creation in agro-industrial services.

After defining the coding phase based on the findings from the paper's portfolio, we determined the record units (i.e., the opportunities and barriers for the adoption of lean thinking in the value co-creation in the agro-industrial services), which were then used to label the opportunities and barriers. Subsequently, we calculated the register unity frequency, in an attempt to categorize each article within a record unit.

In the final phase of the content analysis, drawing upon the findings on opportunities and barriers, each team, that is, the members of the facilitators and barriers, created individual tables to summarize and highlight the results from the content analysis.

Fifth, the two tables from the content analysis were synthesized into one single file. Then, the authors jointly analyzed it and discussed the findings until convergence, ensuring, thereby, the coherence of the coding of the context unit and record unit. Sixth, in the last stage based on the SLR, the authors dedicated themselves to the findings by writing up. So, based on the SLR steps and the content analysis, Table 2 shows the resulting portfolio from the literature.

Table 2

Documents Portfolio Related to The Lean Thinking in The Agroindustrial Service

Cod	Authors	Year	Title	Journal/Source
A1	Zanin, et al.	2020	Driving Sustainability in Dairy Farming from a TBL Perspective: Insights from a Case Study in the West Region of Santa Catarina, Brazil	Sustainability
A2	Mittal, e al.	2020	Improving regional food hub operational efficiency with lean practices	Industrial and Systems Engineering Research Conference
A3	Aguiar et al.	2020	Organizational innovation in the context of family farms: lean diagnosis	Journal of Innovation Management
A4	Zhang and Paudel	2019	Policy improvements and farmers' willingness to participate: Insights from the new round of China's Sloping Land Conversion Program	Ecological Economics
A5	Wang and Luo	2019	Vegetable supply chain integration: the case of a trinity cooperative in China	International Food and Agribusiness Management Review
A6	Muñoz et al.	2019	Trends and gaps for integrating lean and green management in the agri-food sector	British Food Journal
A7	Gengatharen, D; Jie, F	2019	Australian food retail supply chain analysis	Business Process Management Journal
A8	Vidickiene and Gedminaite	2018	Challenges for agricultural policy in the service-driven economic system	Ekonomika Poljoprivreda-Economics of Agriculture
A9	Vanishree et al.	2018	Value chain analysis of input delivery system for liquid milk in Bengaluru milk union of Karnataka	Indian Journal of Dairy Science
A10	Ji, et al.	2018	Determinants of cooperative pig farmers' safe production behaviour in China - Evidences from perspective of cooperatives' services	Journal of Integrative Agriculture
A11	Antony et al.	2018	Assessing Lean adoption in food SMEs: Evidence from Greece	International Journal of Quality & Reliability Management
A12	Stallman and James	2017	Farmers' willingness to cooperate in ecosystem service provision: does trust matter?	Annals of Public and Cooperative Economics
A13	Ladychenko and Metelska	2017	Institutional framework of government support for Ukrainian farms	8th International Scientific Conference Rural Development
A14	Wang et al.	2016	Models of Chinas E-commerce in the agricultural sector: An exploratory study	International Journal of u- and e- Service, Science and Technology
A15	Bonamigo et. al.	2016	Dairy production diagnosis in Santa Catarina, Brazil, from the perspective of business ecosystem	British Food Journal
A16	Engelund et al.	2009	Optimisation of large-scale food production using Lean Manufacturing principles	Journal of Foodservice
A17	Taylor	2005	Value chain analysis: an approach to supply chain improvement in agri-food chains	International Journal of Physical Distribution & Logistics Management
A18	Wibowo et al.	1998	Concept of a Rex rabbit farming based on a partnership agribusiness system	Proceedings of the 6th World Rabbit Congress
A19	Navarro et al.	2015	The impacts of differentiated markets on the relationship between dairy processors and smallholder farmers in the Peruvian Andes	Agricultural Systems
A20	Ionescu	2015	The impact of extension and rural development consortium valcelele on the rural space development	Scientific Papers-Series Management Economic Engineering in Agriculture and Rural Development
A21	Handayati et al.	2015	Value Co-creation in Agri-chains Network: An Agent-Based Simulation	Procedia Manufacturing
A22	Shanoyan, al.	2014	Cooperative Innovation: The Case of Team Marketing	International Food and

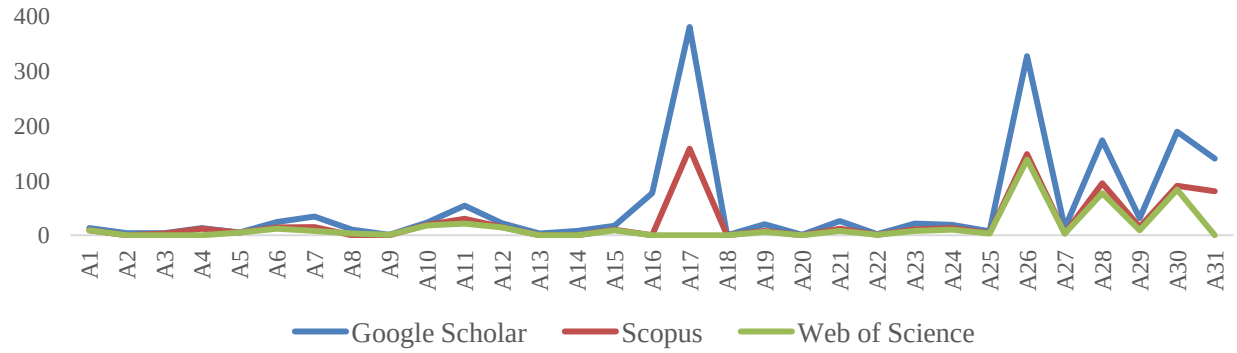
			Alliance, LLC	Agribusiness Management Review
A23	Dhehibi et al.	2014	Technical Efficiency and Its Determinants in Food Crop Production: A Case Study of Farms in West Bank, Palestine	Journal of Agricultural Science and Technology
A24	Chen et al.	2013	Efficiency measurements in multi-activity data envelopment analysis with shared inputs an application to farmers' cooperatives in Taiwan	China Agricultural Economic Review
A25	Xu et al.	2012	A Dairy Industry Information Cooperative Service System Based on a Production Process Ontology	Journal of Integrative Agriculture
A26	Ito et al.	2012	Distributional effects of agricultural cooperatives in China: Exclusion of smallholders and potential gains on participation	Food Policy
A27	van der Waal and Zongo	2011	Developing a Fresh Mango Export Value Chain with West-African Smallholder Mango Farmers	III ISHS
A28	Perez et al.	2010	Development of lean supply chains: a case study of the Catalan pork sector	Supply Chain Management: An International Journal
A29	Ng	2010	Understanding B2B Supplier Selection Relationships: The Case of Taiwan Agribusinesses	Journal of Business-to-Business Marketing
A30	Deng et al.	2010	Policy support and emerging farmer professional cooperatives in rural China	China Economic Review
A31	Arturo Garza-Reyes et al.	2010	Lean production, market share and value creation in the agricultural machinery sector in Brazil	Journal of Manufacturing Technology Management

Source: The authors

We verified the Cite Score for all documents based on the listed portfolio. The relevance of the documents was verified in Google Scholar and the databases of Scopus and Web of Science. The Cite Score consult was realized on Abril 17 of 2023. Figure 2.

Figure 2

Cite Score of documents



According to Figure 2, we can observe that paper A17 was the more cited in Google Scholar (380 times) and Scopus database (158 times), then paper A26 was cited 327 in Google Scholar, 148 times in Scopus, and 138 times in the Web of Science.

4 Results and discussion

After the content analysis, five record units were defined for listing the opportunities (Table 3), and five record units were defined to list the barriers (Table 4) regarding the research problem.

Table 3

Opportunities For the Lean Adoption in The Value Co-Creation in the Agro-Services

Analyses unit	Context unit	Code	Freq
Increasing productivity through cooperation	With the availability of services enabled an increase in the productivity and quality of the milk of the members, the cooperative is studying to create new services for its members.	A9	7
	Cooperation assists small producers in food safety management to reach market requirements.	A10	
	The producer is more likely to join cooperatives or cooperate with other farmers or stakeholders if he has high general trust. In addition, the producer will be more likely to cooperate with the people he already knows, as he has more confidence that they will comply with the agreement and will also reduce transaction costs.	A12	
	Producing with local raw materials allows an increase in foreign exchange revenue, which encourages cooperation between farmers and can reduce the number of intermediaries in production.	A13	
	Cooperation with private companies can generate new technologies, set a standard for product quality, create a relationship between supplier and farmer, and increase business efficiency.	A18	
	The development of farmer associations can enable these farmers to negotiate better milk prices, gain access to communal land, or buy cheaper fodder and concentrates as a group.	A19	
	Support from sector managers for the transition to adopting lean manufacturing practices, creating a sustainable advantage for Brazilian companies.	A31	
New technologies and techniques of production	Investment and continuous improvements in production play a positive role in the sustainability of rural businesses in the dairy industry	A1	7
	Small companies are more flexible and agile to process changes because they can quickly respond to consumer needs. In addition, they can offer customized products or services, which presents a great opportunity in this production sector, as customers are looking for new products and changes.	A11	
	Cooperation enables producers' access to technologies and knowledge of how to use them, which increases the profit.	A14	
	The analysis of the value chain is a way to start a partnership process. The team has more access to the operations, questions, and problems in the partner institutions. In addition, the work exposes that value stream mapping techniques are essential and can be applied in the red meat sector.	A17	
	There is a clear need for further research investigating computer simulation to illustrate micro-level interaction. The conceptual model proposed in this article is taken as an input and a set of procedures in conducting the simulation. This additional investigation will also indicate the suitability of value co-creation as a management principle in this network, as well as the applicability of agent-based modeling.	A21	
	There are a growing number of young, more business-oriented farmers who are characterized as being well-educated and willing to adopt new technologies and risk management practices. Consideration should be given to how TMA will extend the value proposition to make it attractive to new demographic groups of farmers while continuing to meet the needs of traditional customers.	A22	
	In the future, developments will be important for agriculture in cooperative training	A25	

	services to use smart search and automatic classification techniques to extend the information/expertise knowledge in cutting-edge databases. The study highlighted the potential for agricultural information cooperative service, so that these questions would now benefit from further investigation, which would make illuminate the promising applications of agriculture.		
Strengthening public policies	The existence of public policies for technical assistance can positively impact the sustainability of dairy farms.	A1	4
	The strongest part of the dyad (the government) provided services to optimize the quality and efficiency of the program's forests. These measures help farmers to adopt public policy.	A4	
	On average, interviewed farmers can potentially increase their production by as much as 28% through more efficient use of production inputs. This result implies that there is considerable scope for improving crop production in the study region. Highlights the need for government policies to create training/programs through extension activities in crop production (rotation, sowing time, etc.), in general, and improve management.	A23	
	A concerted effort by cooperatives and the government to promote broad inclusion would pave the way for further agricultural cooperative development in China.	A26	
Rentability	The work points out as the main opportunity to remedy the aforementioned limitations, the creation of services on agribusiness products. Involving innovation, agro is no longer an anonymous agent in the food chain to become an active member and add value to its products.	A8	4
	More research is needed to study the choices mango orchard owners/farmers make regarding the investment of labor and resources in their mixed farming systems.	A27	
	Further research to assert that there is cultural support for lean collaboration is recommended as a precursor to applying the five lean principles. For example, a tool such as the Supply Chain Collaboration Index (Ryals and Humphries, 2007) could be applied.	A28	
	There are still many outstanding questions about the current new wave of FPCs. It is unclear whether they are sustainable. Can they last without continued government support? Is there an alternative form of support that might be more effective, cost-effective, and sustainable? Are FPCs positively affecting farmer income and productivity? These and other issues need to be on the research agenda in the coming years.	A30	
Increases in productivity	In this paper we have identified various lean practices that can help to increase the operational efficiency and effectiveness of regional food hubs	A2	4
	The high competitiveness in the highly widespread commodities market in the agro-industrial sector makes the farms operate with very low operating margins. In this sense, the implementation of lean can be useful to reduce waste and use less resources for the operation of agribusiness.	A6	
	The work suggests the application of lean tooling practices (mainly kaizen and 5s) together with an increase in the quality of information in the supply chain.	A7	
	The Lean method reduced meal delivery time maintaining quality, improved storage packaging, facilitated the team's work routine by improving the organization and the position of ingredients and tools. In addition, tools were added to employees make suggestions on what could be improved.	A16	

Source: The authors

The recording unit "increasing productivity through cooperativism" can be noted as an opportunity for agro-industrial players to increase their competitiveness in the market via Lean Thinking (Österberg and Nilsson, 2009; Cristobal-Fransi et al., 2020; Eisler et al., 2007). Extension services and resources for production with subsidies for members are examples of facilities that cooperatives can offer to their members, which increases overall productivity (Onwuka et al., 2017; Vanishree et al., 2018). In this sense, Lean aims to preserve and increase

activities that add value to the customer's perception in continuous flow. Thus, cooperativism can be a way to make production flow. As opposed, in the case of small rural producers (family agriculture), when acting individually: the producer is limited to delivering value to a desired level of service to the client and consumer (Bonamigo, 2017; Ferenhof et al., 2018).

The collaboration networks not only increase productivity (Chen et al., 2013) but also play a significant role in the economic dynamic of a region, as demonstrated by Pio (2020) who found that nonprofit organizations like cooperatives are crucial in determining a region's GDP. With both factors being so important, social innovation and social entrepreneurship can work together to identify and solve problems for unmet social needs (Phillips et al., 2015).

The collaboration among actors through the implementation of new resources, and exchange of experiences and technologies, together with Lean, can result in the development of new products or their innovation, process improvement, and the development of new technologies to streamline and add value to the process, have better business management through knowledge of processes and consumer needs. This can be considered as co-creation of value, whereby both parties can achieve good growth and an improved brand value, provide solutions, construction, and share of knowledge with lower costs adding value to the brand (Chairany et al., 2022; Albuquerque and Martins, 2022; Zokaei and Simons, 2006).

As for the topic “new technologies and techniques of production” it can be considered an opportunity to Lean Thinking application in value co-creation of agro-industrial services, as the gap related to the technical factors is a fragility in the production. Olaoye (2014) pointed out that, among other factors, the low level of cooperation between research institutions and the industry is causing a lack of technical efficiency. However, in more developed countries, the technical problems faced by agro-industrial players were softened when there was cooperation among participants (Schiller et al., 2014).

Considering that the principles of Lean Philosophy are applied in the enabling technologies of Industry 4.0 (Stefani et al., 2021), Powell et al. (2013) related how the pull production principle and the enabling technology of systems integration can interconnect systems through the use of Enterprise Resource Planning (ERP) software, which integrates the business management of various sectors of a company, such as accounting, finance, human resources, and sales. Furthermore, Majuwala et al. (2019) studied how the principles of Lean Philosophy can be applied together with Big Data enabling technology to reduce the occurrence of GIGO (Garbage in Garbage Out), aiming to reduce costs and data processing time for decision-making. Such approaches are enablers of the circular economy, as it does reduce waste in the value chain. In this sense, Ciliberto et al. (2021) pointed out the fact that the Lean

Production model can integrate the principles of circular economy, creating a successful business structured on the systemic use of technologies, such as digital (information technology), engineering (material technology), and hybrids (mixing both technologies).

In addition, Ciliberto et al. (2021) also state that when Lean operates with Industry 4.0, it is possible to integrate the production info with the company's lean management system, analyzing in real-time its environmental impact through economic and social assessments. All of these factors integrate sustainability into the value chain, allowing the circular economy of the production system.

The current global scenario, with the widespread use of social media, has facilitated interaction, and sharing of information and resources among farmers. The use of communication networks, social media with posts, and connections between individuals who would not have had contact without the use of this technology have enabled the exchange of techniques, strategies, and experiences, as well as the marketing of agricultural products and the acquisition of resources (Misra et al., 2020). Furthermore, there is the possibility of identifying the best input prices since the exchange of information among agro-industrial actors is facilitated by these means of communication (Inegbedion et al., 2020; Palaniswamy and Krishna, 2022; Neto et al., 2015).

Moreover, co-creation can help with the development of new products. Bianchi et al (2018), for example, found that design thinking is a strong methodological approach to enable co-creation between competitors in an open innovation environment. Nonetheless, ideally within a collaborative setting, Solaimani (2019) proposed that Lean and innovation can work together to promote an analytical mindset, which in turn stimulates continuous improvement pursuing a systemic problem-solving approach to reach an efficient and effective learning process.

Some studies have covered "strengthening public policies". Public policies can enhance a farm's sustainability (Zanin et al., 2020; Cocklin et al., 2007), its productivity (Tweeten and Zalauf, 1997), efficiency in land usage (Zhang and Paudel, 2019), and the overall niche cooperative level (Chang, 2009). And although there is no evidence in the conducted SLR that Lean thinking adoption can be enhanced through public policies, many of the achieved benefits are also goals of lean thinking, which corroborates with the fact that lean adoption doesn't depend on full know-how to be applied (Aguiar et al., 2020). Thus, a joint action among government and cooperatives enables the development of their members.

Strategic planning is a crucial stage to ensure the sustainability of farms within the context of agribusiness. The implementation of public policies and government support offers an opportunity for sector managers to enhance their understanding and planning of actions, enabling the maintenance of farm sustainability. In this regard, it is possible to reduce waste and increase the profitability of agricultural activities in accordance with contemporary socio-environmental demands (Martinez, 2020).

According to Tavares (2018), the recognition of the seven wastes in Toyota Production System - TPS: defects, overproduction, waiting, transportation, inventory, motion, and extra processing, once recognized and managed, allow better profitability for companies that adopt the Lean methodology in an agricultural service context. In this sense, greater profitability allows the sustainability of the business and can add value to the product via a service economy (Calegari and Ferreira, 2018), in consequence, increases the potential for payment to cooperatives members (Martí and Andrés, 2015).

In addition to waste elimination, access to information, and communication technologies (José, 2020), the resource exchange and the development of the technique also increase profitability (Pires and Amaral, 2007). Thus, the adoption of Lean Thinking and cooperation increases the profitability that producers obtain, allowing them to make more investments in improvements, acquire better tools and materials, and have access to more knowledge. Thus, these actors in the agro-industrial sector can improve their productivity, their managerial skills, and growth within the market (Ferenhof et al., 2019).

In addition, to improve profitability, farmers need to strengthen their brands as a business strategy. Then, marketing and value co-creation emerged as a way for creating brand identity and product valuation, enhancing distinctive features that can meet the needs of end consumers. Furthermore, it can be used to innovative aspects that are not yet available in the agricultural market or to meet the demands of specific niches (Soares et al., 2021).

The competitive nature of the market usually leads to a cost of production very close to the value created, creating a market with thin margins (Boehlje, 1999). According to Muñoz-Villamizar et al. (2019), Lean Thinking adoption may be useful to reduce waste and the usage of resources, increase the adopter's productivity, and increase the customer's perception of the value of products, services, or processes that the customer is willing to pay. In this sense, Carlborg et al. (2013) pointed out five Lean principles to increase productivity in the following order: define value, define value stream, flow (creating value with no interruption of the production process), pull production, standardization, and perfection.

Furthermore, the emergence of Agriculture 4.0 has enabled farmers to access resources that assist in making decisions based on a more refined scientific and analytical rigor. In this way, it is possible to understand the particularities of agricultural products and improve their quality, productivity, and efficiency of production. This optimization of natural resources contributes to the sustainability of agricultural activity, ensuring a more conscious and responsible use of the environment (Vasconcelos, 2018).

Table 4

The Barriers to Lean Adoption in The Value Co-Creation in The Agro Sevices

Analyses unit	Context unit	Cod	Frq
The characteristics of the industry	During post-production, small-scale farmers lack sales channels, such as supermarkets and wholesale markets.	A5	6
	The work presents five challenges of current agribusiness: overproduction, the technological treadmill, the demands for environmental sustainability, the dynamism of the business environment, and globalization.	A8	
	To encourage the entry of young Ukrainian farmers into the agricultural sector, the government needs to create a regional plan for crops and production in rural areas to prevent the devaluation of products or shortage of goods.	A13	
	The absence of a clear and viable financial model to calculate the costs of current operations and possible profits hinders the application of Lean.	A17	
	Uncertainty in the supply of milk and the price of milk offered in the simultaneous presence of formal and informal markets. Small farmers are constrained by the lack of land and fodder to improve cow productivity and reduce their production costs.	A19	
	The high volatility in the agricultural Market.	A22	
Lack of incentives	The cost associated with adopting an inventory tracking and data management system can be prohibitive.	A2	13
	Farmers have scanted technical and technological knowledge to efficiently control the farm.	A3	
	It is not easy for small-scale farmers to obtain financial support to expand production and sales, which hinders the overall expansion of vegetable production, supply, and sales.	A5	
	Chinese small farmers dominate pig production; however, a lack of resources makes them less likely to adopt safe production codes.	A10	
	Limited technical, financial, and time resources difficult the lean implementation to small farmers.	A11	
	E-commerce in the agricultural sector helps to create cooperatives between farmers. However, the low informatization in this sector, the lack of knowledge in the use of these tools, and the high costs of adopting these online resources hinder access to this commerce form.	A14	
	The lack of management and marketing capacity brings an absence from the focus of partnership development.	A18	
	The Romanian rural area is in a state of stagnation in terms of economic and social development, public policies designed and implemented so far have failed to boost this environment.	A20	
	While the demand for food is becoming more sophisticated than ever, the food supply maintains a traditional way of production.	A21	
	The performance of the agricultural sector for the Palestinian economy has been unsatisfactory and has been unable to meet the growing demand for food; Technical inefficiency of farmers.	A23	
	The empirical results suggest that there are significant divergences in terms of	A24	

	performance between the four TFC departments.		
	The costs associated with extensive mango production by small orchard owners are high. High costs of researching and collecting the crop and the high costs of agronomic management of dispersed farmers limit the competitiveness of West African mangoes. Professional investment and much more intensive production systems seem to be needed.	A27	
	Taiwan's agribusiness industry traditionally, and still is, characterized by a large number of small, labor-intensive microenterprises lacking investment in new technologies.	A29	
Resistance to change	Another potential challenge in the actual implementation of the lean practices is the cultural change required to encourage the current food hub employees to adopt new work procedures.	A2	6
	In the food sector, the inter-organizational aspects of Lean do not allow an easy application, besides the fact that it's not appropriate for most companies in this sector. In addition, the probability of abandonment in the Lean application process is also because this is a long-term type of investment, and these companies expect short-term results.	A11	
	Cooperation requires trust between farmers, and in some cases, this is a problem for the producer, as he needs to trust that the cooperator will be able to comply with the agreement or will not leave the process. Because if they do not comply with the agreement, this will bring losses to this producer. So this lack of trust becomes a problem for the producer to cooperate.	A12	
	The uncertainty of potential benefits and necessity of many management resources and time make it difficult to obtain the company's commitment to adopt the Lean method.	A17	
	The reluctance of some families to join the cooperative. The reason for the low participation rate is that farmers do not clearly understand the difference between cooperatives organized in the 1950s and those that exist today. It considered that they refuse to join cooperatives for fear of losing land use rights and full control over farm management.	A26	
	In the preproduction process, they lack scientific cooperation.	A5	
Lack of knowledge about Lean Thinking	The work finds that the adoption of lean thinking can be difficult in an inter-organizational context, as it can cause a high level of dependence on buyers and reduce the level of profitability.	A7	4
	Specialized search engines for agricultural information are an effective source of detailed agricultural information in a potentially more focused way than that returned by universal search engines like Baidu (www.baidu.com) or Google (www.google.com).	A25	
	A review of this literature found that no published works were focusing on the study of the supply chain of pigs under development in Spain and, particularly, nothing focused on the applicability of the "lean" discipline in this area. The need to establish a value stream management team for Catalonia's pork supply system could be built around associations that foster collaboration in certain aspects, such as liaison of the policymaker and contribution to research on the Pork benefits for health. Another difficulty to be overcome in the pork chain is the need for commitment and support from senior management.	A28	
	Although the relative importance of selection criteria in various industries (e.g., automotive, manufacturing) concerning purchasing and product scenarios is evident in the literature, essentially, there are no such studies aimed specifically at the agribusiness sector. This study investigated the early development of a supplier selection framework within the context of the Taiwanese agribusiness industry and therefore constrains the applicability of the findings to other markets and industries.	A29	
The complexity in the fabrication of	Lean must be adjusted to achieve food safety requirements, as perishable materials and products are used. Thus, elements such as the quality control of the final product and of the materials used to make hospital meals will be considered. Another challenge is the different shapes and sizes of ingredients that make standardization and production flow difficult.	A16	3
	There is a difficulty in identifying what can or cannot add value to the	A17	

agro-products	production of animal meat. Thus, it becomes less clear how to apply some improvement techniques and analysis of the Lean method.	
	The agricultural machinery and implements sector is characterized by complexity, difficult products to make, often with long lead times, facts that can delay or hinder the real benefits of implementing lean principles as a viable strategy in this specific sector.	A31

Source: The authors

As for the identified barriers, the "industry characteristics" have some inherent problems. One kind is the effect that external factors cause in agribusiness, such as the location, the customers, the suppliers, and the government (Trung and Itagaki, 2012, Hubeis et al., 2017). The volatility caused by these factors affects the decisions taken in the agribusiness sector (Shanoyan and Briggeman, 2014a).

Nonetheless, Vidickiene and Gedminaite (2018) pointed out five characteristics of the niche which are barriers to agro-industrial production, namely: the overproduction (which creates pressure to sell the products), the technological treadmill, the environmental sustainability pressure, the niche dynamism, and globalization (which has created competitors from all around the world). Therefore, the adoption of Lean principles and the interest to cooperate with other actors in the agro-industrial system, are affected by the problems that these industries present. Lack of access to markets, and lack of financial planning and management contribute to these players not being able to adhere to these improvements within their companies (Bonamigo, 2017; Ferenhof et al., 2018).

Many small farmers still face the challenge of establishing an adequate sales channel for their products. A plausible solution to this issue consists of creating sales channels that enable more efficient commercialization (Wang and Luo, 2019). Then, social networks have emerged as a highly relevant tool for farmers, as they not only allow for the exchange of information and acquisition of inputs at more affordable prices but also provide a platform for selling products and promoting their brand, potentially reaching new markets (Inegbedion et al., 2020).

There is, however, another barrier that can make the factors cited above even more complicated: the "lack of incentives". Wang and Luo (2019) pointed to the fact that it is hard for small-scale farmers to get financial support to expand production, which hinders production development. In this sense, cooperation is a way to mitigate this issue, once it allows access to financial resources through value co-creation (Bonamigo, 2017a). Above all, the restriction of technical and financial resources is a barrier to the Lean thinking adoption of small producers, so the lack of external incentives can be a problem in the adoption of Lean Thinking when the

player works single, that is, without co-creating value (Psomas et al., 2018). Thus, the lack of financial resources, investments, knowledge, technologies, and incentives hinders the agro-industrial development of actors that look for ways to apply innovations to improve their businesses and partnerships. Mainly for small farmers, who have less knowledge and many competitors.

However, external factors alone aren't the only barrier to the Lean Thinking adoption in the value co-creation of agro-industrial services. It is also important to consider the internal factors negatively influencing Lean adoption in this context. The cultural changes for Lean thinking adoption are evident (Mittal et al., 2016; Ferenhof et al., 2018), and so it is needed to create a cooperative environment for the agro-industrial actors to enable the support services to be possible among the players (Stallman and James, 2017). Dent and Goldberg (1999) categorized the principal change resistance causes to be: surprise, inertia, misunderstanding, emotional side effects, trust lack, failure fear, personality conflicts, poor training, a threat to job status/security, workgroup breakup, fear of the poor outcome, change faults and uncertainty.

As a means of incentivizing its cooperative members to adopt lean practices on their farms, by providing resources, training, and guidance to mitigate issues that many farmers face regarding their value chain and how they can make their production more streamlined, value co-creation has been successful in facilitating the exchange of resources, experiences, and techniques. The exchange between actors who wish to apply Lean or have already applied Lean in their businesses can yield positive results for those who would struggle to do so in isolation and in some cases may not be able to implement any tools at all (Troccoli and Altaf, 2012).

This resistance is a potential barrier facing the players of the niche, so to overcome it, Dent and Goldberg (1999) proposed some strategies to overcome it through their literature review, namely: education, participation, facilitation, negotiation, manipulation, coercion, discussion, financial benefits, and political support. In this sense, Ferenhof et al. (2018) present a Lean management system based on behavior routine and knowledge management to deal with the culture change via Toyota Kata. The Kata allows people to be involved in the development of knowledge through deliberate practices based on the scientific method, overcoming obstacles, and involving workers at all production systems levels for continuous improvement inspired by Lean (Suárez-Barraza and Miguel-Davila, 2020; Ferenhof et al., 2018; Bonamigo et al., 2015). So, for a company to innovate, it must first seek a solution to internal problems. Then, with a committed, interested team that seeks knowledge of how they will seek improvement strategies to increase productivity and quality.

Yet about the internal barriers regarding Lean Thinking adoption in the agro-industry, the lack of knowledge is a current problem. Rahmah et al. (2017) found that the lack of knowledge and technical mastery are the main obstacles for agro-SMEs to implement Lean. On the other hand, Dora et al. (2016) studied a case in which the lean training of the managers provided enough knowledge for Lean adoption in a small food-processing company. Yet accordingly, to Dora et al. (2016), the company was able to make continuous change with limited investments, which was achieved with the proper Lean Thinking knowledge.

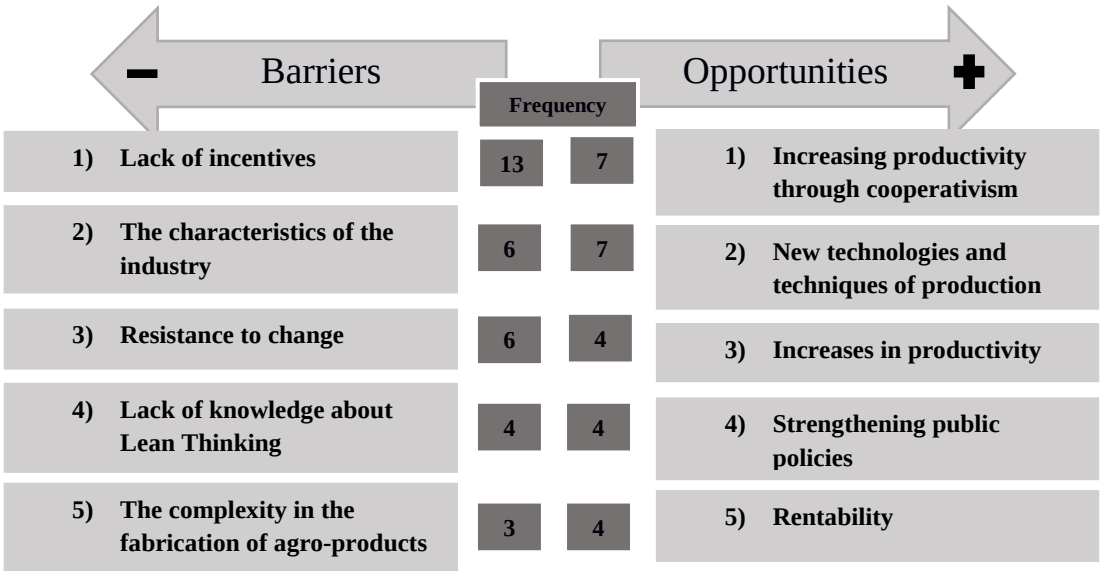
Integrating internal and external factors, the last barrier identified was “the complexity in the fabrication of agro-products”. One complexity commonly faced in the agro-industrial niche is product perishability. This impacts the entire supply chain design and the entire strategy of the agro-industrial players (Esteso et al., 2021).

Taylor (2005) regarded that, in animal production, lies a problem when identifying what might and might not add value to the product. In this sense, without defining value, Lean adoption is prejudiced. This problem is called "production waste" in Lean Thinking (Womack et al., 2007; Womack and Jones, 2010; Aguiar et al., 2020; Ussuna, 2019; Nielsen and Pejstrup, 2018). Through cooperation, the actors could find a solution to the before-mentioned problems in agribusiness. Thus, they would add value to the products, eliminate waste, seek continuous improvement in the business, and increase profits.

From the recognition of the opportunities and barriers related to Lean adoption in the value co-creation to agro-industrial services, we built Figure 3 which summarizes the findings. Figure 3.

Figure 3

Opportunities and Barriers to Lean Adoption in the Agribusiness



In light of what was observed, the sectors that predominate in the study that stand out are the agriculture sector in general (30%), in second place the dairy sector (13.33%), and the meat production sector in general (13.33%), followed by horticulture (10%), agribusiness (10%), food sector (10%), others (10%) and finally the family farming sector (3.33%).

5 Conclusion

The present study aimed to recognize the opportunities and barriers to Lean Thinking adoption in value co-creation for agro-industrial services. Once these elements were recognized from the literature, it was possible to encourage cooperation among players in the agribusiness context, maximize mutual gains, and categorize risk-sharing among the players. In addition, it was also possible to check how to add value through co-created agro-industrial services.

Lean adoption can positively impact the value co-creation in agro-industrial services with a shorter lead time, reduction of inefficiencies, and service development techniques, which reflects in economic advantages and gains for players co-creating value. On the other hand, cultural aspects of the agro-industrial sector are presented as an obstacle. This factor is shown to be linked to the lack of knowledge related to Lean Thinking, as well as the unrecognition of the advantages that Lean presents in the agro-industrial service context. Since the genesis of Lean, there is a set of gaps to understand how the "Japanese philosophy" can be adopted in the context of value co-creation for agro-industrial services.

Based on exposure, the opportunities and barriers recognized in this study, allow guiding players in the agro-industrial ecosystem to stimulate initiatives related to the value co-creation among multiple players to transpose problems linked to the quality, technology access, traceability, and innovation by sharing knowledge and complementarity of resources to provide new benefits and add value to products based on the service economy via Lean in agribusiness.

Nonetheless, value co-creation based on the Lean agribusiness approach can help with access to new production technologies through resource sharing among the players. Such technologies would otherwise have an unfeasible nature to the participants of the agribusiness ecosystem. However, resource sharing is an idealistic topic in a system where the lack of trust is a reality. Even so, one way of getting around this problem would be through digital platforms, which might help to create an additional layer of security to deal with the uncertainties of the field.

Finally, some opportunities for future studies were identified. The first one is related to the empirical test of the elements mentioned in this paper arising from the literature. The second comprises case-study diagnoses within an agro-industrial system to verify these elements' behavior empirically. The third comprises evaluating how the identified variables (opportunities and barriers) interrelate, via quantitative tests (e.g., factor analysis).

5.1 Managerial Implications

This paper concentrates on the opportunities and barriers to Lean Thinking adoption in value co-creation for agro-industrial services, which were scattered in the current literature, or not exposed. Based on the elements listed, strategies for supporting decision-making can be used by managers, consultants, researchers, and governments, to stimulate agriculture development via value co-creation among the actors. In addition, these strategies guide the way to Lean adoption in agro-industrial services.

Thus, the resource sharing among the actors is a way actors' agile way of co-creating value based on Lean practices and stimulating the interaction among for the sector competitiveness via cooperation. In this context, the producer cooperatives are the actor key for stimulating and disseminating Lean thinking in agriculture.

In terms of the social and commercial benefits, the technology access, information, and Lean mindset are possible ways to mitigate the rural exodus in sub-developing countries, where small producers cannot sustain themselves economically in the countryside due to a lack of

management knowledge and/or access to technological resources, thus leaving the rural area and migrating to urban centers.

5.2 Limitations and future research

Lean thinking and the value co-creation in the agriculture context is an emergent approach, but the theoretical base is still insufficient to draw any sharper conclusions. In this sense, we understand the first step was recognizing in the current literature the opportunities and barriers to Lean Thinking adoption in value co-creation for agro-industrial services.

This study exposed an overview of the agricultural sector based on the Lean perspective, it does not cover a specific food chain, since we observed the lack of data that characterize a specific production system, for categorization. In this way, future empirical research can be carried out in different food chains to diagnose the elements in practice, as well as to conduct comparative studies between different food chains.

Additionally, future research can also conduct a comparative analysis between the opportunities x barriers to Lean Thinking adoption in value co-creation for agro-industrial services in this research listed. The finds can be guidelines for a management model construction for Lean agriculture. This study is limited to B2B relationships, future research is necessary to analyze the relations among agro-industrial actors and consumers of their products or services to prioritize an overview of the B2C relationships for agro-industrial services.

AUTHORS' CONTRIBUTIONS

Contribution	Bonamigo, A.	Corrêa, A. G. A.	De Oliveira, G. S. C.	da Silva, P. V. S. C.	Andrade, H. S.
Contextualization	X	X	X		X
Methodology	X	X	X		
Software	---	---	---	---	---
Validation	X	---	---	---	X
Formal analysis	---	---	---	---	---
Investigation	---	X	X	X	---
Resources	---	---	---	---	---
Data curation	---	---	---	---	---
Original	X	X	X	X	X
Revision and editing	X	---	---	---	X
Viewing		---	---	---	
Supervision	X	---	---	---	X
Project management	X	---	---	---	X
Obtaining funding	---	---	---	---	---

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