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Trends and gaps for integrating lean and green management in the agri-food sector

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Abstract

Purpose – The purpose of this paper is to analyze gaps and trends, as well suggest approaches and methodologies that should be addressed by future studies for implementing the lean and green management in the agri-food sector.
Design/methodology/approach – Based on a sample with 117 papers, this paper presents a systematic review on the integration of lean and green in the agri-food sector.
Findings – Key findings indicate that research on lean and green topics has increased in recent years, an important gap in the integration of lean and green in the agri-food sector has been identified. Two paths that remain open for further research are detected: the lack of theoretical, prescriptive and quantitative research and the possibility of integrating the two most used tools of lean (i.e. value stream mapping) and green (i.e. life-cycle assessment).
Practical implications – This study does not only advance the theoretical knowledge of the lean and green field, but it is also beneficial for agri-food companies who aim to effectively deploy lean and green in their processes in order to improve both operational and environmental performances.
Social implications – No other industry matches in such a complete way the agri-food industry's challenge of sustainability that is due to the amount of resources it consumes and its interrelatedness with the well-being of humanity.
Originality/value – There are separate streams of established research on lean and green management in the agri-food sector, yet very few authors have addressed the intersection of these strategic initiatives.

Keywords Lean, Green, Agri-food, Environmental sustainability

Paper type Research paper

1. Introduction

The agri-food sector has a great economic and political importance for countries. It has a direct relationship with the fulfillment of human needs, the support of employment and economic growth, and has a great impact on the natural environment (Cagliano *et al.*, 2016).

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The agri-food industry is of particular interest as it simultaneously attempts to deal with a number of complicating characteristics often unheard of in other industries (e.g. the short shelf life of raw materials, seasonality) (Powell *et al.*, 2017).

Several changes have occurred the last decade in the agri-food sector. For example, the changing consumer consumption concerns and the existence of stricter regulations and laws have increased public pressure throughout the agri-food supply chain (Matopoulos *et al.*, 2007). In this context, the focus of the agri-food sector is on green practices, food safety and food quality management and less on the process improvement methods (Dora and Gellynck, 2015; Ross *et al.*, 2015). These green practices are concerned with the reduction of environmental risk and negative impacts (Carvalho *et al.*, 2017).

The recent literature emphasizes the application of lean manufacturing practices to food processing industries in order to improve operational efficiencies (Bateman, 2005; Powell *et al.*, 2017; Dora *et al.*, 2016). However, lean practices in the agri-food sector provide a different set of challenges due to seasonal variability, bulk production, processing and problems in handling and storage. As lean stems from the mass production of non-perishable goods, not all lean principles and tools will be equally applicable in different industries, such as in the food industry (Engelund *et al.*, 2009).

There are separate streams of established research on lean and green management in the agri-food sector, yet very few authors have addressed the intersection of these strategic initiatives. This is a critical oversight because companies may be missing the synergies that are available through simultaneous implementation. Moreover, they may also be failing to address important trade-offs that may arise when these strategic initiatives are separately implemented (Mollenkopf *et al.*, 2010).

There is a gap in the literature on simultaneously aligning lean and green management practices in the agri-food sector. Hence, this paper proposes trends, current practices and key challenges for filling this gap. The objective of this paper is to provide scholars and practitioners of lean and green for further research in the agri-food sector. This, in turn, will help them to formulate more effective strategies for implementing them in a specific non-conventional sector like agri-food. This paper is organized as follows. Section 2 provides a brief background that introduces basic terminology. Section 3 describes the proposed research method, and Section 4 presents a descriptive analysis of the papers we identified from our systematic review. Section 5 presents the discussion and Section 6 closes the paper by presenting some concluding remarks.

2. Background

2.1 Agri-food sector

The agri-food sector is a central economic feature of most countries, and it accounts for a significant share of production, consumption and employment. For example, in the USA, agri-food and related industries accounted for 4.8 percent of the country's gross domestic product (Cagliano *et al.*, 2016). Given that all countries must have food, creating and supplying food is a critical component in any and all approaches to creating a sustainable planet (Ericksen, 2008). In our study, the agri-food sector is delimited by anything between farming (SIC 0100-0299), agricultural services (SIC 0700-0799), food and kindred products (SIC 2000-2099), wholesale (SIC 5100-5199) and food stores (SIC 54).

The agri-food sector is based on a very heterogeneous group of products with different degrees of perishability, varied manufacturing lead times and diverse customer demands in different amounts at different frequencies (Dora *et al.*, 2016). Likewise, the agri-food industry is also a social issue. The world's population is expected to increase to 8bn by 2030 and to exceed 9bn by 2050 (UN, 2013). Additionally, in too many countries, more food is produced than can be consumed. Research shows that one-third of the global food production is wasted or lost annually (Gustavsson *et al.*, 2011).

Although the overall process involves many players and processes and it is regarded as a complex system, the most longstanding issue for the agri-food industry, as Bryceson (2011) notes, is that it deals in low margin commodities. Competitive market forces have typically led to the cost of production being very close to the value created, leaving relatively thin profit margins (Boehlje, 1999). Furthermore, some current worldwide agenda demands that agri-food systems "produce more food […] with minimized inputs, environmental impact and greenhouse gas emissions, and with enhanced ecosystem services, zero waste and adequate societal value" (Horizon 2020, 2018). In this context, it is interesting that lean and green are introduced simultaneously in the agri-food industry, given the low profits, waste, losses and its impact on the environment.

2.2 Lean and green

Recently, several studies have demonstrated that lean management can be a major part of the answer to sustainability (Cherrafi *et al.*, 2017). As lean is also a management approach that aims to eliminate waste in every area, aligning it with the green paradigm and its methods and tools seems natural (Garza-Reyes, 2015). The goal of lean is to use fewer resources to generate the same outcome through continuous improvement (Bateman, 2005; Duarte and Cruz-Machado, 2017). This goal is clearly environmentally friendly: fewer materials are used in production and quality improvements wastes, resources consumption and pollution costs (King and Lenox, 2001). Several authors have written about whether the lean and green approach is evident in practice, how best to achieve it and what its net benefits are (Kleindorfer *et al.*, 2005). In this context, lean and green management are increasingly being adopted by companies, very often jointly. Lean management focuses on waste as it applies to the inefficiency of processes, whereas green management focuses more on pollution in the form of air emissions and solid and hazardous waste (Molina-Azorín *et al.*, 2009).

The concept of lean production arose from the study of Japanese manufacturing techniques, particularly in the automobile industry, where it was known as the Toyota Production System (Garza-Reyes, 2015; Sunder *et al.*, 2018). Womack defined lean manufacturing as "a system that utilizes fewer inputs and creates the same outputs while contributing more value to customers" (Womack *et al.*, 1990). That is, it is a system that identifies and eliminates waste (i.e. anything that does not add value from the customers' perspective) through continuous improvement (Duarte and Cruz-Machado, 2017), creative thinking and teamwork (Higgins *et al.*, 2007; Sunder *et al.*, 2018). The most commonly cited benefits of lean manufacturing practices are quality improvement, increased productivity, reduced lead time, improved delivery time and reduced costs (Dora *et al.*, 2016).

On the other hand, the company's commitment to environmental sustainability is emerging as an important strategic issue in the business world (Corbett and Klassen, 2006; Aguilera-Caracuel *et al.*, 2011). Consequently, green management has emerged as a philosophy and management approach for reducing the negative ecological impact of an organization's products and services as well as improving the environmental efficiency of their operations, while still achieving their financial objectives (Tseng *et al.*, 2013; Duarte and Cruz-Machado, 2017).

A high number of papers reinforce the existence of synergies based on the joint implementation of lean and green initiative. For instance, at least seven literature reviews that focused exclusively on lean and green topics have been conducted by Johansson and Sundin (2014), Martínez-Jurado and Moyano-Fuentes (2014), Garza-Reyes (2015), Hallam and Contreras (2016), Pejić *et al.* (2016), Cherrafi *et al.* (2017) and Martínez León and Calvo-Amodio (2017). However, various other reviews related to lean or green topics show that the body of knowledge is not new but at the same time still demands further research in some sectors, as the agri-food (Morioka and de Carvalho, 2017).

3. Research method

We conducted a systematic review, as a valid research approach and a necessary step in structuring a research field (Easterby-Smith *et al.*, 2015). This qualitative method has already been successfully used in other similar studies on topics closely linked to the present study, including green supply chain management (Srivastava, 2007) and lean manufacturing, Six Sigma and/or sustainability (Cherrafi *et al.*, 2016; Sunder *et al.*, 2018). As pointed out by Drohomeretski *et al.* (2015), the main objective of a review is not only to evaluate how much is being published but, rather, to identify trends and gaps in the literature.

The scope of this study encompasses integration of lean and green in the agri-food sector. The literature review was conducted based on the approach proposed by Bultó *et al.* (2016) and followed next criteria:

(1) Scopus, ISI Web of Knowledge, Google Scholar, ScienceDirect, Emerald Insight, Taylor & Francis, Wiley Online Library where chosen as databases.

(2) The keywords used for different searches were a combination of: "Lean," "Continuous improvement," "Green," "Ecology," "Clean," "Environment," "Eco-Sustainability," "Agri-food," "Food," "Agriculture."

(3) Publication dates were from 1990 to 2017. The year 1990 was selected as the starting point because debate on lean and green can be traced to this period (Verrier *et al.*, 2016).

(4) Relevant books and articles whose main content focuses on the links between lean, green management and the agri-food sector were selected. Textbooks, unpublished working papers, conference presentations and proceedings were excluded.

After conducting numerous searches, more than 500 papers were found. They were subsequently submitted to a final selection on the basis of the following criteria:

(1) article's main contribution must deal with at least two of the three main topics of the study (i.e. lean manufacturing, green management and/or the agri-food sector);

(2) articles dealing with certain aspects related to lean management systems (e.g. agile production, etc.), green management (e.g. social sustainability, ethics, etc.), the agri-food sector (e.g. regulations, safety, security, etc.) and/or technical aspects were rejected; and

(3) complementarity bundles of lean and other practices such as Six Sigma, resilience, balanced scorecard, etc., were also excluded.

This new selection resulted in 117 papers that met all three criteria.

4. Research results

This section describes the data obtained from the sample of papers. After a descriptive analysis of the sample is presented, the integration of lean and green in the agri-food sector is discussed. The method described in the previous section enabled us to define the four lines of research linked to the interrelationships between lean, green and the agri-food sector. To be more specific, the four research topics and number of papers evaluated per topic are:

(1) Lean and green (LG) – 66 papers.

(2) Green in agri-food sector (GA) – 27 papers.

(3) Lean in agri-food sector (LA) – 20 papers.

(4) Lean and green in agri-food sector (LG-A) – 4 papers.

4.1 Descriptive analysis of literature

First, using a chronological perspective, we observed how each of the four research topics has evolved over time. Figure 1 shows the cumulative frequency of the number of articles published annually during the period under analysis. It can be observed that the four topics have received increased attention from researchers. The LG topic has been the subject of a growing number of contributions over time in several sectors. As this topic groups all the sectors (besides the agri-food) the gap between LG and the other three topics has widened, especially since 2012. Furthermore, there has been significant growth in the isolated implementation of lean or green in the agri-food sector since 2005 and 2004, respectively. However, there has only been a moderate increase in interest in the integration of lean and green in this sector (LG-A). These insights are reinforced when looking at the most cited papers per topic, as shown in Table I. It is important to note that the total LG sample has an average of 42.86 citations per paper, while GA has 19.75, LA has 23.7 and LG-A has only 3.25 citations per paper. These data indicate the different investigative attention given to each of the four topics. Furthermore, the most cited article for each topic is cited at a much greater rate relative to the second most cited article.

Second, according to Jasti and Kodali (2014), the nature of a research study can be classified into five major categories. They are: conceptual, descriptive, empirical, exploratory cross-sectional and exploratory longitudinal. We used this classification to develop a more extensive and detailed classification in order to better understand research streams and identify the predominant research method. Our classification segregates articles according to: empirical and/or theoretical methodology; descriptive and/or prescriptive method; quantitative and/or qualitative approach; and research method (e.g. interview, survey, literature review, study case, etc.). Figure 2 shows the relative distribution of these categories overall and for each research topic. As the number of papers per topic differs, an analysis using relative values allows us to compare the four topics in order to identify research gaps. According to these results, theoretical, descriptive and qualitative approaches are the predominant types of research. As a balance between approaches could be desirable, there is an important gap in the theoretical development of the LA and LG-A topics. In addition, there is a need for prescriptive models and quantitative research for each topic.

Regarding specific methodologies used see Figure 3, in general, the most common research method is the case study method (37 papers). Interestingly, modeling (34 papers) is also very common, while interviews (9 papers) are scarce. As is expected the topic of LG has the highest coverage in most of the methodologies. However, it is important to note that LG has a lack of multicase studies (4 papers). In addition, there are several literature reviews (15 papers). This means that there has been a need to collect a large amount of research. To the best of our knowledge, this paper is the first review of the LG-A topic.

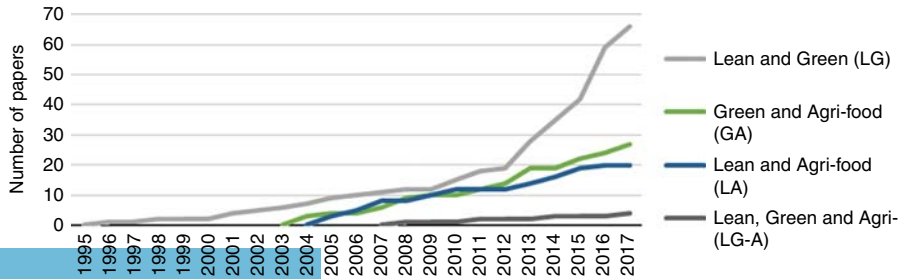

Figure 1.
Cumulative frequency of the number of articles published

Topic	Authors	Citations	Scope/focus
LG	Florida (1996)	751	Relationship between production and innovative practices to environmentally manufacturing
	King and Lenox (2001)	336	Empirical and statistical analysis of the environmental performance
	Simpson and Power (2005)	194	Relationship between suppliers and firm's level of environmental management
	Kainuma and Tawara (2006)	178	Multiple attribute utility theory method for assessing a supply chain management
	Rothenberg *et al.* (2001)	174	Relationship between lean manufacturing practices and environmental performance measured in terms of air emissions and resource use
GA	Horlings and Marsden (2011)	112	Conceptual dimensions of ecological modernization in agriculture
	van der Werf *et al.* (2007)	78	Comparison of sustainability assessment tools at farm level
	Higgins *et al.* (2008)	70	Certification in alternative agri-food networks
	Marsden (2004)	61	Engagement between ecological modernization theory and rural development
	Notarnicola, Hayashi, Curran and Huisingh (2012)	60	Introductory article of special issue in sustainable agri-food industry
LA	Cox and Chicksand (2005)	55	Strengths and weaknesses of lean management thinking in the food and farming industry in the UK
	Simons and Zokaei (2005)	39	Introduction of lean to UK red meat industry
	Higgins *et al.* (2007)	37	Multi-agent methodology for management including agile and lean principles
	Upadhye *et al.* (2010)	37	Lean manufacturing model for a biscuit company
	Scott *et al.* (2009)	34	Survey of structured continuous improvement programs in the Canadian food sector
LG-A	Mason *et al.* (2008)	9	Sustainability metric in value stream mapping
	Cardozo *et al.* (2011)	2	Lean and sustainable practices of dairy SMEs in Venezuela
	Folinas *et al.* (2014)	2	Systematic approach for measuring the environmental performance of a supply chain in agri-food sector based on a lean technique
	Powell *et al.* (2017)	0	Lean and six sigma strategy to improve environmental sustainability

Table I.
Most cited papers per topic

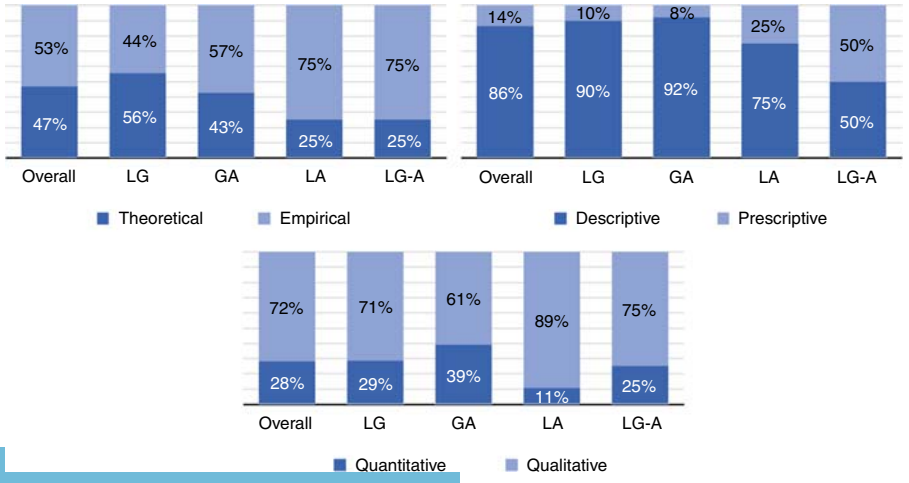

Figure 2.
Relative distribution of research approaches overall and per research topic

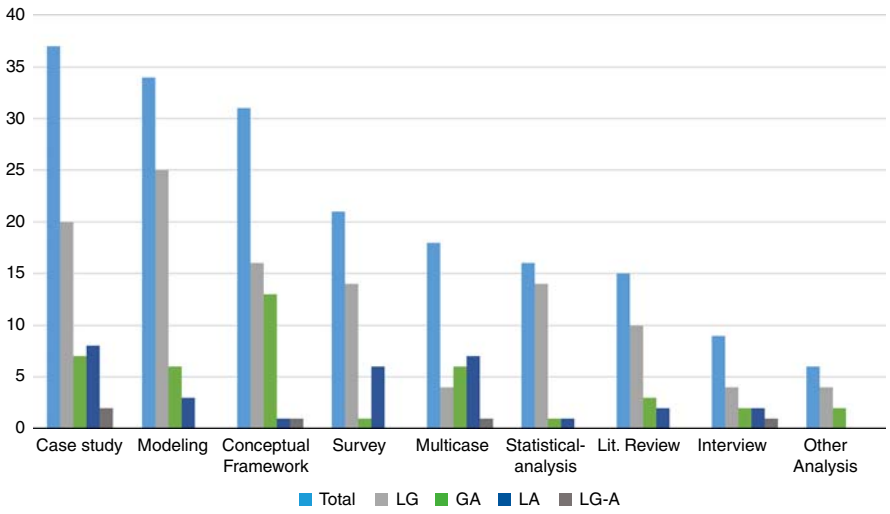

Figure 3.
Distribution of research methods

4.2 Lean–green in the agri-food sector

According to Carvalho *et al.* (2017), researchers agree that companies can achieve a greater competitive advantage by making their businesses more environmentally friendly. Green management practices may improve the ecological efficiency and competitiveness of a company by reducing its environmental risks and impacts (Zhu *et al.*, 2007). However, despite the importance of taking a green approach to address the issues related to the environment, many companies are still skeptical about the benefits to their business and the rate at which green systems are being implemented is not keeping pace with the rapid global spread of the manufacturing industry. Even though many success stories have proven this point, it seems most managers still see environmental waste minimization not as a competitive opportunity but as a "necessary evil," simply to avoid legal sanctions (Tilina *et al.*, 2014). The issue of how to address environmental management practices may be a costly endeavor if a number of important economic factors are not taken into consideration (Simpson and Power, 2005).

Vachon and Klassen (2008) argue that in considering the eco-efficiency perspective, reducing environmental externalities is not enough for companies; it is also necessary to promote value creation and produce economic value. That is, efficiency and performance must be improved. This goal of efficiency is reached by eliminating wastes, reducing costs and improving efficiency through lean strategies (Carvalho *et al.*, 2017).

As shown in Table II, there is extensive literature in the context of green/agri-food, green/lean and lean/agri-food. However, research combining all three topics has not emerged yet. To the best of our knowledge, only four articles integrate lean and green management in the agri-food sector: Mason *et al.* (2008), Cardozo *et al.* (2011), Folinas *et al.* (2014) and Powell *et al.* (2017). It is important to note that Powell *et al.* (2017) is the only article in our sample which integrates an additional management practice besides lean and green (i.e. Six Sigma). We selected this paper, however, as very few articles integrate lean and green management in the agri-food sector.

The combination of the heterogeneous nature of the agri-food sector industry, the huge variation in the quality of raw materials and their highly unpredictable supply and the rigorous customer/retailer demands make the manufacturing sector unique (Dora *et al.*, 2016). It is interesting that lean and green are introduced simultaneously in the agri-food industry, given the waste and losses in that field. However, despite the promising results

Results	Topic LG	GA	LA	LG-A
Research approaches (frequency)	Theoretical (40) Empirical (32) Descriptive (61) Prescriptive (7) Quantitative (20) Qualitative (50)	Theoretical (12) Empirical (16) Descriptive (24) Prescriptive (2) Quantitative (11) Qualitative (17)	Theoretical (5) Empirical (15) Descriptive (15) Prescriptive (5) Quantitative (2) Qualitative (17)	Theoretical (1) Empirical (3) Descriptive (2) Prescriptive (2) Quantitative (1) Qualitative (3)
Top 3 – Research methods (frequency)	Modeling (25) Study case (20) Conceptual framework (16)	Conceptual framework (13) Study case (7) Modeling (6)	Study case (8) Multicase (7) Survey (6)	Study case (2) Conceptual framework (1) Interview (1)
Most used tool (frequency)	VSM (9)	LCA (11)	VSM (3)	VSM (3)

Table II.
Main results per topic

that come from integrating the green and lean approaches, there are some limitations and trade-offs to implementing them, whether simultaneously or sequentially, in the agri-food sector. Since there is strong evidence that agri-food companies operate differently from other organizations in other sectors, the next section provides an overview for agri-food producers planning lean–green implementation.

5. Discussion

Based on the literature review, the benefits and synergies of the lean and green approach could be extrapolated and applied to the agri-food sector understanding its specific and contextual factors. For example, lean does not, in its original form, address the safety aspects of food production (Engelund *et al.*, 2009). Thus, it is necessary to adjust some lean and green principles to the specific requirements of a production scenario in order to correctly and efficiently implement those approaches in the agri-food sector (Dora and Gellynck, 2015). Furthermore, there is an important gap in the theoretical, prescriptive and quantitative development of LG-A topic. Conceptual frameworks, mathematical models and statistical analysis should be conducted, respectively, to fill this gap.

Dües *et al.* (2013) concluded that the overlap of lean and green paradigms consists of the following common attributes: waste and waste reduction techniques, people and organization, lead time reduction, supply chain relationship, key performance indicator (KPI): service level, and also certain common tools and practices they share. Furthermore, another area of mutual development concerns international standards. According to King and Lenox (2001), businesses that adopt the quality management standard ISO 9000 are more likely to adopt the environmental management standard ISO 14000.

The most potent barriers to lean–green implementation are lack of knowledge, limited resources, lack of training and inadequate process control techniques. Mittal *et al.* (2016) presented three criteria barriers (economic, technical and organizational) of lean–green systems. Note that the identified barriers are similar to other barriers for management system implementation (e.g. Shi *et al.*, 2008). To overcome those limitations and barriers, Zhan *et al.* (2016) proposed five categories for enhancing lean and green implantation in organizations: mindset and attitude, leadership and management, employee involvement, integrated (holistic) approach and the correct selection of tools and techniques. Based on the results of our research, to achieve an effective green and lean approach, agri-food managers should adopt strategic initiatives such as changing company culture, continuous improvement, employee involvement and leadership commitment, trust between managers and employees, safer working conditions, stakeholder relationship and information sharing. These are necessary surrounding conditions to establish the organizational culture where the lean–green methodology takes hold.

However, as people are the key piece, all employees must have access to green and lean approaches through training programs, brochures, specific meetings and awareness sessions (Galeazzo *et al.*, 2014). In addition, as the successes and failures of lean manufacturing and other similar initiatives are highly context-dependent, Dora *et al.* (2016) provide an overview of the determining factors (i.e. enabling and/or obstructing factors) in implementing lean manufacturing practice in this industry. They include three specific factors for analyzing a company's context, i.e., nature of the process, product and plant. The inclusion of context-specific factors is very valuable and helps to formulate more effective strategies for lean and green implementation in a specific non-conventional sector such as agri-food.

On the other hand, the results of our research show that life-cycle assessment (LCA) and value stream mapping (VSM) are two interesting tools for meeting the expectations of both lean and green management (see Table II). LCA is used in 12 papers (10 percent of the total sample): Kainuma and Tawara (2006), Higgins *et al.* (2008), Notarnicola, Hayashi, Curran and Huisingh (2012), Notarnicola, Tassielli and Renzulli (2012), Arzoumanidis *et al.* (2013), Boye and Arcand (2013), Cerutti *et al.* (2013), Iakovou *et al.* (2015), Khoshnevisan *et al.* (2015), Sala *et al.* (2017), Tasca *et al.* (2017) and Arzoumanidis *et al.* (2017). Of these papers, only Kainuma and Tawara (2006) used this tool in addressing the LG topic; the other 11 times it was used in the GA topic. The LCA concept was adopted in order to assess the sustainable efficiency of farm operations, and as a tool it has been increasingly used to improve the environmental performance of goods and services, including products belonging to the agri-food sector (Arzoumanidis *et al.*, 2017). However, the application of LCA to food products and systems is not straightforward, as many challenges arise at the methodological level due to the still incomplete knowledge of certain environmental mechanisms and to the inherent complexity of the systems to be analyzed. In fact, aspects, such as genetically modified organisms, desertification, pesticides, antibiotic-resistant strains of microorganisms and growth hormone residues in food, just to mention a few, are not adequately addressed (Notarnicola, Hayashi, Curran and Huisingh, 2012; Arzoumanidis *et al.*, 2013).

VSM is used in 15 papers (13 percent of the total sample). This tool is used in the LG (Simons and Mason, 2003; Miller *et al.*, 2010; Marudhamuthu and Krishnaswamy, 2011; Nallusamy *et al.*, 2015; Ng *et al.*, 2015; Garza-Reyes *et al.*, 2016; Thanki and Thakkar, 2016; Mostafa and Dumrak, 2017; Vinodh *et al.*, 2011), LA (Lehtinen and Torkko, 2005; Tanco *et al.*, 2013; Vlachos, 2015) and LG-A research topics (Mason *et al.*, 2008; Folinas *et al.*, 2014; Powell *et al.*, 2017). Although this tool has not been used in the GA topic, it is interesting that 75 percent of the papers that addressed the LG-A topic have used it. The VSM tool is oriented toward distinguishing value from waste. It is a process mapping method that documents the current and future states of a value stream, including all the information and material flows needed to deliver value to a customer. The real purpose of mapping is to design the future state, since mapping and analysis without action is waste (Tanco *et al.*, 2013). VSM allows production flows to be visualized, highlighting opportunities for improvement and clearly exposing waste. All these benefits are enhanced by visual management, especially the sharing of common objectives (Verrier *et al.*, 2016).

In view of all that has been mentioned so far, the present study makes at least two noteworthy contributions to develop a research agenda for the integration of lean and green in the agri-food. First, we have identified a lack of theoretical, prescriptive and quantitative research in the existing literature. Furthermore, we have highlighted the type of research that should be conducted to fill this gap (i.e. conceptual frameworks, mathematical models and statistical analysis). Second, given that LCA is frequently used for GA and VSM seems to be successful in the lean context, including in the agri-food sector, bundling these tools could be interesting in order to effectively integrate lean and green in the agri-food sector in particular. For example, the sustainable-VSM proposed by Mason *et al.* (2008) uses time and

CO_2 emissions as performance indicators. However, other indicators that are more elaborate and align with LCA could be selected. The setting up of these KPIs may influence worker behavior, encourage progress, and help achieve organizational objectives and quantify wastes.

6. Conclusions

This paper presented a systematic review with the aim of investigating the contributions of and interrelations between the lean and green approaches in the agri-food sector. Based on a sample with 117 papers, our research identified contributions to and gaps in this body of knowledge. Given the worldwide agenda for improvement of the agri-food systems, it must be stressed that there is a significant gap regarding lean and green integration in this sector. There is extensive literature in the context of green/agri-food, green/lean and lean/agri-food. However, research combining all three topics has not yet emerged. It is hoped that this study will inspire further research and exploration in this area. We have highlighted key aspects, gaps, approaches and methodologies that, in our opinion, set a new and promising research agenda for implementing the lean and green approach in the agri-food sector. The contributions of this paper do not only advance the theoretical knowledge of the lean and green field, they are also beneficial for organizations, especially agri-food companies, which aim to effectively deploy lean in their processes to meet current global politics, as Horizon 2020.

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