Green and sustainable supply chain management models in agri-food supply chains: a literature review[1]

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Abstract

Framework of the research: *The escalating interest in addressing the challenges presented by supply chains in terms of environmental and social impact, as reflected in international standards and agendas, calls for a systematic organization of research in this domain which focuses on the models used and the industries investigated.*

Purpose of the paper: *The purpose of this study is to explore and review the wide and interdisciplinary literature published on Green and Sustainable Supply Chain Management models from 2010 to 2023, with a major focus on agri-food supply chains. This paper discusses the evolution of both models and identifies avenues for further research.*

Methodology*: Papers were retrieved from the Scopus and Web of Science databases and subjected to a longitudinal analysis based on descriptive characteristics (i.e. methodologies, TBL pillars addressed, geographical context in which the studies were developed, etc.), and a bibliometric thematic mapping analysis.*

Findings*: The study offers a comprehensive investigation of extant studies on Sustainable SCM and the Green SCM approach, and sheds light on their implementation in agri-food. Firstly, a comparison is made between the agri-food sector and other industries according to the descriptive characteristics identified. Secondly, current motor, niche and emerging themes in agri-food are identified and discussed. Finally, major issues characterizing sustainable supply chain research in agri-food are addressed, with a focus on social sustainability.*

Practical implications: *The study identifies future research directions that may be beneficial for encouraging the adoption of sustainable practices in this industry.*

Research limits*: The main limitation of the study may concern the selection criteria at the basis of the literature review which determined the analyzed corpus.*

Originality of the paper: *The paper combines a content analysis approach with bibliometric techniques to analyze the link between sustainability and food supply chain management, comparing the adoption of Green and Sustainable models and discussing peculiarities unique to the agri-food industry.*

Key words*: sustainable supply chain management; agri-food; systematic literature review; triple bottom line*

1. Introduction

The transition towards sustainable systems has been at the center of the scientific and political debate for many years now, with calls for significant changes at all levels, from governments to companies to societies. One of the biggest challenges facing firms in this regard is the redesign of their supply chain management (SCM) processes (Schrettle *et al.*, 2014) to embed the principles of sustainable development - economic growth, environmental preservation and social equity (Bruntland, 1987; Elkington, 1994). Such practices are not only necessary to maximize efficiency within the supply chain, they are also required to align sustainability goals with sustainability practices. Elkington (2018) highlighted the importance of adopting an integrated approach to fully embedding sustainability at the core of each organizational process along the supply chain. Based on a global study involving 1200 professionals in 97 countries, the 2025 MIT State of Supply Chain Sustainability Report stresses how, in order to achieve their sustainability goals, companies must reorganize their supply chains around four approaches: contractual commitment towards sustainability; providing training or resources along the supply chain; adopting sustainability criteria in the selection of suppliers; requesting third-party audits or certifications to assess internal and supplier sustainability performance (Velazquez Martinez *et al.*, 2025). Considering the new Green Claims directive issued by the European Union, which will require thorough measurement of sustainable performances and third-party certification, ESG requirements for reporting represent a particularly crucial issue for companies operating within a supply chain.

Researchers have been extensively attempting to interpret this ongoing transition and to provide a universal interpretative framework capable of driving companies towards sustainable development while at the same time protecting their stakeholders' interests. A few prevailing models have emerged from this academic debate: contributions on sustainability management are, in fact, mostly attributable to the two main Green (GSCM) and Sustainable SCM (SSCM) frameworks.

Ahi and Searcy (2013) analyzed the different definitions of GSCM and SSCM, concluded that SSCM represents an extension of the former, and proposed a broader and alternative definition, encompassing both frameworks. This perspective has been shared by other authors over the years (e.g. Winter and Knemeyer, 2013; Mitra, 2014) who have proposed methods for integrating socio-economic indicators in GSCM models.

Given the variety and multidisciplinary nature of sustainable SCM contributions, it has become necessary to identify, select and classify the vast array of literature published internationally on this topic, as well as to follow the evolutionary trends of GSCM and SSCM frameworks and identify new research opportunities. Previous literature reviews on GSCM and SSCM have shown how both frameworks have been widely adopted, over the years, in various geographical and sectorial contexts (Rajeev *et al.*, 2017; Mardani *et al.*, 2020), with differences in adoption rate - for example, between mature and emerging economies. In terms of sectors, only a few contributions have focused on the specifics of implementing

these frameworks across industries (e.g. Beske *et al.*, 2014, on dynamic capabilities in the agri-food industry). At a sectorial level, the agri-food industry deserves further attention for many reasons. Despite the substantial increase in global food demand in the last decade, inequalities in terms of distribution across populations are still severe (Accorsi *et al.*, 2019). Such increased demand is also raising the challenge of providing healthy and sustainable diets for today's customers while reducing waste and preserving resources for future generations (Lawrence *et al.*, 2019). It is widely acknowledged that many food production activities have a tremendous impact in terms of their environmental (e.g. land use, deforestation, and water usage) or social (e.g. food crises) consequences, making them crucially important for the achievement Sustainable Development Goals (Agnusdei and Coluccia, 2022). The need to satisfy actual demand through production while preventing resource depletion is also in line with the concept of economic sustainability (Lobo *et al.*, 2015). Finally, the impact of the agri-food industry also extends to the food service industry, multiplying potential sustainability issues at the furthest point of the supply chain. Specifically, the issue of food loss and waste is crucial not only between the different stages of the supply chain but also as concerns the distribution system that interacts directly with consumers (Principato *et al.*, 2023).

To address these challenges and the rapid changes in the dietary habits and preferences of customers, the agri-food industry is therefore witnessing the redefinition of its supply chains, and therefore the need for flexible and sustainable production processes.

With the above in mind, the present study aims to update and extend current literature on GSCM and SSCM by comparing the adoption of both models across industries, with a specific focus on agri-food supply chains. The study aims to:

- analyze the evolution of sustainability management literature in agri-food supply chains, from 2010 to 2023;
- make comparisons between the development of sustainability management models (GSCM and SSCM) in agri-food supply chains and other industries;
- identify relevant topics and new opportunities for future research in the field of sustainability management in agri-food supply chains;
- discuss peculiarities in the adoption of GSCM and SSCM in agri-food supply chains and their implications for researchers and practitioners.

2. Methodology

A systematic literature review methodology was adopted, with a twofold objective: first, to maintain objectivity when selecting papers for our study by limiting the subjective intervention of researchers (Denyer *et al.*, 2003), and second, to efficiently evaluate and investigate broad topics (Tranfield *et al.*, 2003). Sustainability management is, in fact, extensively addressed in literature and comprises a wide variety of multidisciplinary contributions.

Data was collected through the search and selection process proposed by Rajeev *et al.* (2017) and inspired by Mayring (2004) and Seuring and Müller (2008). This sequential procedure consists of multiple steps that allow researchers to identify the most relevant contributions with respect to the objectives of their work.

First, the literature search was conducted on the well-established academic databases Scopus and Web Of Science, ensuring that the most relevant peer-reviewed contributions were considered (Harzing & Alakangas, 2016). The following keywords were used: "sustainable supply chain management", "green supply chain management", "green purchasing", "green design", "green logistics", "environmental purchasing", "green manufacturing", "green supplier selection", "environmental supplier selection" and "sustainable supplier selection". In order to compare studies conducted in the agri-food sector and in other industries, the authors decided to not limit the search by using food-related keywords, enabling them to acquire consistently comparable samples.

The search was limited to peer-reviewed journal articles published in English and took place in July 2023, returning 2313 papers. The authors then refined the dataset by assessing the quality and rigor of the journals to be included. Only well-reputed journals, as per the ABDC/ABS ranking (A or B category journals) or the H-Index and SCImago rankings where necessary, were considered for the study. Priority was given to indexed management journals. Finally, papers focused entirely on topics or domains not pertinent to the investigated managerial context were manually excluded (e.g. design of sustainable technologies, sustainable investing practices). Specifically, papers that investigated the entire supply chain were included while those which addressed aspects that only marginally affect the supply chain and its management (i.e. that only impact one stage of the supply chain or activities that do not directly interfere with supply chain management strategies and operations) were not. At the end of the selection process, 1411 papers investigating economic, environmental and/or social sustainability in supply chains were identified. Of these, 118 papers were concerned with agri-food supply chains and investigated either supply chains in their entirety or specific stages.

The process of content analysis was conducted by defining categories to compare studies (see Seuring and Gold, 2012). Categories were first identified by researchers separately, and then compared to increase the reliability of the analysis (Kolbe and Burnett, 1991). The categories identified by the authors, according to the framework proposed by Durach *et al.* (2017) include: research methods; the geographical area that served as the setting for the study; industry (following the Global Industry Classification Standards); and TBL dimensions and sub-dimensions addressed. Coding was carried out with the support of the qualitative analysis software MAXQDA Analytics, which facilitated the classification of papers and the subsequent longitudinal analyses.

Finally, bibliometric analyses were conducted on the sub-sample of 118 papers concerning agri-food supply chains: for these papers, metadata were retrieved with the following information: 1) authors, 2) year of publication, 3) keywords, 4) category. Alongside descriptive bibliometric

analyses, useful for the identification of trending topics and areas that would benefit from further investigation (Fahimnia *et al.*, 2015), we focused on the thematic mapping of investigated topics. Thematic mapping is a technique that uses keywords to identify emerging and leading thematic areas in a specific field of research (Guo *et al.*, 2017). Thematic mapping uses the co-occurrence of keywords - a type of co-word analysis - for the clustering of studies; the clusters are then framed into a matrix based on their density (which corresponds to the degree of development of a topic) and centrality (the degree of relevance of a topic) (Aria and Cuccurullo, 2017). VosViewer and bibliometrix software was used to support the analysis and visualization process (van Eck and Waltman, 2010; Aria and Cuccurullo, 2017).

For the purposes of clarity, Table 1 below summarizes the methodology stages, from the search and selection of papers to bibliometric analysis.

Tab. 1: Search, selection, coding and analysis stages

Stage	Description	Details
Determination of the primary characteristics of papers to be included	Definition of criteria for inclusion	Peer-reviewed journal articles that were published in English between January 2020 and July 2023
2313 papers		
Data search	Definition of search procedures and keywords	- Cross-selection within SCOPUS and Web of Science with harmonization of the datasets. - Keywords: *sustainable supply chain management, green supply chain management, green purchasing, green design, green logistics, environmental purchasing, green manufacturing, green supplier selection, environmental supplier selection, sustainable supplier selection.* - Selection of contributions published in peer-reviewed academic journals in English.
Data selection	Application of inclusion/exclusion criteria	- Inclusion of papers focusing on sustainability or economic, environmental and social performance applied to supply chains. - Exclusion of articles dedicated to specific and non-managerial issues (e.g. design of green technologies, sustainable investment practices), - Reputation-based selection of journals (A/B categories according to the ABDC/ABD ranking, H-Index and SCImago evaluation)
1411 papers – full sample		
Literature synthesis and coding	Identification of codes and classification criteria	- Research methods - Country or geographical area - Industry - TBL dimensions and sub-dimensions addressed
118 papers – sub-sample of papers concerned with the agri-food sector		
Bibliometric descriptive analysis		Comparison between the full sample and studies developed in the agri-food sector under the abovementioned dimensions.
Thematic clustering analysis		Thematic mapping of topics addressed by studies in the agri-food sector with the goal of identifying under-researched areas of interest.

Source: authors

3. Results

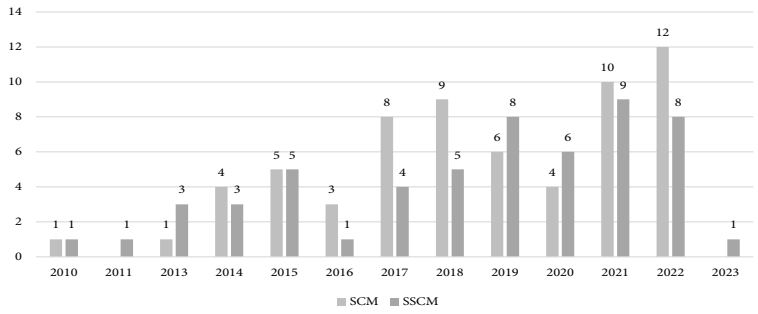
3.1 Evolution of SCM literature (2010-2023): descriptive mapping

Of the 1411 papers identified, 981 (69.5%) used industry data to validate their findings; of these, 39.4% of papers were concerned with manufacturing companies - either industry-specific or not specified. Aside from these, the agri-food sector presented the highest number of papers published (12%), followed by mining and energy production (8.8%) and automotive (8.1%). This is consistent with the attention focused on these sectors by major international organizations. The details on industry-specific studies are provided in Appendix A.1.

Our analysis identified an increasing interest in research on sustainable supply chains in the most recent decade. This general increase was contextual to the development of SSCM as an emerging model and topic, especially since 2013. In all likelihood, the effect of the global commitment to environmental protection was also reflected in researchers' attention toward these issues, since the following years led to the reaffirmation and consolidation of the GSCM model. The presence of SSCM was still marginal in literature from 2010 to 2013 before experiencing a steep growth in subsequent years. In June 2021, the UN conference in Rio de Janeiro not only formalized the commitment to promoting the green economy, it also broadened the concept of sustainability and laid the groundwork for defining the Sustainable Development Goals. This shared blueprint clearly showed how the main challenges in sustainability are actually interconnected, thus indirectly supporting the vision adopted by SSCM, which considers economic, environmental and social aspects simultaneously.

By narrowing down the analysis to agri-food literature, the evolution of publications displayed a more balanced division between types of papers as well as a wider adoption - in proportion - of the SSCM framework (Figure 1). A steep increase in publications can be seen as of 2017; this is consistent with new legislation concerning agri-food supply chains, such as Implementing Regulation EU 2017/1375, to combat grocery retailers' dumping actions towards farmers and other suppliers.

Fig. 1: Sustainability-related publications on supply chain management in agri-food



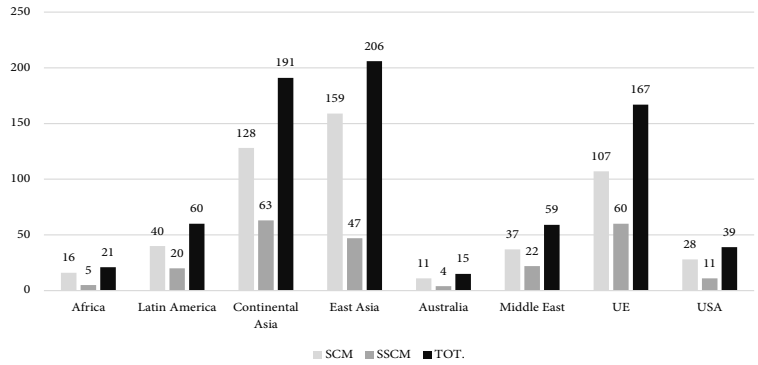
Source: the authors

Papers were also classified according to the methodology adopted by the authors when conducting their research. Most papers were empirical, although they do not always refer to a specific geographical area or industry. This is the case for several mathematical model studies, which are rarely tested empirically using primary data from companies, and surveys. Quantitative models are prevalent, although case studies and interviews and mixed-method studies indicate variety in the empirical validation of theories; proportionally, the latter are well diffused in SSCM literature as they are used to promote virtuous behaviors and successful examples of sustainable management. As regards the agri-food domain, qualitative methods were used in the main, followed by surveys and mathematical models. Qualitative methods include both case studies and interviews, most of which with managers or experts. Their prevalence is connected with the variety of productions being investigated: in fact, many agri-food supply chains present specific features and challenges, which require differentiated approaches and sustainability-oriented managerial practices (Kharola *et al.*, 2022; Leòn-Bravo *et al.*, 2019). Theoretical works developed in agri-food are further addressed in Appendix A.2.

As for the geographical setting, 790 of the 1411 papers on GSCM or SSCM (56%) narrowed their results down to a specific country or area (Figure 2); of these, only 25 were theoretical or literature review studies. This suggests that researchers have been increasingly focusing on the contextual factors - e.g. cultural and political aspects - that could favor or discourage the adoption of sustainable practices. The majority of studies were developed in Eastern Asia (26.1%), followed by the Indian subcontinent (24.2%) and the European Union (21%). Notably, 33 papers address sustainability in supply chain management across countries, with 22 of which comparing Western and Eastern economies. This trend has been growing since 2017, a new area of interest in the study of multinational companies and global supply chains, given the complexities inherent to the convergence of shared environmental and social objectives in drastically different contexts (Koberg and Longoni, 2019).

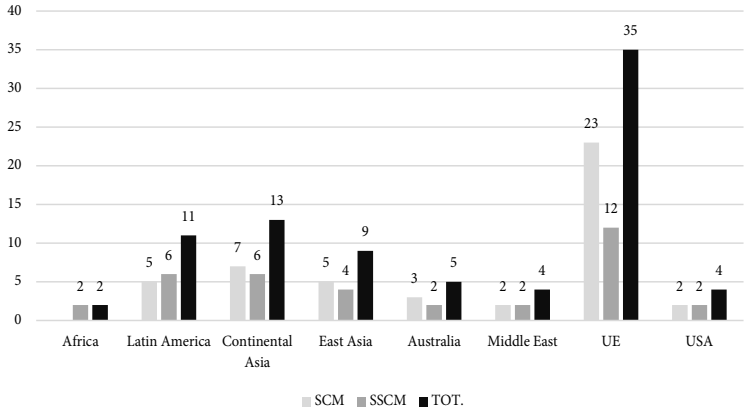
As far as the agri-food sector is concerned, papers with a geographical focus constitute 74.5% of publications. Of these, 35 out of 88 (39.7%) were developed in the European context (Figure 3). Agri-food productions are, in fact, of primary importance for European countries, and most of them also constitute opportunities for international trade. The handful of comparative studies mostly focus on multinational food supply chains (for example, Emberson *et al.*, 2022, compare sustainable supply chains of beef and timber in UK and Brazil). Multinational companies are also developing social projects in developing countries where part of their production is carried out (for example, Gold *et al.*, 2013, discuss case studies on base-of-the-pyramid projects, such as Danone Foods' "micro-factories" supply chain in Bangladesh and Nestlé's Milk Districts initiative in Pakistan). Such investments have a positive impact on social contexts by supporting local farmers and small business owners and providing the population with quality, healthy and affordable food.

Fig. 2: Country-specific studies in sustainable supply chain management literature



Source: the authors

Fig. 3: Country-specific studies in agri-food sustainable supply chain management literature



Source: the authors

A final descriptive aspect concerns the research objects of the studies, their connection with TBL pillars and their combinations (Table 2). Of the 1411 analyzed papers, 509 applied the SSCM framework (36%), while 688 applied the competing GSCM framework (48.7%). The environmental dimension was the most addressed (1303 papers in total), closely followed by the economic dimension (1285). The social dimension was addressed by 593 studies. Although this framework reflects the strong interest of authors in the environmental TBL, it is interesting to note how, in the agri-food sector, the number of publications focused on the SSCM model exceed those dedicated to the GSCM model, which implies that such issues are more pressing in this context.

Tab. 2: TBL dimensions addressed by sustainable supply chain papers

TBL dimension	Definition	N° of papers	N° of papers Agri-food industry
Economic	Production systems that satisfy present consumption levels without compromising future needs (Lobo *et al.*, 2015)	49	3
Environmental	Environment's ecological integrity and carrying capacity, and its continuous support to human life (Brodhag and Taliere, 2006)	81	5
Social	Systems of social organization that cover a wide range of issues, including poverty, human rights, gender equity and equality, public involvement (Farazmand, 2018)	20	1
Socio-economic	Focus on social and economic sustainability	39	4
Socio-environmental	Focus on social and environmental sustainability	25	2
Environmental and economic (GSCM)	Focus on economic and environmental sustainability, corresponding to the Green Supply Chain Management model	688	48
Environmental, social, and economic (SSCM)	Focus on economic environmental and social sustainability, corresponding to the Sustainable Supply Chain Management model	509	55

Source: the authors

3.2 Green and Sustainable Supply Chain Management in the agri-food sector: thematic mapping of investigated topics

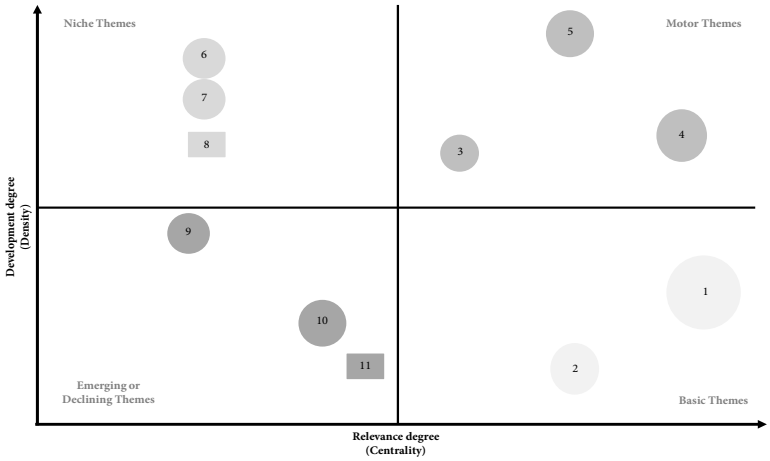
In order to advance knowledge of studies developed in the agri-food sector, thematic mapping based on keywords was applied to the subset of 118 papers. Thematic mapping is a bibliometric technique that allows researchers to classify topics as "basic", "motor", "niche" or "emerging / declining", based on the centrality and density of clusters. Thematic mapping is a way of representing findings that originates from the co-occurrence network analysis which is conducted on bibliometric metadata through clustering algorithms. In the present study, the edge betweenness algorithm applied to keywords identified 11 clusters of topics: details for each cluster are presented in Table 3, whereas Figure 4 shows their distribution according to the centrality/density matrix. The list of papers belonging to each cluster can be found in Appendix A.3. The analysis of the location of topics in the quadrants helps researchers identify the most relevant research trends and opportunities for future research. In this section we discuss each of the clusters, which are labelled using corresponding high-frequency keywords.

Tab. 3: Co-occurrence clusters of high-frequency keywords in the agri-food SSCM field

Cluster number	Keywords	Matrix quadrant	Frequency	Density	Centrality
1	Sustainable supply chain management; food industry; food supply chain; circular economy; food manufacturing; dynamic capabilities; global supply chain	Basic themes	83	47.83	1.23
2	Green supply chain management; environmental management system; operational performance	Basic themes	19	32.93	0.38
3	Supply chain; framework; institutional pressure	Motor themes	12	52.08	0.19
4	Sustainable supply chains; collaboration; eco-innovation; sustainable development; buyer-supplier relationships; standards	Motor themes	15	37.5	0.15
5	Environmental sustainability; green supplier selection; carbon emissions; life cycle assessment (LCA)	Motor themes	24	81.48	0.26
6	Corporate sustainability; retail; sustainable consumption and production	Niche themes	8	75	0.11
7	Data Envelopment analysis (DEA); performance measurement; undesirable outputs	Niche themes	10	68.1	0.15
8	Sustainable supplier selection	Niche themes	5	50.1	0.11
9	Corporate social responsibility; agricultural supply chain; green supply chain	Emerging or declining themes	6	50.2	0.25
10	Sustainable supply chain performance; sustainable performance	Emerging or declining themes	7	40.1	0.17
11	Emerging markets; base-of-the-pyramid	Emerging or declining themes	5	33.3	0.25

Source: the authors

Fig. 4: Thematic mapping of topics in the agri-food SSCM field



Source: the authors

3.2.1 Basic themes

The lower right quadrant comprises topics that are considered very important, even if they appear with relative low frequency. In mature field research, this quadrant includes established topics that have increasingly become less relevant as research progresses, but have the potential to become more relevant again, especially if addressed with innovative perspectives. The two clusters in this quadrant focus, respectively on the two major management frameworks (SSCM in Cluster 1 and GSCM in Cluster 2). Also, it should be noted that GSCM is associated with maintaining consistent operational performance - which is tied to the economic profitability of sustainable actions - and with the development of environmental managerial practices. The topics considered as "established" include the analysis of circular economy systems, the development of dynamic capabilities as relevant to sustainability implementation, and the study of global supply chains.

3.2.2 Motor themes

The upper right quadrant contains research topics with high relevance and high frequency of occurrence, and therefore constitutes the main focus of research in the field. Three research clusters are identified as follows. The first (Cluster 3), is concerned with the analysis and development of frameworks, with two main focuses. On the one hand, studies in this cluster thoroughly examine different production contexts and identify or develop solutions specific to individual supply chains. On the other hand, they also address the institutional pressure on achieving greater sustainability in supply chains with a bigger potential environmental and social impact. Studies in Cluster 4 analyze the topic of sustainable development through the lens of human relationships that lead to collaboration agreements for the definition of standards and innovations. Finally, Cluster 5 is concerned with the environmental pillar, either in terms of waste prevention (i.e. the Life Cycle Assessment approach) or green supplier selection.

3.2.3 Niche themes

The upper left quadrant identifies niche themes, namely topics that appear frequently but are considered less important than motor themes for the advancement of the field. This quadrant includes topics that are very specific in nature and that are being developed vertically. Cluster 6, the first niche area, is dedicated to the final stages of the supply chain, namely the distribution of sustainable products, through retailing and consumption studies. Cluster 7 emphasizes the issues related to performance measurement, specifically through the methodology of Data Envelopment Analysis (DEA) and DEMATEL math models. Finally, Cluster 8 concerns sustainable supplier selection. It is interesting to compare its positioning with that of green supplier selection, which is a motor theme. We posit that sustainable supplier selection research is still a niche area due to the lack of established measures for defining social sustainability criteria.

3.2.4 Emerging or declining themes

Topics in the lower left quadrant have low relevance and frequency of occurrence: these topics can therefore be identified as either declining or emerging, and have to be thoroughly examined. Cluster 9 can be considered a declining theme as it includes topics such as corporate social responsibility and green supply chains, which are well established among studies focusing on supply chain management models (GSCM and SSCM). Conversely, Cluster 10, which addresses sustainable supply chain performance, can be considered as an emerging topic due to the aforementioned need to identify relevant aspects that can improve the social sustainability of productions. Further investigation of this issue will also be able to advance research on niche topics such as sustainable supplier selection, following the definition of crucial social criteria. Finally, Cluster 11 includes all topics concerning emerging markets and base-of-the-pyramid sustainable management practices. Compared to global supply chains, which are a basic theme, a potential shift in research perspectives is identified. Research is in fact moving from the analysis of sustainable practices managed globally by multinational companies - even when they benefit actors in the supply chain situated in emerging countries - to the study of local supply chains and built-in solutions for these socio-economic contexts.

4. Discussion

The present study has presented a summary of the literature on Green and Sustainable Supply Chain Management over 2010-2023, a period that appears to be very dense in scientific works across various geographical and industrial contexts. As part of this study, special focus was paid to the agri-food sector, in terms of recursive dimensions (i.e. type of study and methodology adopted; diffusion of GSCM vs. SSCM models; identification of macro-themes according to the TBL paradigm) and topics of interests. Specifically, following the thematic mapping of topics, literature in the agri-food sector appears to be just as heavily fragmented due to the wide variety of contexts addressed: the supply chains investigated concern global or local/farm-to-table products, but also fresh, processed and/or preserved products. To clarify the thematic structure, clusters were categorized as basic themes, motor themes, and niche themes. The basic themes represent foundational topics frequently addressed across studies, such as environmental sustainability practices. The motor themes include areas that are both highly developed and influential in driving further research, such as HR sustainability and integration of TBL dimensions. The niche themes refer to emerging or less explored topics, such as retailing strategies or sustainable supplier selection. Each cluster has been contextualized with references to prior studies to highlight its significance and links to existing literature.

A call for more research on the generation of new local distribution networks emerges, with particular relevance for emerging markets and

countries, as well as on conciliation between small actors in the supply chain and large-scale producers and retailers. Retailing is still a "niche theme", despite retailers often being the focal firm of agri-food supply chains, which could also promote eco-innovations upstream as well as enhance collaborations among the other supply chain actors. This prioritization is particularly relevant in light of recent supply chain regulations, which increasingly require traceability, sustainability reporting, and compliance with labor and environmental standards. In this sense, it would be relevant to integrate HR sustainable development, which is already a motor theme, with a perspective specifically addressing how HR management can contribute to the dissemination of sustainable culture and operations upstream and downstream.

Another significant insight is that more papers were published on SSCM than on GSCM despite the fact that the social dimension is still understudied - with respect to the environmental and economic dimensions - in the agri-food sector, therefore implying an advancement in addressing social issues. This is unusual since the literature as a whole still heavily addresses GSCM, even if SSCM is a growing field of research. Nevertheless, more studies on social sustainability are called as a major research opportunity in the agri-food sector. This is consistent, for example, with sustainable supplier selection being still a "niche" theme with respect to green supplier selection. In this sense, we identify two main issues to be addressed. The first issue concerns the need to identify objective measures of corporate social risk and social performances and achieve greater effectiveness in their evaluation (Tundys and Wisniewski, 2018). Recent studies (e.g. Malak-Rawlikowska *et al.*, 2019; Arcese *et al.*, 2023) have been trying to identify socially-centered criteria for the self-assessment of companies and for well-informed supplier selection along the supply chain. Nevertheless, most of these works are theoretical or based on mathematical modeling and need to be tested with more field studies on actual supply chains. This is particularly important for the agri-food sector, where many issues are specific to different products. New classifications may therefore be required in order to maintain consistency with such specificities. Furthermore, social goals must be effectively systematized and integrated with pre-existing economic and environmental goals and related measures (Ecer and Pamucar, 2020). One suggested future research perspective is investigating the potential of integration between different TBL dimensions and between GSCM and SSCM models. The second issue arises from the variety of subjects directly benefiting from socially sustainable actions. Environmentally sustainable actions tend to benefit society as a whole - by improving life quality and well-being and by preserving resources for future generations -, whereas socially sustainable ones are designed to fit the interests of a specific target. In the agri-food sector, both the internal members of the supply chains (workers, employees, small independent entrepreneurs acting as suppliers, their families and communities, etc.) and consumers are relevant targets. As regards the former, a wide variety of socially sustainable actions is found. As for consumers, product safety is a core issue that has to be guaranteed along the supply chain, followed by consistent packaging information (Delai and Takahashi, 2013; Acosta *et al.*, 2014). Moreover,

increasing the propensity of customers towards sustainable purchases - and encouraging responsible consumption and nutritional choices - is crucial for driving changes and shifts in agri-food production chains. Due to their visibility and proximity, retailers and large-scale producers should therefore be considered not only as powerful actors in the supply chain but also as influencers and promoters towards customers. From the literature review, it emerges that only a limited number of studies explicitly address the requirements and requests of final consumers in the design of sustainable supply chain management practices, despite the fact that many authors have shown that demand is driving the main shifts in sustainability (Busch and Spiller, 2016; Petljak *et al.*, 2018; Longoni and Cagliano, 2018; Dhaoui *et al.*, 2020). The contribution of food retailers and large producers also involves coordinating the reduction of food waste and loss through the identification of more efficient production systems, on one hand, and new ways of salvaging food on the other (Principato *et al.*, 2023). For details on sustainable social actions, ranked by range and degree of involvement, see Appendix A.4.

Finally, we suggest that there is room for new, cross-sectoral studies. From our analysis, it emerged that extant studies have mostly compared industries (e.g. agri-food vs. automotive). Agri-food supply chains, however, have significant interactions with other supply chains, with implications on the overall impact of the chains themselves. Examples are the chemical industry (fertilizers and veterinary products), the transport and logistics sector, and the hospitality industry - where restaurant and catering services share the need to converge "lean and resource-efficient" production with "local and seasonal" agricultural goods. Highlighting the interaction among these clusters and aligning them with both recent academic findings and regulatory requirements allows the discussion to more clearly reflect practical relevance and scientific contribution.

5. Limitations and future research

The present work is not without limitations. The biggest limitation is the methodology used in the selection of the literature to be reviewed. Having chosen the approach proposed by Rajeev *et al.* (2017), only publications in English taken from A/B journals were selected. Expanding the dataset would have led to the identification of specific, original contexts addressed in papers published in national journals. As such, this could represent another opportunity for future research that could mix an industrial-based approach with the analysis of geographical contexts and countries.

6. Conclusion

In conclusion, the results of this study provide a comprehensive overview of GSCM and SSCM research in the agri-food sector, identifying key themes, fragmentation in the literature, and emerging opportunities for further study. The main contributions include highlighting gaps in social sustainability, emphasizing the strategic role of retailers and large producers, and identifying areas where the integration of TBL dimensions

could strengthen both theoretical and practical outcomes. Overall, the study offers guidance for academics and practitioners who aim to design sustainable supply chain strategies that address multiple dimensions and actors.

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Appendix A. Supplementary Data

Tab. A.1: Sustainability-related publications on supply chain management

INDUSTRY CODING	SCM	SSCM	TOT.
[Papers without a specific industry focus]	256	174	430
Manufacturing industries (multiple)	279	108	387
Materials, mining, energy	54	32	86
Agri-food and wine productions	54	26	80
Luxury, fashion and textile	37	37	74
Transports and logistic services	41	19	60
Electronics	38	12	50
Food retail	13	10	23
Housing and constructions	16	6	22
Chemical	13	8	21
Utilities and communications	15	5	20
Hospitality, catering, tourism	10	8	18
Governmental bodies & NGOs	10	6	16
Healthcare & Pharmaceutical	9	5	14
Papers comparing multiple industries	12	14	26

118 agri-food papers: 80 "agri-food and wine productions", 23 "Food retail", 1 "Comparison"

Tab. A.2: Sustainability-related publications on food supply chain management

Source	Issue and objective of the study	Dimension addressed
Beske *et al.* (2014)	Identify dynamic capabilities related to sustainable supply chain management practices, by conceptualizing supply chains as knowledge-sharing environments. Dynamic capabilities and SSCM practices are integrated as ways to enhance traceability and tracking and to fulfill customer demands.	SSCM
Dania *et al.* (2018)	Investigate the landscape of collaboration behavioural factors in sustainable agri-food supply chain management literature. The study adopts the Resource Dependency Theory while reviewing contributions and identifies 10 key behavioural factors.	SSCM
Govindan (2018)	Identify theories underlying sustainable consumption and production, as well as indicators, drivers and barriers, within the food industry.	SSCM
Nematollahi and Tajbakhsh (2020)	Propose a review on sustainable agricultural supply chains, with a focus on crop-based and livestock sectors that are monitored by eco-social corporate initiatives or government sustainability-driven legislation.	GSCM
Adams *et al.* (2021)	Illustrate the state-of-the-art of food manufacturing operations in sustainable supply chains, through a comparison between SMEs and large multinational companies.	Social & Environmental
El-Bilali *et al.* (2021)	Define the boundaries of the research strand on agri-food systems - that include food supply chains among their elements - in terms of environmental, economic, social and political sustainability dimensions.	SSCM
Palazzo and Vollero (2021)	Identify building blocks and main research directions in food sustainable supply chains, particularly considering the opportunities in neglected emerging countries.	SSCM
Siems *et al.* (2021)	Scrutinize the interlinkage and distribution of dynamic capabilities in sustainable supply chain management literature of two distinctive sectors - food vs. automotive industry - and provide a temporal perspective by comparing two periods.	SSCM
Lwesya and Achanta (2022)	Present research trends in food supply chains in developed and developing countries. The study focuses on changes in food systems due to globalization, urbanization, environmental concerns, new consumption patterns and new technologies.	GSCM
Caccialanza *et al.* (2023)	Systematize management and agriculture literature concerned with the sustainability of the meat supply chain.	SSCM

Tab. A.3: Sustainability-related publications on food supply chain management

Cluster number	Keywords	Papers
1	Sustainable supply chain management; food industry; food supply chain; circular economy; food manufacturing; dynamic capabilities; global supply chain	Pullman and Dillard (2010); Beske *et al.* (2014); Christ (2014); Grimm *et al.* (2014); Chkanikova (2016); Colicchia *et al.* (2016); Tidy *et al.* (2016); Sgarbossa and Russo (2017); Varsei *et al.* (2017); Postacchini *et al.* (2018); Silvestre *et al.* (2018); Gruchmann *et al.* (2019); Nematollahi and Tajbakhsh (2020); Adams *et al.* (2021); Kuchler and Herzig (2021); Nunes *et al.* (2021); Siems *et al.* (2021); Vandchali *et al.* (2021); Guimaraes *et al.* (2022); Mahroof *et al.* (2022); Mastos and Gotzamani (2022); Mastos *et al.* (2022); Palazzo and Vollero (2022); Tseng *et al.* (2022b); Le (2023); McLoughlin *et al.* (2023); Munch *et al.* (2023)
2	Green supply chain management; environmental management system; operational performance	Savino *et al.* (2015); Bala *et al.* (2017); Kirilova and Vaklieva-Bancheva (2017); Sharma *et al.* (2017); Longoni and Cagliano (2018); Banasik *et al.* (2019); Kumar *et al.* (2019); Trivellas *et al.* (2020); Maaz Mam-Ahman *et al.* (2022); Zhang *et al.* (2022)
3	Supply chain; framework; institutional pressure	Grekova *et al.* (2014); Leigh and Li (2015); Montoya-Torres *et al.* (2015); Signori *et al.* (2015); Sayed *et al.* (2017); Rajabion *et al.* (2019); McLoughlin and Meehan (2021); Naderi *et al.* (2021); Tapia-Ubeda *et al.* (2021); Shahzad *et al.* (2022)
4	Sustainable supply chains; collaboration; eco-innovation; sustainable development; buyer-supplier relationships; standards	Touboulic and Walker (2015); Li *et al.* (2016); Brennan and Tennant (2018); Dewick and Foster (2018); Carmagnac and Carbone (2019); Glover, (2019); Perez-Mesa *et al.* (2019); Do Canto *et al.* (2021); Chkanikova and Sroufe (2021); Gloet and Samson (2022); Lwesya and Acantha (2022); Tseng *et al.* (2022a)
5	Environmental sustainability; green supplier selection; carbon emissions; life cycle assessment (LCA)	Govindan *et al.* (2017); Banaeian *et al.* (2018); Shi *et al.* (2018); Pelton (2019); Phochanikorn and Tan (2019); Manocha and Srai (2020); Misopoulos *et al.* (2020)
6	Corporate sustainability; retail; sustainable consumption and production	Delai and Takahashi (2013); Validi *et al.* (2014); Berning and Venter (2015); Frostenson and Prenkert (2015); Sehnem and Oliveira (2017); Dhaoui *et al.* (2020); Silva *et al.* (2022)
7	Data Envelopment analysis (DEA); performance measurement; undesirable outputs	Hadiguna and Tjahjono (2017); Badiezadeh *et al.* (2018); Phochanikorn and Tan (2019); Chand and Tarei (2021); Do and Huang (2022); Izadikhah *et al.* (2022); Vaez-Ghasemi *et al.* (2022)
8	Sustainable supplier selection	Acosta *et al.* (2014); Zhou and Xu (2018); Liu *et al.* (2019); Brix-Asala *et al.* (2021); Emberson *et al.* (2022)
9	Corporate social responsibility; agricultural supply chain; green supply chain	Soler *et al.* (2010); Sharma *et al.* (2015); Ali *et al.* (2017); Bayne *et al.* (2019); Manikas *et al.* (2019); Naseer Maur *et al.* (2019); Packer *et al.* (2019); Li and Zhu (2020); Deng *et al.* (2021); Hu and Li (2022)
10	Sustainable supply chain performance; sustainable performance	Erol *et al.* (2011); Genovese *et al.* (2017); Petljak *et al.* (2018); Zaid *et al.* (2018); Pohlmann *et al.* (2020); Khan *et al.* (2021); Yontar and Ersoz (2021); Yang *et al.* (2021)
11	Emerging markets; base-of-the-pyramid	Gold *et al.* (2013); Gomez-Luciano *et al.* (2018); Pakdeechoho and Sukhotu (2018); Seuring *et al.* (2019); Liu *et al.* (2021); Le *et al.* (2022a); Le *et al.* (2022b); Singh and Srivastava (2022)

Tab. A.4: Socially sustainable actions in agri-food supply chains

INDIVIDUAL COMPANY IN THE SUPPLY CHAIN	- Workers' average annual training time - Annual number of applied innovative ideas generated by employees - Annual personnel turnover - Annual number of recordable incidents with respect to harassment and violence - Annual number of recordable accidents	Erol *et al.* (2011); Kirci and Seifert (2015); Liu *et al.* (2019); Brix-Asala *et al.* (2021); Mastos and Gotzamani (2021); Naderi *et al.* (2021); Singh and Srivastava (2022); Tseng *et al.* (2022a)
	- Gender diversity - Inclusion and hiring policy for vulnerable population	Erol *et al.* (2011); Delai and Takahashi (2013); Acosta *et al.* (2014); Sgarbossa and Russo (2017); Brix-Asala *et al.* (2021); Mastos and Gotzamani (2021); Naderi *et al.* (2021)
	- Avoidance of exploitative forced and child labour	Bastian and Zentes (2013); Acosta *et al.* (2014); Brix-Asala *et al.* (2021); Mastos and Gotzamani (2021); Emberson *et al.* (2022); Singh and Srivastava (2022); Tseng *et al.* (2022a)
	- Effectiveness of personnel recruitment, selection and training - Employees' sensitivization on human rights - Externalities in terms of new employment possibilities	Erol *et al.* (2011); Delai and Takahashi (2013); Berning and Venter (2015); Sgarbossa and Russo (2017); Zhou and Xu (2018); Silva *et al.* (2020); Mastos and Gotzamani (2021); Singh and Srivastava (2022)
	- Organization's openness to stakeholder involvement in decision making - Structured CSR policies or programs with stakeholders, involving all management levels	Erol *et al.* (2011); Acosta *et al.* (2014); Kirci and Seifert (2015); Pakeechocho and Sukhotu (2018); Zhou and Xu (2018); Carmagnac and Carbone (2019); Gruchmann *et al.* (2019); Packer *et al.* (2019); Pohlmann *et al.* (2020); Silva *et al.* (2020); Mastos and Gotzamani (2021); Gloet and Samson (2022)
RELATIONS BETWEEN MULTIPLE ACTORS IN THE SUPPLY CHAIN	- Fair trade with all participants in the supply chain and avoidance of one-sided dependencies or insolvencies in the chain - Avoidance of non-compliant business practices throughout the supply chain (e.g. bribery, intimidation and price agreements)	Bastian and Zentes (2013); Delai and Takahashi (2013); Signori *et al.* (2015); Touboulic and Walker (2015); Chkanikova (2016); Gomez-Luciano *et al.* (2018); Pakeechocho and Sukhotu (2018); Pohlmann *et al.* (2020); Brix-Asala *et al.* (2021); Mastos and Gotzamani (2021); Vandchali *et al.* (2021); Singh and Srivastava (2022)
	- Payment of fair and adequate wages for all workers in the supply chain - Freedom of association and protection of rights to organize and to bargain collectively for all workers in the supply chain	Bastian and Zentes (2013); Delai and Takahashi (2013); Acosta *et al.* (2014); Stiller and Gold (2014); Signori *et al.* (2015); Pakeechocho and Sukhotu (2018); Zhou and Xu (2018); Pohlmann *et al.* (2020); Mastos and Gotzamani (2021); Singh and Srivastava (2022); Tseng *et al.* (2022a)
	- Normalization of prices towards farmers, so that they are not affected by commodity prices over the year - Premium, above-average prices paid for organic products - Long-term contracts and commitments for improvements along the supply chain - Reward-and-incentive systems and cross-insurance mechanisms - Active training and alignment of sustainable goal with suppliers	Pullman and Dillard (2010); Stiller and Gold (2014); Touboulic and Walker (2015); Chkanikova (2016); Bala *et al.* (2017); Gomez-Luciano *et al.* (2018); Carmagnac and Carbone (2019); Gruchmann *et al.* (2019); Seuring *et al.* (2019); Fracarolli-Nunes *et al.* (2020); Brix-Asala *et al.* (2021); Vandchali *et al.* (2021); Gloet and Samson (2022)
LOCAL COMMUNITY	- Fraction of total sales invested for social projects; - CSR / social projects developed within the local community	Erol *et al.* (2011); Delai and Takahashi (2013); Acosta *et al.* (2014); Zhou and Xu (2018); Packer *et al.* (2019); Toussaint *et al.* (2021); Le *et al.* (2022)
	- Ensure that farming and production conditions throughout the supply chain do not endanger the health of workers or residents in the area	Bastian and Zentes (2013); Validi *et al.* (2014); Genovese *et al.* (2017); Pakeechocho and Sukhotu (2018); Pohlmann *et al.* (2020); Toussaint *et al.* (2021); Le *et al.* (2022); Tseng *et al.* (2022b)
	- Improvement of social environment in regions of origin, farming areas and production sites (e.g. educational system, health care and food supply for local population	Bastian and Zentes (2013); Gold *et al.* (2013); Carmagnac and Carbone (2019); Packer *et al.* (2019); Pohlmann *et al.* (2020); Toussaint *et al.* (2021); Le *et al.* (2022); Tseng *et al.* (2022b)

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