Green logistics practices in the food sector: a framework

Giulia Galli*, Chiara Siragusa*, Marco Melacini*,
Alessandro Perego*, Angela Tumino*
**Department of Management, Economics and Industrial Engineering, Politecnico di Milano, Via Lambruschini 4/B, 20156 – Milano – Italy*
giulia.galli@polimi.it, chiara.siragusa@polimi.it, marco.melacini@polimi.it, alessandro.perego@polimi.it, angela.tumino@polimi.it

Abstract: There is an increased attention to environmental sustainability in the food industry, given the raising concerns about emissions it produces. Logistics is a key component in the carbon footprint of food products, with emissions from infrastructures and means of transport significantly impacting the environment. In response to this, novel distribution practices within the food supply chain have emerged, aimed at reducing the impact of the product in its whole life cycle. Despite this, existing literature lacks a comprehensive framework that systematically summarises these evolving practices, with logistics often relegated to a peripheral role within broader green supply chain frameworks. This study aims to bridge this gap by developing a bespoke framework tailored specifically for sustainability practices in the logistics stage of food companies. The review of approximately 100 papers has produced useful insights. Firstly, theoretical lenses related to green supply chain management and systems theory are analysed to provide context. Secondly, empirical topics linked to green logistics practices used in the food industry are studied. Sustainability reports from various food companies have enriched the findings by integrating the framework with real-world implementations. The outcome is the compilation of a list of green practices classified in a novel taxonomy. The resultant framework classifies approximately 200 distinct practices, which span various categories, including network design, warehouse management, transport, packaging, reverse logistics, and offsetting strategies. Emphasis was placed on clarifying the role of Industry 4.0 technologies in enhancing logistics sustainability. The contribution of this study is both theoretical, as it fills the gap in the literature, and practical, as it gives managers actionable insights to facilitate their transition toward greener logistics practices. Future research could delve deeper into evaluating the effectiveness of these identified practices in terms of their tangible environmental impacts and in terms of their economic viability.

Keywords: Green Logistics, Environmental Sustainability, Food, Framework

1. Introduction

The importance of environmental sustainability is growing in society, as actors such as companies, governments, and individuals understand the role it plays to guarantee the well-being of future generations (United Nations, n.d.). Integrating sustainability into corporate strategies is a requisite for being competitive, as internal and external players push to adopt greener practices (World Economic Forum, 2022). Some industries impact more than others on the emissions released. The Independent's ranking of industries by emissions placed agriculture in the 4th position and food retail in the 5th one (The Independent, 2023). In the lifecycle of food products, production accounts for more than 70% of the emissions. The next most crucial phases are food processing (10%) and logistics (5%) (Notarnicola et al., 2017). Even if the impact of logistics can seem low, its absolute value is far from being negligible, and the diffusion of green logistics is of foremost relevance. According to the World Economic Forum, logistics and transport account for 13% of the total emissions worldwide. Warehouse accounts for 11%, with the remaining 89% coming from transport.

The topic is thus very relevant and worth studying, both from an academic and a practical point of view. However, in the analysis of literature, a specific framework that classifies green logistics practices in the food industry was not found. The existing frameworks consider logistics only as a subcategory of wider supply chain frameworks. While this is useful for analysing the interconnections, logistics is only given a peripheral role and not given enough attention. In other instances, practices are individually analysed, but no interrelations are studied. The need to produce a specific and comprehensive framework for logistics stems from the impact food distribution has on the environment, that can be reduced with green practices. A summary of these practices is a first step towards the improvement of the environmental footprint of food logistics. The aim of this work is therefore to fill in the gap, by analysing and classifying green distribution practices in the food supply chain, thus expanding the concepts of Green Supply Chain Management and Green Logistics.

The paper is organized as follows: paragraph 2 introduces the methodology; paragraph 3 analyses the current literature; paragraph 4 introduces the new taxonomy; paragraph 5 critically analyses the results; paragraph 6 is dedicated to concluding remarks.

2. Methodology

First, an analysis of the literature has been carried out. The analysis of concepts such as Green Supply Chain Management (GSCM) and Green Logistics helps to set the background of the analysis. Moreover, given the framework isolates one stage of the supply chain, it is necessary to consider the links between this framework and the other stages of the supply chain. The analysis of systems theory provides a useful basis for the interpretation of results, as it helps defining the interconnections between different practices, functions, divisions, actors, and supply chains. For the list of practices, a first narrative analysis aims at analysing green practices in various industries and in various parts of the supply chain, focusing on distribution. A second systematic review focuses on the food sector and on logistics. Moreover, classifications of existing practices are analysed.

Regarding the mentioned systematic review, with the keywords, 843 papers were found. After applying the filter for the subject area, 273 papers were excluded, arriving to a sample of 570. Filtering for document type, the sample was downsized to 543 papers. 16 of these were not in English, and the sample narrowed down to 527. By reading the abstracts, only 86 were deemed pertinent and analysed. 5 papers are added based on the most relevant references. The papers are integrally read, and a further elimination of papers that proved not to be relevant is performed, leading to the exclusion of 26 papers. The 65 remaining papers form the final sample.

At the same time, secondary sources ranging from sustainability reports to companies' websites are analysed. 17 sustainability reports were studied. The output of these two concurrent analyses is a list of green logistics practices that will be then classified in the novel taxonomy, after the classification categories are defined.

The second step involves developing a novel classification framework, which focuses specifically on distribution in the food industry. The categories are defined based on the literature analysis of current supply chain frameworks and based on the similarities of practices collected. After that, practices are classified. This means firstly selecting from the list of practices the ones that are relevant. Secondly, defining the practices identified. Lastly, classifying the different practices in the framework previously designed. One practice can be classified in more than one field.

The overall methodology, as explained in this paragraph, is graphically summarised in Figure 1.

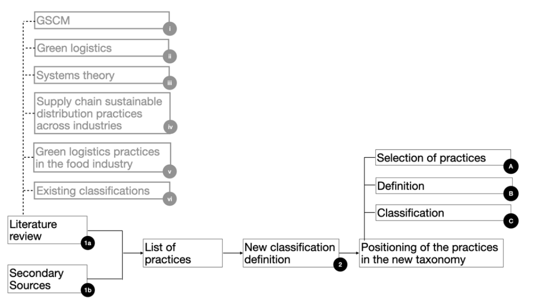

Figure 1: Graphical representation of the methodology

3. Literature review

To better understand the wider context where green logistics practices exist, an analysis of the concept of GSCM was carried out. The most important characteristic identified in its definitions is the inclusion in supply chain management of environmental criteria and/or the minimization of negative effects on the environment of supply chain practices (Albino et al., 2009; Andic et al., 2012; Chen, 2013; Murtagh & Badi, 2020), with the integration of the economic performance in some cases (Büyüközkan & Çifçi, 2012). Focusing specifically on the definition of Green Logistics, the main aim of this activity is reducing environmental harm (Yubo et al., 2011) with the goal of sustainable development (Liu & Yuan, 2012), similarly to GSCM. Green logistics is linked to the concept of reverse logistics. However, as it is specified in literature (Bajdor, 2012), reverse logistics is only a part of green logistics. To analyse the interdependencies between various practices, stages of the supply chain, actors, and value chains, system theory may offer a useful theoretical lens. The concept of systems theory was initially introduced by Von Bertalanffy. In one of his articles (Von Bertalanffy, 1972) he explained the different connotations of systems theory. One of the applications of systems theory, of interest to the present work, is the application to management (Kast & Rosenzweig, 1972). According to systems theory, any institution constitutes a cohesive, integrated structure comprising various interconnected subsystems. Moreover, the systems examined within different disciplines exhibit several common characteristics (Fillieule, 2001).

To classify green logistics practices, the examination of existing classifications was carried out. The main classifications involve categorizing in terms of area, such as for the ESG (Tsang et al., 2023) or triple bottom line classification (Carter & Rogers, 2008; León-Bravo et al., 2017; Kusi-Sarpong et al., 2019; Viu-Roig & Alvarez-Palau, 2020), or in terms of supply chain stage (Eltayeb & Zailani, 2014; Karimi & Rahim, 2015; Despoudi, 2020; Kalpande & Toke, 2021; Das & Jharkharia, 2019; Amemba et al., 2013, Tseng et al., 2019; Luthra et al., 2014; Maditati et al., 2018; Asif et al., 2020). Some practices fit in more than one category and are analysed separately, such as internal environmental management, collaboration, training, or new technologies. Another framework classifies practices on two axes. The first one categorizes practices upstream, practices in the focal company, and practices downstream. The other axis considers the impact (Azevedo et al., 2011). A common classification separates the following categories: internal environmental management, green purchasing, customer environmental collaboration, investment recovery, reverse logistics, design for environment, supplier environmental collaboration (Diabat et al., 2013; de Sousa Jabbour et al., 2015; Qin et al., 2021, Sadeghi Asl et al., 2023; Herrmann et al., 2021).

From the analysis of primary and secondary sources, it emerged that a comprehensive framework focused on green logistics in the food industry is missing. Existing classifications are all at a supply chain level. The aim of this work is to fill in this gap, by analysing and classifying green distribution practices in the food supply chain.

4. Introduction of the new taxonomy

Table 1: New classification

Network design		
Infrastructures / Nodes	Building improvement	*Energy efficiency*
		Refrigerants
		Water
		Wastage
	Processes	*Inventory management*
		Handling
		Storage
		Waste management
		Other operations
	Collaboration	
Distribution	Type of transport	*FTL*
		Last Mile
	Means of transport	*Fuel*
		Mode
	Driver's behaviour	
	Management	*Routes*
		Spaces
	Collaboration	
Packaging	Materials	
	Size	
	Management	
Reverse logistics		
Compensation		
Other	Management Systems	
	Training	
	Result monitoring	
	Standards compliance	
	Strategy	
	Collaboration	
	Noise pollution	
Notes	Innovation technology	

The new classification, as represented in Table 1, concentrates on the distribution aspect of various food products. As shown in table 1, the classification involves three levels: a macro category that analyses the stage of the supply chain; a category that examines the domain in which practices are operational; a micro category that considers the improvements introduced by the practices.

Network design (Dukkanci et al., 2019) aims at designing the distribution system, in terms of number of levels, of nodes for each level, type of node, location. Some examples of practices are centralized warehouses, port centric logistics, a network of grocery lockers, shorter supply chains. Practically, a company can decide to redesign its network according to the mentioned practices, for example introducing a central warehouse near a port, to increase the use of intermodal transportation and to optimize the flows.

Infrastructures/Nodes (Despoudi, 2020) relates to improving the efficiency of warehouses or transit points. In particular, the building improvement (Qian et al., 2022) section explains what practices can be used inside the building to improve its environmental sustainability. The first improvement regards energy efficiency (Despoudi, 2020; Tsang et al., 2023; Choudhary & Sangwan, 2019; Qian et al., 2022), with practices such as using LED lights, building insulation, installation of electrostatic filters and inverters. Refrigerants (Neusel & Hirzel, 2022) refer to the improvement of the process used to keep food products cold. Some practices are the transition to refrigerants with lower global warming potential or the reduction of the consumption of hydrofluorocarbons. Water (Tsang et al., 2023; Choudhary & Sangwan, 2019) involves the optimization of the use of water and can relate to the reduced usage of water, reduced pollution, or the treatment of wastewater after use. For example, the installation of technologies such as timers can help reduce the amount of water used in operations. Wastage (Qian et al., 2022) refers to the leakage of energy, water, refrigerants, fuel, and other substances. Examples could be monitoring and fixing compressed air losses, heat recovery, insulation to contain heat loss, proactive leak monitoring. Practically, a company can change the lighting system to introduce newer and less polluting technologies or switch to less polluting refrigerants. Moreover, a system to treat water after use can be introduced. Another category in the field of nodes greening is processes. This refers to the operations, activities, and the systems in support of those carried out in the warehouse. Inventory (Kumar et al., 2023) refers to the sizing of stock. This influences the dimension of the building and therefore its carbon footprint. Some activities can be reducing inventory or sharing of warehouses. Handling (Kunrath et al., 2023; Tsang et al., 2023) refers to the tasks involved in the movement, sorting, and placing of goods. One example relates to the use of Industry 4.0 technologies, such as artificial intelligence or machine learning. Moreover, the use of drones is in this category. Storage (Accorsi et al., 2022) refers to the system aimed at storing, retrieving, and managing goods or information. Scaling dimension of containers to optimize the density of products or sharing warehouses are some examples. Waste management (Tsang et al., 2023) includes practices aimed at disposing the waste inside the node, such as recycling, energy recovery, or a zero-waste gardening system. Other operations is a residual category that includes operations not previously studied. Examples are preventive maintenance, training, paperless operations. Collaboration (León-Bravo et al., 2017) is linked to all the activities that are done in cooperation with other departments, other actors inside the supply chain, or outside. A trivial example is warehouse sharing. Practically, a company could collaborate with other actors to introduce a shared warehouse. Moreover, the company could introduce Logistics 4.0 features, such as autonomous vehicles for handling goods.

The third macro category is distribution (Despoudi, 2020), which is related to the logistic activities aimed at physically moving the goods from one node to the other or between actors. The type of transport relates to the difference between primary and secondary transport. Full Truck Load usually refers to the movement of goods from the production site to the warehouse, or between different warehouses. Last mile delivery entails transport from the warehouse to the points of destinations, usually in the urban area. Means of transport (Das & Jharkharia, 2019; Ueasangkomsate & Suthiwartnarueput, 2018) is an area in which companies can act. Specifically, fuel (Tsang et al., 2023; Das & Jharkharia, 2019) is one key driver of emissions. The company can choose to use alternative fuels with respect to gasoline, for example CLNG or electric vehicles. The mode (Das & Jharkharia, 2019) of transport refers to the method used to physically transport the goods, for example road, railway, ship, plane, or even intermodal transport. Driver's behaviour (Fritz & Ruel, 2024), with activities such acceleration, deceleration, gear switch, also has an impact on pollution. Management (Ueasangkomsate & Suthiwartnarueput, 2018) is the planning of the trip and of the spaces in vehicles. Routes (Ueasangkomsate & Suthiwartnarueput, 2018) planning can be addressed to optimize the routing to achieve the best possible option in terms of kilometres travelled. Also, routes in which the driver's behaviour is optimized are preferable. Spaces (Ueasangkomsate & Suthiwartnarueput, 2018; Accorsi et al., 2022) planning is another driver. This refers mostly to saturation of the vehicle, in terms of weight or space. Saturation increases the fuel used, but reduces the number of journeys needed, with a net effect of emission reduction. Collaboration (Das & Jharkharia, 2019; León-Bravo et al., 2017) refers to practices in cooperation with other departments, other actors of the supply chain, or outside the supply chain. For example, sharing the same means of transport. Practically, a company could switch to electric vehicles for last mile delivery or, as exemplified above, increase intermodal transport.

Packaging (Morgan et al., 2022; Tsang et al., 2023; Choudhary & Sangwan, 2019; Bradley & Corsini, 2023; Zhu et al., 2010) is the fourth macro category. It can be divided in primary, secondary, and tertiary. Materials (Morgan et al., 2022; Zhu et al., 2005; Tsang et al., 2023) are of foremost importance. Using recycled, recyclable, biodegradable materials can help reduce the impact of the product. Size (Tsang et al., 2023) is also critical: reducing the amount of material used in packaging reduces the impact as less material is used and produced, and less material goes to waste. Management (Bradley & Corsini, 2023) involves activities such as the development of infrastructures to enhance the retrieval of returnable packaging or to refill refillable packaging. In practice, a company could reduce the use of virgin plastic and increase the use of recycled materials for packaged foods.

Reverse logistics (Tsang et al., 2023; Kazancoglu et al., 2021; Despoudi, 2020; Ali, 2022; Sellitto, 2015; Sellitto, 2018) refers to the process of moving goods from their final destination back to the manufacturer or another point in the supply chain. Used products can be reused, remanufactured, refurbished. A company could, for example, introduce returnable packaging, that could be collected after use and reintroduced in the supply chain for further use.

Compensation (Acampora et al., 2023) is related to activities of carbon offsetting. Some examples could be buying carbon credits on the market or initiating a campaign to plant trees.

The section other involves all the activities that are valid across all stages of the logistics process. Management systems (Zhu et al., 2012; Zhu et al., 2010; Kalpande & Toke, 2021) are processes implemented by organizations to effectively plan, execute, monitor, and improve their activities. Training (Tsang et al., 2023) can be internal training or training in collaboration with external actors. Result monitoring (Kumar et al., 2023) is related to the matching of the actual results with the objectives, to identify where and how to act to improve the performance. Standards compliance (Acampora et al., 2023) refers to adherence to legal or other recognized requirements that can act as a guideline to improve companies' sustainable performance. Strategy (Tsang et al., 2023; Jia et al., 2023) is related to the higher definition of an approach that prioritizes the environmental performance, with practices such as the existence of an environmental department or the inclusion of environmental criteria in the definition of KPIs. Collaboration (Kalpande & Toke, 2021; León-Bravo et al., 2017), as stated before, refers to cooperation with other departments, with actors of the supply chain, or outside the supply chain. Noise pollution (Amirian et al., 2022) is considered separately. Some notes are necessary. One such note is innovation technology (Kumar et al., 2023), with practices such as artificial intelligence, machine learning, the use of drones. For example, a company could introduce a sustainability department or a monitoring process. Moreover, collaboration with external actors for employee sustainability training could be considered. In addition, renovating equipment with new and more technological machines could help in emission reduction.

5. Critical discussion

This paper represents an expansion of the concept of GSCM with a particular focus on logistics, broadening the current topic of Green Logistics. When considering logistics from a systems standpoint, various synergies emerge, especially among practices, categories, divisions, companies, and supply chains. Systems theory helps in defining the interconnections between the various categories analysed. Even if the practices are applied in different parts of logistics, these parts are linked and share a common objective, which is the reduction of emission and the improvement of environmental performance. Moreover, logistics is considered as an open system, that interacts with the external environment. For example, sharing warehouses or means of transport involves cooperation between various actors and different supply chains, who act as a system. This practice helps both reducing costs and emissions.

In terms of number of solutions analysed, the majority falls under the infrastructure/nodes category. This is interesting given that, as stated in the introduction, most emissions come from transport. In secondary sources as well, nodes are given more attention than transport. However, the distribution category is still relevant, especially the selection of means of transport and alternative transport modes.

A difference between the practices studied in theory and in practice was found. Practitioners mainly focus on some specific aspects. Apart from sustainable sourcing, which is less linked to logistics, they mainly focus on renewable energy and resource consumption, specifically water, energy, and waste. Other relevant categories are packaging and transport modes. Literature offers instead a more varied range of solutions. One of the most analysed solutions is alternative food networks (Jia et al., 2023, Accorsi et al., 2022). This usually involves localizing and shortening food chains, thus reducing food miles. However, this is not widely applied by big actors in practice, who prefer to reduce miles by optimizing routes. Another aspect more diffused in theory is reverse logistics (Vijayan et al., 2014). Circular economy is considered by practitioners with the use of reusable packaging, but the logistics part is less analysed. One aspect that is instead given more attention in practice versus literature is certifications. Certifying products helps demonstrating the efforts, but many different certifications exist, and it could be interesting to compare the various options. Compensation of emissions is also more mentioned in practice.

Almost 10% of the practices could be linked to new technologies. Logistics 4.0 is widely studied in theory. The technological innovation is given attention in practice as well, but the link to sustainability is clearer in literature (Kouhizadeh et al., 2021; Rejeb & Rejeb, 2020). Some examples could be the use of autonomous vehicles, the use of drones, the implementation of artificial intelligence and machine learning techniques in routing.

6. Conclusion

The identification of green logistics practices in the food supply chain is of critical importance given the relevance of emissions in the industry and in particular in the distribution stage. In this study, literature was analysed, and a gap was found, as a green logistics framework for food companies is not present in literature. However, practices are present in papers that study individual practices, in papers that include logistics practices in wider supply chain frameworks, and in sustainability reports of companies. These practices were summarised and included in a novel classification.

This study enhances the existing literature by consolidating green logistics practices and organising them into a dedicated taxonomy. Moreover, the present work also helps practitioners in identifying possible new solutions in various stages of the logistics function to reduce emissions and improve sustainability. The analysis of both primary and secondary sources was of foremost importance to compare similarities and differences: this work serves as bridge, as practices that are studied only in theory could be considered more in practice and solutions present more in practice could be further studied in literature, together with practices with controversial effects (short supply chains, compensation). The novelty of the framework stems from the fact that it is specific for logistics, and it comprehensively summarizes all the practices. Moreover, the practices could be valid also in other sectors and the framework could be expanded to other industries.

However, one limitation of this work is that it lacks an analysis of the economic and environmental effects of the studied practices. Further research could therefore be focused on the identification of the most promising logistics solutions and in the analysis of their environmental and economic impact, for example through case studies.

Results in this paper are based on PNRR project OnFoods Spoke 2, WP 2.4. The complete list of practices is present in OnFoods deliverables.

References

1. Acampora, A., Ruini, L., Mattia, G., Pratesi, C. A., & Lucchetti, M. C. (2023). Towards carbon neutrality in the agri-food sector: Drivers and barriers. *Resources, Conservation and Recycling*, 189, 106755.
2. Accorsi, R., Cholette, S., Guidani, B., Manzini, R., & Ronzoni, M. (2022). Sustainability assessment of transport operations in local Food Supply Chain networks. *Transportation Research Procedia*, 67, 1-11.
3. Albino, V., Balice, A., & Dangelico, R. M. (2009). Environmental strategies and green product development: an overview on sustainability-driven companies. *Business strategy and the environment*, 18(2), 83-96.
4. Ali, S. S. (2022). Green Manufacturing: An Assessment of Enablers 'Framework Using ISM-MICMAC Analysis. *Foundations of Computing and Decision Sciences,* 47(3), 271-290.
5. Amemba, C. S., Nyaboke, P. G., Osoro, A., & Mburu, N. (2013). Elements of green supply chain management. *European journal of business and management*, 5(12), 51-61.
6. Amirian, S., Amiri, M., & Taghavifard, M. T. (2022). The emergence of a sustainable and reliable supply chain paradigm in supply chain network design. *Complexity*, 2022.
7. Andiç, E., Yurt, Ö., & Baltacıoğlu, T. (2012). Green supply chains: Efforts and potential applications for the Turkish market. *Resources, Conservation and Recycling*, 58, 50-68.
8. Asif, M. S., Lau, H., Nakandala, D., Fan, Y., & Hurriyet, H. (2020). Adoption of green supply chain management practices through collaboration approach in developing countries–From literature review to conceptual framework. *Journal of Cleaner Production*, 276, 124191.

9. Azevedo, S. G., Carvalho, H., & Machado, V. C. (2011). The influence of green practices on supply chain performance: A case study approach. *Transportation research part E: logistics and transportation review*, 47(6), 850-871.
10. Bajdor, P. (2012). Comparison between sustainable development concept and Green Logistics: The literature review. *Polish journal of management studies*, 5, 225-233.
11. Büyüközkan, G., & Çifçi, G. (2012). A novel hybrid MCDM approach based on fuzzy DEMATEL, fuzzy ANP and fuzzy TOPSIS to evaluate green suppliers. *Expert Systems with Applications*, 39(3), 3000-3011.
12. Bradley, C., & Corsini, L. (2023). A literature review and analytical framework of the sustainability of reusable packaging. *Sustainable Production and Consumption.*
13. Carter, C. R., & Rogers, D. S. (2008). A framework of sustainable supply chain management: moving toward new theory. *International journal of physical distribution & logistics management*, 38(5), 360-387.
14. Chen, Y. J. (2013). Environmental sustainability and green supply chain management. *Advanced Materials Research*, 664, 123-128.
15. Choudhary, K., & Sangwan, K. S. (2019). Adoption of green practices throughout the supply chain: an empirical investigation. *Benchmarking: An International Journal*, 26(6), 1650-1675.
16. Das, C., & Jharkharia, S. (2019). Effects of low carbon supply chain practices on environmental sustainability: an empirical study on Indian manufacturing firms. *South Asian Journal of Business Studies*, 8(1), 2-25.
17. Despoudi, S. (2020). Green supply chain. *In The interaction of food industry and environment* (pp. 35-61). Academic Press.
18. Diabat, A., Khodaverdi, R., & Olfat, L. (2013). An exploration of green supply chain practices and performances in an automotive industry. *The International Journal of Advanced Manufacturing Technology*, 68, 949-961.
19. Dukkanci, O., Bektaş, T., & Kara, B. Y. (2019). Green network design problems. *In Sustainable transportation and smart logistics* (pp. 169-206). Elsevier.
20. Eltayeb, T., & Zailani, S. (2014). Going green through green supply chain initiatives toward environmental sustainability. *Operations and Supply Chain Management: An International Journal*, 2(2), 93-110.
21. Fillieule, R. (2001). System: Social. *International Encyclopedia of the Social & Behavioral Sciences*, 15418–15423.
22. Fritz, M. M., & Ruel, S. (2024). What does "sustainable supply chain management" really mean? A contribution to bridging the gap between research, education and practice. *The International Journal of Logistics Management*, 35(2), 332-363.
23. Jia, F., Shahzadi, G., Bourlakis, M., & John, A. (2023). Promoting resilient and sustainable food systems: A systematic literature review on short food supply chains. *Journal of Cleaner Production*, 140364.
24. Kalpande, S. D., & Toke, L. K. (2021). Assessment of green supply chain management practices, performance, pressure and barriers amongst Indian manufacturer to achieve sustainable development. International *Journal of Productivity and Performance Management*, 70(8), 2237-2257.
25. Karimi, A., & Rahim, K. A. (2015). Classification of external stakeholders pressures in green supply chain management. *Procedia Environmental Sciences*, 30, 27-32.
26. Kast, F. E., & Rosenzweig, J. E. (1972). General systems theory: Applications for organization and management. *Academy of management journal*, 15(4), 447-465.
27. Kazancoglu, Y., Ekinci, E., Mangla, S. K., Sezer, M. D., & Kayikci, Y. (2021). Performance evaluation of reverse logistics in food supply chains in a circular economy using system dynamics. *Business Strategy and the Environment*, 30(1), 71-91.
28. Kouhizadeh, M., Saberi, S., & Sarkis, J. (2021). Blockchain technology and the sustainable supply chain: Theoretically exploring adoption barriers. *International journal of production economics*, 231, 107831.
29. Kumar, M., Choubey, V. K., Raut, R. D., & Jagtap, S. (2023). Enablers to achieve zero hunger through IoT and blockchain technology and transform the green food supply chain systems. *Journal of Cleaner Production*, 405, 136894.
30. Kunrath, T. L., Dresch, A., & Veit, D. R. (2023). Supply chain management and industry 4.0: a theoretical approach. *Brazilian Journal of Operations & Production Management*, 20(1), 1263-1263.
31. Kusi-Sarpong, S., Gupta, H., & Sarkis, J. (2019). A supply chain sustainability innovation framework and evaluation methodology. *International Journal of Production Research*, 57(7), 1990-2008.
32. Lakshmimeera, B. L., & Palanisamy, C. (2013). A conceptual framework on green supply chain management practices. *Industrial Engineering Letters*, 3(10).
33. León-Bravo, V., Caniato, F., Caridi, M., & Johnsen, T. (2017). Collaboration for sustainability in the food supply chain: A multi-stage study in Italy. *Sustainability*, 9(7), 1253.
34. Liu, Y., & Yuan, Z. (2012, June). Discussion on Common Development of Green Logistics and Urban Environment. *In 2012 2nd International*

Conference on Remote Sensing, Environment and Transportation Engineering (pp. 1-4). IEEE.

35. Luthra, S., Garg, D., & Haleem, A. (2014). Green supply chain management: Implementation and performance–a literature review and some issues. *Journal of Advances in Management Research*, 11(1), 20-46.

36. Maditati, D. R., Munim, Z. H., Schramm, H. J., & Kummer, S. (2018). A review of green supply chain management: From bibliometric analysis to a conceptual framework and future research directions. *Resources, Conservation and Recycling*, 139, 150-162.

37. Morgan, D. R., Styles, D., & Lane, E. T. (2022). Packaging choice and coordinated distribution logistics to reduce the environmental footprint of small-scale beer value chains. *Journal of Environmental Management*, 307, 114591.

38. Murtagh, N., & Badi, S. (2020). Green Supply Chain Management in Construction: A Systematic Review. *Successful Construction Supply Chain Management: Concepts and Case Studies*, 63-85.

39. Neusel, L., & Hirzel, S. (2022). Energy efficiency in cold supply chains of the food sector: An exploration of conditions and perceptions. *Cleaner Logistics and Supply Chain*, 5, 100082.

40. Notarnicola, B., Tassielli, G., Renzulli, P. A., Castellani, V., & Sala, S. (2017). Environmental impacts of food consumption in Europe. *Journal of cleaner production*, 140, 753-765.

41. Qian, D., Dargusch, P., & Hill, G. (2022). Carbon management behind the ambitious pledge of net zero carbon Emission—a case study of PepsiCo. *Sustainability*, 14(4), 2171.

42. Qin, X., Godil, D. I., Sarwat, S., Yu, Z., Khan, S. A. R., & Shujaat, S. (2021). Green practices in food supply chains: evidence from emerging economies. *Operations Management Research*, 1-14.

43. Rejeb, A., & Rejeb, K. (2020). Blockchain and supply chain sustainability. *Logforum*, 16(3).

44. Sadeghi Asl, R., Bagherzadeh Khajeh, M., Pasban, M., & Rostamzadeh, R. (2023). A systematic literature review on supply chain approaches. *Journal of Modelling in Management*, 18(2), 372-415.

45. Sellitto, M. A. (2018). Assessment of the effectiveness of green practices in the management of two supply chains. *Business Process Management Journal*, 24(1), 23-48.

46. Sellitto, M. A., Bittencourt, S. A., & Reckziegel, B. I. (2015). Evaluating the implementation of GSCM in industrial supply chains: Two cases in the automotive industry. *Chemical Engineering Transactions*, 43.

47. Tsang, Y. P., Fan, Y., & Feng, Z. P. (2023). Bridging the gap: Building environmental, social and governance capabilities in small and medium logistics companies. *Journal of Environmental Management*, 338, 117758.

48. Tseng, M. L., Islam, M. S., Karia, N., Fauzi, F. A., & Afrin, S. (2019). A literature review on green supply chain management: Trends and future challenges. *Resources, Conservation and Recycling*, 141, 145-162.

49. Ueasangkomsate, P., & Suthiwartnarueput, K. (2018). Analysis of the Relation between Green Logistics Management Practices and Export Intensity for Thai Food and Drinks SMEs. *Journal of International Logistics and Trade*, 16(2), 46-56.

50. Vijayan, G., Kamarulzaman, N. H., Mohamed, Z. A., & Abdullah, A. M. (2014). Sustainability in food retail industry through reverse logistics. *International Journal of Supply Chain Management*, 3(2), 11-23.

51. Viu-Roig, M., & Alvarez-Palau, E. J. (2020). The impact of E-Commerce-related last-mile logistics on cities: A systematic literature review. *Sustainability*, 12(16), 6492.

52. Von Bertalanffy, L. (1972). The history and status of general systems theory. *Academy of management journal*, 15(4), 407-426.

53. Yubo, S., Gang, L., & Jiao, H. (2011, January). Research on green mining logistics system model of coalmine. *In MSIE 2011* (pp. 1040-1043). IEEE.

54. Zhu, Q., Geng, Y., Fujita, T., & Hashimoto, S. (2010). Green supply chain management in leading manufacturers: Case studies in Japanese large companies. *Management Research Review*, 33(4), 380-392.

55. Zhu, Q., Sarkis, J., & Geng, Y. (2005). Green supply chain management in China: pressures, practices and performance. *International journal of operations & production management*, 25(5), 449-468.

56. Zhu, Q., Sarkis, J., & Lai, K. H. (2012). Green supply chain management innovation diffusion and its relationship to organizational improvement: An ecological modernization perspective. *Journal of Engineering and Technology Management*, 29(1), 168-185.

57. World Economic Forum (2022). Why sustainability is crucial for corporate strategy. https://www.weforum.org/agenda/2022/06/why-sustainability-is-crucial-for-corporate-strategy/

58. United Nations (n.d.). Sustainability. https://www.un.org/en/academic-impact/sustainability

59. The Independent (2023). Which industries pollute the most? A deep dive into global and UK emissions. https://www.independent.co.uk/advisor/solar-panels/most-polluting-industries