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Implementing environmental practices within the Greek dairy supply chain

Drivers and barriers for SMEs

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Abstract

Purpose – Food supply chain (FSC) in Greece is dominated by small and medium-sized enterprises (SMEs), who face several challenges in adopting green practices. The purpose of this paper is to identify the key drivers and barriers influencing the environmental performance of SMEs within the Greek dairy supply chain (SC).
Design/methodology/approach – Descriptive research methodology attempts to prioritize the drivers and barriers for improving the environmental sustainability performance. Analytical hierarchy process and sensitivity analysis are used to understand the complex nature of the influencing factors.
Findings – The analysis identifies five barriers and six drivers for the implementation of green practices within the dairy SC. While external drivers significantly influence the market structure and logistics network, government, competitors and customers are the driving factors for improving environmental performance.
Research limitations/implications – The study contributes to filling the literature gap on key factors influencing the implementation of green practices within the FSC. The identified influential factors will contribute toward building a framework for improving sustainability performance within the Greek dairy SC.
Practical implications – The study is expected to benefit the Greek and European SMEs by driving their environmental practices within the perishable SC network.
Originality/value – The paper provides directions for researchers, practitioners and policy makers in understanding the challenges for implementing green practices in the dairy SC. The holistic approach followed in this paper is a building block for a conceptual framework on implementing environmental sustainability within the FSC. Apart from contributing to the current literature by extending the research horizon to SMEs' green adoption capability, this study also provides better understanding of the pivotal role of internal and external key factors in influencing sustainability performance.

Keywords SMEs, Environmental practices, Food supply chain, Drivers and barriers, Greek dairy sector, Sustainability performance

Paper type Research paper

1. Introduction

The environmental impact of different supply chain (SC) and logistics activities is significantly influencing a firm's competitive position and customer satisfaction. The diminishing resources and the increasing amount of waste are adding to the existing burden on the environment

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(Srivastava, 2007). These external pressures, combined with the customer and government awareness have made the environmental sustainability a key focus area in the recent business agendas (Linton *et al.*, 2007; Peterson, 2009; Rauter *et al.*, 2017). The current SC practices are striving to implement the sustainability practices to improve their overall performance, enhance brand reputation and consequently achieve higher margins. The implementation of environmentally sustainable practices has become a challenging issue especially in the food sector. The food and drinks sector is very dynamic with constant changes in the customer demand (Trienekens *et al.*, 2012; Beske *et al.*, 2014). The food supply chain (FSC) refers to an interdependent system of organizations, processes, activities, stakeholders and resources involved in moving the food from producers to consumers. The processes in a typical FSC involve production, processing, distribution, consumption and disposal. Accounting for 14.6 percent (€1,048 billion turnover) of all the production in manufacturing sector across the European Union (EU) (Eurostat, 2014), FSC connects three important European economies, namely, agriculture, food processing industry and distribution sector (European Commission, 2015). As the FSC is becoming agile and global, the changes in the packaging, storage and delivery systems are making this sector energy intensive with significant impact on the environmental sustainability.

Across all 28-EU countries, food and drinks industry is dominated by small and medium-sized enterprises (SMEs), accounting for an average of 51.6 percent turnover and 64.3 percent of the employment (Eurostat, 2014). While earlier research studies have highlighted the competitive advantages of deploying proactive environmental strategies in the businesses (Lee and Ball, 2003; Alt *et al.*, 2015), the adoption of these strategies by SMEs have mainly been reactive, focusing largely on the compliance rather than sustainability (Ching-Hsun, 2015). Since the environmental responsiveness varies among firms in the same sector, identifying obstacles of environmental sustainability implementation across the network is a primary step in helping industry's transition toward a sustainable SC. The SMEs face several challenges or barriers in implementing these sustainable practices in their SC network (Lamprinopoulou and Tregear, 2011; Dey and Cheffi, 2013; Glover *et al.,* 2014); and they are required to equip themselves to mitigate these challenges in order to become resilient and adaptable. There is limited availability of empirical research on drivers and barriers to environmental sustainability performance, particularly in the context of FSCs (Bourlakis, Maglaras, Gallear, and Fotopoulos, 2014; Ramirez *et al.,* 2014). The elimination of all the barriers at once being a difficult proposition, industries are required to identify and prioritize the key factors for systematic improvement of the environmental performance. This research aims to comprehend key factors influencing the implementation of environmental performance measures in the Greek SMEs. The research specifies three objectives in order to achieve the overall aim:

(1) to identify and classify the major factors (drivers and barriers) influencing the green practices in FSC management through a comprehensive literature review;

(2) to assess the level of importance of each driver and barrier using collected data on the Greek dairy SC; and

(3) to examine the stability of drivers and barriers by conducting a sensitivity analysis.

The case study is focused on the Greek dairy SC network, one of the principal industries in the Greek food sector. It is identified as the third most important sector in the food and drink production and accounts for over 17 percent of the total production value (Bourlakis, Maglaras, Gallear, and Fotopoulos, 2014). Similar to most of the FSCs across 28-EU countries, majority of the Greek food industry consists of several SMEs with a few large manufacturers. Despite having a significant economic value, the SMEs face several

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environmental challenges to maintain competitiveness compared to the larger enterprises. Moreover, due to the perishable nature of the dairy products, which need processing, refrigeration and quick distribution to secure food quality standards, these constraints further reinforce the need for efficient sustainability practices within the dairy SC. The research aims to identify the key drivers and barriers for implementing green practices in the Greek dairy SC using analytical hierarchy process (AHP), a decision support tool for modeling complex problems. It further aims to conceptualize a framework for improving environmental sustainability performance within FSC for SMEs.

The rest of the paper is organized as follows: Section 2 encloses a comprehensive literature review, classified as internal and external barriers to environmental performance in SC management. Section 3 contextualizes the current situation of SMEs in the Greek food sector. Section 4 presents the research methodology used for collecting and analyzing the data. The results from the primary data are analyzed and interpreted in the Section 5. Section 6 encloses key findings and conducts sensitivity analysis for implementing green practices within the dairy SC. Section 7 discusses conclusion, managerial implications and future research directions.

2. Literature review

2.1 Food supply chain

There are several studies on the FSC (e.g. Sgarbossa and Russo, 2017; Handayati *et al.,* 2015). In the era of globalization, FSC constitute a dynamic environment characterized by the evolving consumer demand for food safety, quality and sustainable production methods (Ting *et al.*, 2014; Validi *et al.*, 2014). In addition, both the customers and firms are increasingly interested in the origin of products and adherence to the sustainable practices (Bourlakis, Maglaras, Aktas, Gallear, and Fotopoulos, 2014). The majority of the environmental pollution is driven by production and logistics activities and there is a need for the environmentally friendly practices to reduce CO_2 emission (Pålsson and Kovács, 2014; Dubey *et al.*, 2015). Today's FSC are global and the products tend to travel longer distances than before. Along with the challenges related to sustainable production and high energy consumption, the food industry has to cope with the challenges related to distribution, storage facilities and reverse logistics (RL) (Glover *et al.*, 2014). Modern food industries are constantly looking to create SC networks that can reduce the environmental impact and organizational costs (Validi *et al.*, 2014; Beske *et al.*, 2014). Therefore, it is crucial to identify the major factors that influence the decisions of the food SMEs for implementing green practices.

Food retailers play an important role in the FSC, as they are the bridge between the manufacturers and the customers (Amato and Amato, 2009). The sharp increase in home-deliveries by retailers has contributed to the rise of greenhouse gas emission. There is also an evident increase in the number of the returned products (Petersen and Kumar, 2015). Hence, the primary objective of the FSC is to develop a well-structured logistics network to handle forward and reverse product flows. Addressing these issues is of great importance to the SMEs, particularly while dealing with the fresh products. The perishable nature of food products emphasizes the importance of responsiveness in terms of lead time, environmental impact, delivery location and volume as key competitive factors (Validi *et al.*, 2014).

2.2 Greek food sector and SMEs

The Greek food industry contributes toward 25 percent of the total gross national product (GNP) and that makes it the leader among all the industrial sectors (Notta *et al.*, 2010). Furthermore, the Greek food sector consists of several SMEs consisting of a number of food producers and processors. Greek SMEs constitute 90 percent of the production and processing business activities within the food sector (Lamprinopoulou and Tregear, 2011).

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The Greek food sector adheres to international quality standards and has been home to many leading multinational food manufacturers such as Nestlé, Coca-Cola, Vivartia, PepsiCo and Cadbury for decades. These multinational companies already have a very strong presence in the Greek market. The Greek market consists of almost 16,000 SMEs producing 15 percent of the total output, while the rest is produced by bigger companies in the food sector (Kaditi, 2011). Despite the entry of multinational large size companies in the Greek food market, it is still driven by the SMEs, especially in the dairy sector. While large companies can afford the development and implementation of the sophisticated performance measures, SMEs face several challenges in adopting green practices in their SC network (Bourlakis, Maglaras, Aktas, Gallear, and Fotopoulos, 2014; Diabat *et al.*, 2014; Mathiyazhagan *et al.*, 2014). Moreover, the recent financial crisis in Greece and other EU countries calls for an urgent need to study the key factors influencing the implementation of green practices and hence the overall sustainability performance of the Greek FSC.

3. Factors influencing environmental performance

Companies have been increasingly facing internal and external challenges to manage their environmental sustainability performance as a part of their business strategy (Ageron *et al.*, 2012; Walker and Jones, 2012; Seuring and Gold, 2013; Zhu *et al.*, 2013). The growing awareness of environmental protection, increasing government regulations and customer consciousness toward the ethical issues have forced firms to be more environmentally responsible (Agan *et al.*, 2013; Huang *et al.*, 2016). The environmental impact on the SMEs is overshadowed by large multinational companies, as the SMEs do not acknowledge the sustainability impact (Sen and Cowley, 2013). The SMEs are facing increasing pressures from the customers to incorporate environmental considerations into their network in order to create sustainable and responsible SC. In order to first understand what drives and enables this transformation in the SMEs, internal and external factors influencing sustainability adaptation are identified from the academic literature.

3.1 Internal factors

Internal factors arising within the organization are mainly associated with the internal operations of an organization. White *et al.* identified more than 100 definitions of sustainability. However, there is a general lack of consensus regarding the definition of sustainability (Giunipero *et al.*, 2012). Apart from the three pillars of sustainability (Carter and Rogers, 2008), it is found to be associated with future generation, growth and equity. Due to the difficulty in interpreting sustainability at the top-management level, certain issues are ignored, thereby negatively affecting the operational feasibility of the sustainable strategies (Abbasi and Nilsson, 2012; Paillé *et al.,* 2013; Johnson, 2015). Owing to the difficulty in comprehending the nature of sustainability, inertia is an additional challenge, which organizations should overcome (Govindan *et al.,* 2014). Inertia is driven by the senior management's predominant focus on the high uncertainty involved in such investments along with the difficulty in realigning the current processes according to the objectives (Abbasi and Nilsson, 2012). It is evident that the top management's commitment is vital considering the radical changes required in the organizational philosophy (Govindan *et al.*, 2014; Roehrich *et al.*, 2014). A prerequisite to the successful implementation of the sustainable practices is the alignment of short-term and long-term strategic goals (Giunipero *et al.*, 2012). However, factors such as difficulty in forecasting beyond the typical investment horizon, high uncertainty, and complexity are some of the constraints in pursuing the environmental objectives (Wu and Pagell, 2011).

High investment cost is highlighted in the literature as the most significant barrier to the sustainable development (Abbasi and Nilsson, 2012; Bourlakis, Maglaras, Aktas, Gallear, and Fotopoulos, 2014). It incorporates initial cost of implementation of sustainability practices

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and compliance with the environmental legislation expanding across the entire SC network. Investment cost is another obstacle for the SMEs due to the limited availability of resources, which restricts their options, making them more vulnerable (Walker *et al.*, 2008). Initial investment for implementing sustainable practices is elusive, making it difficult to realize the financial returns in most of the cases (e.g. Giunipero *et al.*, 2012; Mathiyazhagan *et al.*, 2013; Roehrich *et al.*, 2014). There is a trade-off between the preliminary expenditures and the long-term market payoffs on the account of information ambiguity and constantly changing parameters entailed in the redesign of the organization's processes (Wu and Pagell, 2011; Giunipero *et al.*, 2012). Min and Galle (2001) claim that the size of a firm is one of the most important internal driving forces in implementing sustainability performance. The large-sized companies have a significantly higher rate of financial returns than small or medium-sized companies. Another key issue regarding capabilities and resources is associated with certain procedures related to training and development of personnel (Roehrich *et al.*, 2014). Consequently, a shortage of either of them would act as a serious constraint toward achieving sustainability (Schrettle *et al.*, 2014). According to Mathiyazhagan *et al.* (2013), large firms are more eager to be involved in the sustainability initiatives due to the additional amount of resources they own compared to the SMEs.

There are significant economic benefits gained through the recovery of returned products (Sharma *et al.*, 2011). Effective RL has also been recognized as a critical factor toward the sustainability of a firm's operations. Product return management has been traditionally overlooked due to the firm's sole emphasis on the minimization of operational cost (Mollenkopf *et al.*, 2011). Nonetheless, the unorganized return management not only poses a major challenge toward the implementation of sustainable practices (Shaharudin *et al.*, 2015); but also represents a missed opportunity to create customer value enhancing the firm's competitiveness (Mollenkopf *et al.*, 2011). Cooperation and coordination within a SC has an important role in the adoption of RL strategies (Baiman and Rajan, 2002; Alvarez-Gil *et al.*, 2007). It is evident that the complexity is strongly affiliated to the sustainability theory. It originates in the co-relationship between the pillars of the sustainability and covers all aspects of the firm's management and operations (Abbasi and Nilsson, 2012). Therefore, complexity is another challenge in the development of appropriate processes capable of measuring and assessing sustainable performance.

3.2 External factors

External factors are influenced by the stakeholders of the organization such as suppliers, market competitors and government. The collaboration between focal firms and SC partners is a critical factor affecting the integration of sustainable practices (Grimm *et al.*, 2016). The importance of suppliers' commitment in supporting environmental initiatives is justified by their position in the SC, as they are the first to get involved in this process prior to stakeholders and customers (Ageron *et al.*, 2012). In order to confront the challenges toward adopting sustainability practices, firms employ a series of supportive actions through trainings and evaluation processes aiming at safeguarding transparency and developing identified abilities (Grimm *et al.*, 2016). The most common barrier to the collaboration is suppliers' unwillingness to exchange information (Govindan *et al.*, 2014). According to Walker *et al.* (2008), this unwillingness is mainly attributed to suppliers' fear of getting exposed in terms of their poor sustainable performance and losing the competitive position in the market. The lack of trust is responsible not only for causing collaboration inefficiencies but also for disrupting suppliers' participation in the focal firms' activities (Mathiyazhagan *et al.*, 2013). In order to avoid the aforementioned issues, firms tend to form a partnership with suppliers who share same perceptions regarding sustainable development (Ramirez *et al.,* 2014). With respect to sustainable performance the financial capabilities and firm size are of great importance. Specifically, the suppliers who relish the

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comfort of abundant resources and bigger size are more inclined toward engaging in the sustainable practices than others (Ageron *et al.*, 2012; Mathiyazhagan *et al.*, 2013; Bourlakis, Maglaras, Aktas, Gallear, and Fotopoulos, 2014).

In addition to acting as a driver, environmental regulation and legislation can also be a barrier to the implementation of sustainable practices. While compliance with the legislation provides a framework for nurturing the environmental awareness and minimizing risks, it inhibits its orderly adoption by either not taking into consideration each industry's particular characteristics or setting unrealistic deadlines (Walker *et al.*, 2008). Furthermore, the lack of international environmental regulations and standards increase the implementation complexity of sustainable policies in multi-tiered global SC networks (Giunipero *et al.*, 2012). The lack of appropriate environmental legislation might have a negative impact and thus the firms are not motivated enough to adopt sustainable practices (Lau and Wang, 2009). The economic support from the government can facilitate the implementation of sustainability in the form of subsidies or more favorable tax policies (Aksen *et al.*, 2009). Guidance in terms of consultancy, training and monitoring sustainable processes (Govindan *et al.,* 2014), and financial support to meet the high level of investment (Ageron *et al.*, 2012; Bourlakis, Maglaras, Aktas, Gallear, and Fotopoulos, 2014) is becoming a major hurdle.

Although a driver of economic activity, the market structure can be an inhibitor to long-term sustainability initiatives. The governing volatility, pricing and competitive intensity drive the corporate strategy and require a high level of adaptability (Schrettle *et al.*, 2014). In terms of competition, market fragmentation could pose a critical challenge by limiting the number of available suppliers and hence, the ability to develop a collaboration (Walker *et al.*, 2008). Additionally, it could discourage the entry of new firms by preserving the traditional framework while hindering the sustainable innovation. In the market context, consumers' eco-literacy is a critical factor to sustainability performance. The lack of sustainability awareness among customers generates insufficient demand for "green" products discouraging the firms from integrating sustainable practices (Giunipero *et al.*, 2012; Govindan *et al.*, 2014). Giunipero *et al.* (2012) point out that especially in the time of recession or financial turmoil, the firms tend to neglect the potential benefits of sustainable practices, as they are perceived as an additional cost burden. Hence, the firms prioritize the economic aspect of sustainability opposed to the social and environmental aspects (Reuter *et al.,* 2012). The quality of logistics infrastructure is another important barrier toward the sustainable development. Poor infrastructure inhibits environmental integration, as it distorts the unhindered flow of materials sustaining higher costs (Silvestre, 2015).

Following the extensive literature review, 16 important factors affecting the environmental sustainability adaptation have been identified and grouped into two major categories as internal and external as shown in Table I. Internal factors include misinterpretation of sustainability, stakeholder inertia, focus on short-term strategic goals, initial investment cost, a firm's capabilities and resources, size of the firm, unorganized returns management and complexity. The external factors are organized into unwillingness to exchange information, strict environmental regulations, insufficient support from the regulatory authorities, limited supplier capabilities and resources, poor market structure, consumers' eco-literacy and product price. These key factors identified from the literature are used to develop the questionnaire survey (Appendix). Several other internal and external factors can be found in the existing literature, however, only the most important factors were selected for developing a questionnaire survey.

4. Research methodology

The exploratory research attempts to combine qualitative and quantitative research methods for the data collection and analysis. The research seeks to identify the challenges faced by the Greek dairy SC in implementing green practices. In order to achieve this objective,

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	References
Internal factors	
1. Misinterpretation of sustainability	Giunipero *et al.* (2012), White *et al.*, Abbasi and Nilsson (2012), Paillé *et al.* (2013), Johnson (2015)
2. Stakeholder inertia	Govindan *et al.* (2014), Abbasi and Nilsson (2012), Wu and Pagell (2011), Roehrich *et al.* (2014)
3. Misalignment of strategic goals	Giunipero *et al.* (2012), Wu and Pagell (2011), Longoni and Cagliano (2015)
4. Investment cost	Walker *et al.* (2008), Abbasi and Nilsson (2012), Bourlakis, Maglaras, Aktas, Gallear, and Fotopoulos (2014), Giunipero *et al.* (2012), Mathiyazhagan *et al.* (2013), Roehrich *et al.* (2014)
5. Firms capabilities and resources	Roehrich *et al.* (2014), Schrettle *et al.* (2014)
6. Size of the firm	Min and Galle (2001), Mathiyazhagan *et al.* (2013), Bourlakis, Maglaras, Aktas, Gallear, and Fotopoulos (2014), Bourlakis, Maglaras, Gallear, and Fotopoulos (2014), Ageron *et al.* (2012), Walker and Jones (2012)
7. Unorganized return management	Sharma *et al.* (2011), Mollenkopf *et al.* (2011), Shaharudin *et al.* (2015), Baiman and Rajan (2002), Alvarez-Gil *et al.* (2007)
8. Complexity	Wu and Pagell (2011), Abbasi and Nilsson (2012), Bourlakis, Maglaras, Aktas, Gallear, and Fotopoulos (2014), Bourlakis, Maglaras, Gallear, and Fotopoulos (2014)
External factors	
1. Unwillingness to exchange information	Grimm *et al.* (2016), Ageron *et al.* (2012), Walker *et al.* (2008), Govindan *et al.* (2014), Kache and Seuring (2014)
2. Supplier capabilities and resources	Walker *et al.* (2008), Schrettle *et al.* (2014), Mathiyazhagan *et al.* (2013), Bourlakis, Maglaras, Aktas, Gallear, and Fotopoulos (2014)
3. Environmental regulations	Walker *et al.* (2008), Giunipero *et al.* (2012)
4. Insufficient support and guidance	Ageron *et al.* (2012), Bourlakis, Maglaras, Aktas, Gallear, and Fotopoulos (2014), Govindan *et al.* (2014)
5. Market structure	Schrettle *et al.* (2014), Walker *et al.* (2008)
6. Consumer eco-literacy	Giunipero *et al.* (2012), Reuter *et al.* (2012), Govindan *et al.* (2014), Mathiyazhagan *et al.* (2013), Govindan *et al.* (2014), Gualandris and Kalchschmidt (2014)
7. Product price	Walker *et al.* (2008), Reuter *et al.* (2012), Ramirez *et al.* (2014), Roehrich *et al.* (2014)
8. Logistics infrastructure	Silvestre (2015), Soysal *et al.* (2014)

Table I. Environmental factors identified from the literature

a questionnaire survey was conducted among the dairy manufacturers, distributors and suppliers in the Greece. The study was mainly focused on producers and distributors of the dairy SC products such as milk, yogurt, cream milk, butter, cheese and ice cream. Economically, dairy SC constitutes an important part of the FSC that extends globally. It is also a sector that is vulnerable to the climate change (Dairy Roadmap, 2015), becoming an ideal industry for such kind of study. The questionnaire survey was orientated toward the practices followed within the dairy industry to achieve a good mix of data across the different regions in Greece.

A descriptive research methodology was followed as shown in Figure 1. The literature review supported collecting data on generic internal and external factors, which are influencing the sustainability within the SC. The questionnaire included important internal and external factors to capture holistic responses of the participants and to eliminate possible variability between different responses. This systematic data collection approach helped in conducting a rigorous data analysis. The context of the questions focused on the potential for implementing green practices. This approach to the questionnaire also gauged the participants' perception about whether the environmental practices are helpful in improving their company's image. The key influencing factors for implementing green practices were identified from the questionnaire survey responses. The drivers and barriers were later

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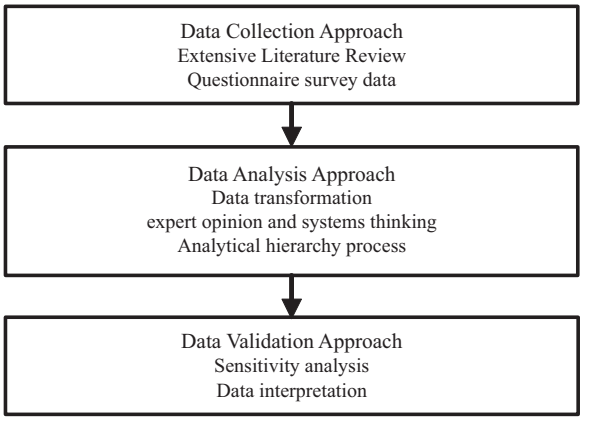

Figure 1. Descriptive research approach

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classified based on informal discussion with some of the respondents and through expert opinion. The drivers and barriers identified were tested using the AHP approach. Five key barriers were identified during the preliminary data analysis. These findings were later used for understanding their causal relationships. The feedback loops and expert opinion provided the crucial insights for developing criterions and weighting of alternatives. All the collected data were divided in groups according to their context and later systematically analyzed using super decisions© – a commercial software for the decision making. In order to validate the results, sensitivity analysis was conducted to see the influence of factors on each other. This process revealed broad knowledge of the challenges within dairy industry and helped in finding possible solutions to the existing environmental problems. At the end, managerial insights were developed following data interpretation activity.

The AHP is a multi-criteria decision-making approach for complicated and unstructured problems. The aim of the AHP is to reach a goal by having rated alternatives and weighted criteria. According to Saaty (1980), the AHP method involves three main stages. The first stage includes the structure of the hierarchy model in terms of goal, criteria and sub-criteria. The second one is related to the development of the questionnaire, which facilitates individual preferences. The last stage involves the data analysis and sensitivity assessment to check the consistency of the results. The AHP provides the percentage distribution of decision points based on the factors that influence the decision. Insights from the feedback loops and expert opinion were integrated into a single matrix using the arithmetic average of every preference.

5. Data analysis

The questionnaire survey was posted to 1,160 micro and small-medium size dairy manufacturers, suppliers and distributors in Greece. Around 9 percent of them (104 companies) responded with the data as shown in Table II. Although more than

Table II. Profile summary of the dairy SC respondents

Size of the enterprise (employees)	Annual turnover (in Euro's)	Total responses	Percentage
< 10 (micro)	2 Million	65	62.50
< 50 (small)	10 Million	24	23.07
< 250 (medium)	50 Million	15	14.42
Total		104	100

Source: Size and Turnover as per European Commission (2015)

20 percent response rate is considered to be ideal for the survey-based research (Malhotra and Grover, 1998), the sample size is believed to be sufficient for conducting the research on identifying the drivers and barriers. Moreover, the data sample captures the views across the country and, hence, can be considered as a good representative of the Greek dairy SC. The response rate can be considered acceptable in comparison to the recent (low) response rates achieved in the SC areas (e.g. Blome *et al.*, 2014; Yusuf *et al.*, 2014). The data from different sized enterprises located in the different geographical areas were collected to have a broader perspective of the Greek FSC. The survey data identified five drivers for implementing the green practices in the Greek dairy SC network. These drivers were identified by consolidating the findings of the questionnaire survey.

5.1 Barriers to implementing green practices in Greek food sector

5.1.1 Poor market structure. The majority of respondents (85 percent) from the micro and small enterprises responded negatively on the potential of implementing sustainability practices due to the existing market structure (between years 2013-2015). The market structure appears to be an important obstacle for the Greek food industry to integrate green practices. The dairy market is highly driven by the cost of the product, where financial investment in greening the product is challenging. It was evident that the Greek market mainly consists of the SMEs and this makes the maintenance of environmental sustainability processes very difficult unlike the large-sized companies, owing to limited financial resources. The respondents resonated that the continuous financial crisis in Greece over the last few years (2009-2015) has led to decline in the market. The cascading effect of this crisis has stalled the evolvement of the market structure. The lack of a market structure for protecting the environment practices is found to be a major concern for the SMEs in the food sector. Contrary to the large-sized manufacturers, the SMEs cannot afford the financial investment required for making radical changes to their SC network design.

5.1.2 Lack of appropriate logistics infrastructure. The lack of appropriate logistics infrastructure became evident from the findings, as half of the respondents (53.25 percent) indicated that the current rail network cannot cope with the demand for perishable products. Moreover, the difficulty in using alternative modes of transport for the distribution of goods is a general problem and is limited only to the dairy sector. The respondents identified that the use of electric vehicles are more environmental friendly and can reduce the CO_2 emissions caused by the logistics procedures. However, it was found that lack of appropriate road infrastructure for the operation of electric vehicles and trucks hindered the growth in the Greek logistics infrastructure. The primary data indicates that the Greek dairy industry uses conventional fuel-driven vehicles for the distribution of products. Undoubtedly, the use of rail for distribution is a more sustainable solution compared to road transport. The trains can carry much bigger volume of goods than the trucks and as a consequence, their environmental impact is much lower. However, the rail routes in Greece have limited geographical penetration and therefore the majority of the firms prefer to use large-good vehicles for transporting goods. This is an important obstacle identified by the majority of the respondents, who argue that they cannot use alternative modes of transport owing to unavailability of appropriate infrastructure. Additionally, the perishable nature of the dairy products also demands quick distribution within the SC in order to assure freshness and quality.

5.1.3 Underdeveloped environmental legislation. The Greek legislation concerning environmental protection is not well developed (Matopoulos and Bourlakis, 2010). As a result, the government is not providing enough financial help to the SMEs to create environmentally sustainable SCs. One-third of the respondents (78.26 percent) confirmed that the external regulations do not direct them in improving their SC network to reduce the

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environmental impact. From the survey it is evident that the governments in the other European countries act as driving forces for the companies to adopt sustainability practices unlike the Greek government, which is lacking in this initiative. Most of the respondents (86 percent) expressed their interest in enhancing their SC's environmental performance through stronger environmental legislations. However, they also agreed that the SMEs could not afford the expenses associated with meeting the environmental standards and any help from policy makers to small companies could be a way forward. Multiple respondents suggested that the government could encourage food companies to implement green SC practices and RL activities by providing appropriate incentives and subsidies.

5.1.4 Demanding warehousing and distribution processes. Another obstacle indicated by the respondents (23.76 percent) is closely associated with the perishable nature of dairy products. Fresh dairy products are extremely sensitive to the external environment. Hence the process of warehousing and distribution need to be carefully designed to meet the quality requirements. Unfortunately, the cold storage facility to maintain daily products is still lacking in Greece. Warehousing and distribution of FSCs are energy consuming and can have a significant impact on the environmental pollution and wastages. The nature of the products also demands quick distribution within the SC in order to assure good quality.

5.1.5 Unorganized returns management. The primary data reveals that only a small number (14.09 percent) of the dairy manufacturers have RL strategies to manage their returns. The companies acknowledge this has a negative impact on the financial performance. According to Maloni and Brown (2006), the food waste is one of the most common issues in the perishable SC. Minimization of such wastes can enhance the sustainability significantly within the food production and distribution processes. Moreover, according to 25.92 percent respondents, integration of anaerobic process for managing the returned goods can contribute to an improved environmental performance. Anaerobic digestion is the natural process in which plant and animal materials (biomass) are broken down by micro-organisms in the absence of air (Brennan and Owende, 2010). The products generated through this process can lead to significant benefits. The respondents believe the improved RL mechanism also likely to reduce the contamination and customer service within FSC.

5.2 Drivers to implementing green practices in the Greek food sector

Through the questionnaire survey data, several drivers that influence the implementation of sustainability practices were identified. In order to analyze them, we classified them into two broad categories as internal and the external drivers.

5.2.1 Internal drivers. 5.2.1.1 Organizational performance. The employee involvement has a significant impact on a company's organizational, environmental and social performance. Another factor that drives companies to adopt sustainable, managerial practices is the reduction in additional costs associated with the food wastage. Firms use alternative methods such as closed loop processes to reduce pollution and consequently, the organizational costs. Overall strong organizational performance is a critical driving force for implementing sustainable practices.

5.2.1.2 Investors. Some of the respondents identified that the investors have the power to influence firms' decisions. The growing pressure on the environment consciousness by investors is encouraging in the context of the Greek FSC. With growing competition among the firms, investors have a variety of choices and can strongly influence on the environmental performance.

5.2.1.3 Suppliers. Suppliers are an important driving force for the firms in their motivation to green the SC networks. Unfortunately, being an indirect force, the majority of the suppliers are not much interested in pressuring the producers to implement sustainable

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practices in their firm. The respondents understand the importance of integration and cooperation in the SC for effective implementation of the environmental policies. The environmental impact can be controlled through the collaboration (between firms and suppliers) to find environmental friendly materials.

5.2.2 External factors. 5.2.2.1 Government. The government is one of the most important external drivers that can strongly influence the strategic planning of a firm. Nowadays, the growing levels of CO_2 in the atmosphere, combined with consumers' awareness, lead governments to create regulations which force companies and industries to become more responsible about the environmental issues. The majority of the respondents supported that the government's involvement is likely to improve the green performance.

5.2.2.2 Consumers. A company's environmental performance is significantly influenced by the behavior of its customers. A constant customer demand creates a rise in congestion on roads with increased greenhouse gas emission. Moreover, the desire of the firms to satisfy the increased demands of consumers leads to a growing number of returns thereby increasing the percentage of waste generated. It makes obvious that consumers are a significant driving force for the companies to strive for a better environmental performance.

5.2.2.3 Competitors. There is an increasing competition among companies for getting a bigger market share. Every organization that intends to increase the market share is trying to differentiate itself from others. This has attracted considerable attention from firms to focus on investing in new environmental friendly technologies in production and transportation in the last two decades. The visibility in the market brings the best practices adapted by the competitors and the respondents believe that competition is an influencing driver of innovation in the business.

6. Data analysis and findings

In order to identify the priority weights, causal loop findings and expert opinions were used in this study. The causal loop diagram (a systems thinking tool) helped in representing the priority weights by evaluating the number of positive and negative feedback loops to and from each variable as shown in Figure 2. The barriers like poor market structure and lack of logistics network are strongly influenced by other variables, which can be seen from the causal loop

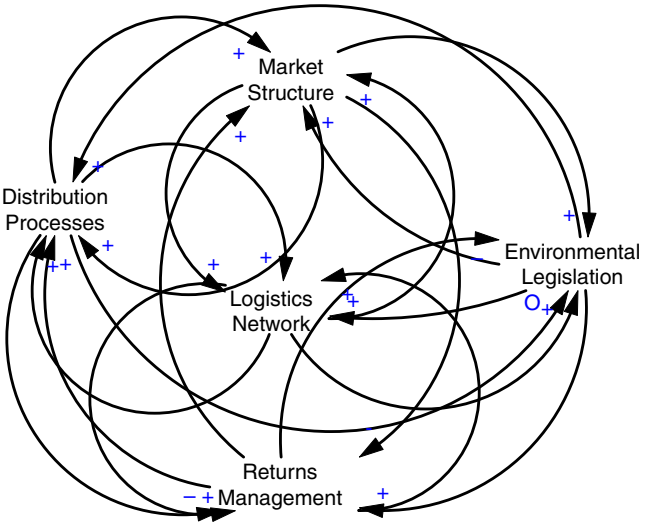

Figure 2. Causal loop for challenges

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diagram. The unorganized returns management and underdeveloped environmental legislation barriers have least influence (having negative and neutral influences) of other variables.

The opinion of experts on the priority of each challenge for implementing sustainable practices was conducted through three structured interviews with the senior managers of the firms. The participants who were interviewed came from different regions of Greece and from various levels in SC network. Interviews with the FSC experts were chosen based on their position, current role, work experience and background knowledge. Although only three experts were interviewed for weighing the challenges, small sample size is deemed acceptable given the experience of each respondent within the field of study. Moreover, it was found that several academic studies using the AHP have used small sample size for prioritizing the weights of criteria (e.g. Ravindran *et al.*, 2010; Subramoniam *et al.*, 2013; Kumar and Nath Banerjee, 2014). The background of the interviewees is provided in Table III. In the study each respondent was asked to weigh the identified challenges based on their experience within the FSC. One-to-nine scale (Satty, 1980) was used for pair-wise comparison of drivers following five attributes – equal, moderate, strong, very strong and extreme. The average priority weight for each challenge was used for further analysis.

Table IV shows the priority weight of each barrier provided by the experts. The AHP obtains the ranking of alternatives in a multi-alternative, multi-criteria and multi-person decision environment (Gu and Zhu, 2006). Figure 3 shows the hierarchy representing the barriers for implementing green practices. Five barriers are represented as attributes for achieving the objective of the research. Internal and external drivers are shown as alternatives with associated sub-alternatives. However, they are not used explicitly in the model to reduce the level of complexity involved in the decision making. Avoiding sub-alternatives during analysis also reduces the inconsistency that may arise in the AHP process (Lin *et al.*, 2010). The AHP assumes unidirectional hierarchical relationships among the decision levels (Yakovleva *et al.*, 2012). The next stage in the AHP process is to evaluate relative importance weights of the factors and alternatives. The un-weighted super matrix provides local priorities derived from the pair-wise comparisons of the influencing variables (Satty, 2001). Table V shows the un-weighted super matrix indicating relative importance of the barriers. The influence of challenges on internal and external factors can be seen in the

Table III. Background of the interview respondents

Respondent number	Position in organization	Background
Respondent 1	Logistics manager	Overall 8 years of logistics fleet management experience, focus on improving the efficiency of fleet and reducing carbon emission
Respondent 2	Procurement officer	Heavily involved in the procurement of milk products, Overall 8 years of procurement experience and focus on reducing the overall cost of product and reduce wastages
Respondent 3	Warehouse manager	Over 10 years of warehousing and distribution experience, focus on improving distribution processes and customer satisfaction

Table IV. Priority weights from experts

Challenges	Respondent 1	Respondent 2	Respondent 3	Average
Market structure	0.543	0.415	0.497	0.485
Logistics network	0.227	0.279	0.301	0.269
Government legislation	0.102	0.135	0.117	0.118
Returns management	0.097	0.087	0.076	0.086
Distribution processes	0.041	0.046	0.039	0.042

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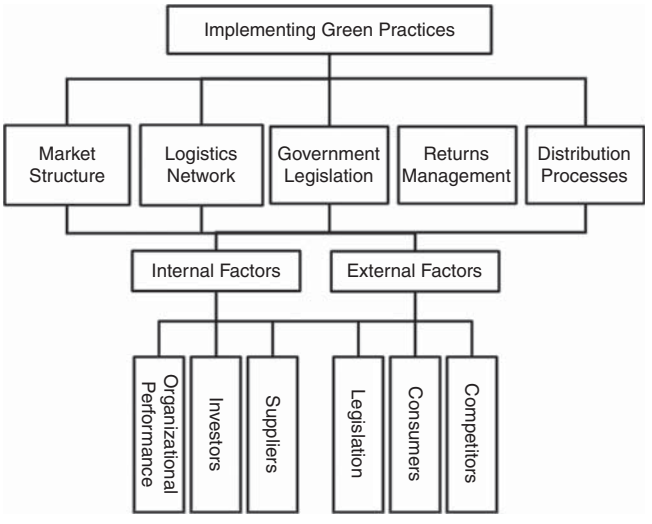

Figure 3. AHP hierarchy: implementing green practices

	Alternatives		Challenges					Implementing green practices
	External factors	Internal factors	Distribution processes	Government legislation	Logistics network	Market structure	Returns management	Goal
Alternatives								
External factors	0.000	0.000	0.421	0.755	0.647	0.500	0.325	0.000
Internal factors	0.000	0.000	0.579	0.245	0.353	0.500	0.675	0.000
Challenges								
Distribution processes	0.200	0.200	0.000	0.000	0.000	0.000	0.000	0.044
Government legislation	0.200	0.200	0.000	0.000	0.000	0.000	0.000	0.123
Logistics network	0.200	0.200	0.000	0.000	0.000	0.000	0.000	0.267
Market structure	0.200	0.200	0.000	0.000	0.000	0.000	0.000	0.488
Returns management	0.200	0.200	0.000	0.000	0.000	0.000	0.000	0.077
Implementing green practices								
Goal	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Table V. Un-weighted super matrix for challenges and barriers

respective rows and on the overall goal (implementing green practices) the in last column. The weighted super matrix can be further achieved by multiplying the priority weights from the clusters to bring the sum of column to unity (Chen and Chen, 2010). The consistency index of the matrix is calculated by $CI = \lambda_{max} - n/n - 1$. This helps in calculating the consistency ratio (CR) by considering average random consistency index precompiled for order less than or equal to 10. For practical purposes, the inconsistency should be less than 10 percent and should not exceed the value of 0.10 (Satty, 1980).

The market structure is identified to be a critical barrier for the implementation of environmentally sustainable practices as evidenced from the results. The SMEs in Greece

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are cash constrained and cannot contribute much for the development of the market structure. The investment for improving the visibility in the market is driven by suppliers as an internal driver and competitors as an external driver. The customers and competitors strongly influence the market in adapting green practices. Strong logistics network is the next important factor for the successful implementation of environmentally friendly practices within the FSC. The results show that priority should be given for improving the market structure and logistics network for the successful implementation of green practices. Improvement in the government legislation and product returns management can significantly influence the success of sustainable implementation with the FSC.

The dynamics of green procurement challenges over a time can be well analyzed by conducting sensitivity analysis (Yakovleva *et al.*, 2012). The sensitivity analysis helps in analyzing the robustness of the system. The behavior of barriers to small variations in the priorities is analyzed in this section. By considering two major drivers with highest priorities, sensitivity analysis shows that the external drivers such as government, competitors and customers significantly influence the logistics network in driving the need for environmental improvement. The market structure is equally influenced by both internal and external drivers as shown in the Figure 4. One of the reasons for this could be that the firms try to survive financially before considering the green performance. The other three barriers are predominantly dependent on the internal drivers. Figure 5 shows internal drivers alone influence the other barriers such as returns management and distribution processes. Figure 5 also shows the weighted comparison of internal and external drivers on different barriers as evidenced through the AHP analysis. From the analysis it was found that the internal as well as external drivers influence the implementation of sustainable practices in the FSC. However, the internal drivers carry higher weightage in the drive toward sustainability.

7. Conclusion and further research

The objective of the research was to identify and prioritize the drivers and barriers to the Greek SMEs in implementing green practices within the dairy SC. As the development of

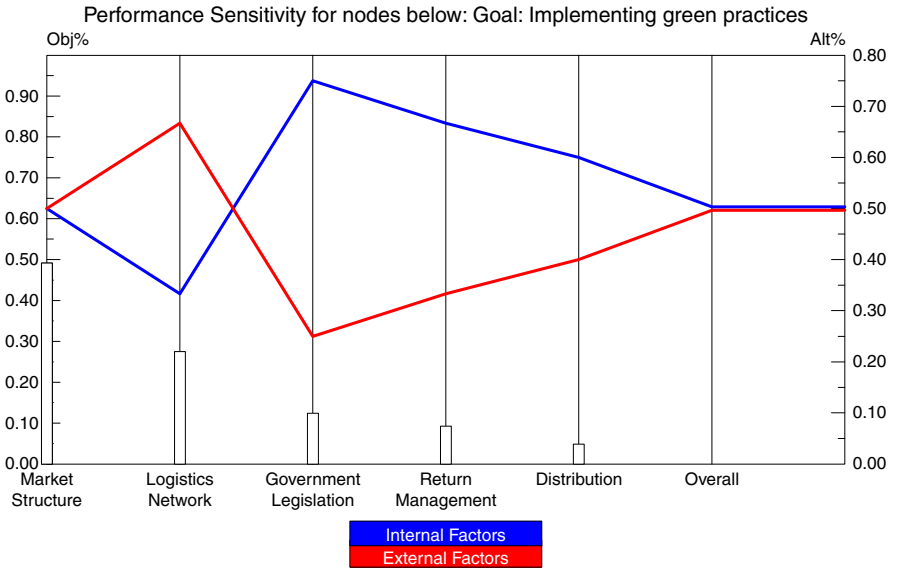

Figure 4.
Sensitivity analysis of the challenges and barriers

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environmentally sustainable FSC is an emerging issue, the research was focused on presenting factors that lead companies to deploy green practices in their SC. The research identified five key barriers and six drivers, which the Greek dairy industry faces in an effort to maintain the environmental sustainability. The research attempted the AHP approach to identify the priority of these factors for the implementation of the sustainable practices. The primary data collected from the Greek dairy industry was systematically analyzed to reflect the influence and weightage of different factors. The study was limited to a specific food sector hence the results are not representative of the whole food industry and cannot be generalized. However, our research complements the findings of Govindan *et al.* (2014) and Ramirez *et al.* (2014) associated with implementing sustainability practices within the SC in different sectors. It is believed that the findings will help the European SMEs and government to understand issues involving environmental sustainability implementation. The research will also fuel the identification of required support from the external agencies.

From a managerial perspective the paper helps to make informed decisions for implementing green practices based on the discussed impelling factors. The empirical work has identified unique drivers and barriers for implementing green practices, which can benefit different stakeholders in the FSC in general. The study also provides a monitoring and control mechanism through the sensitivity analysis to understand the influence of internal and external drivers on each other. The research is believed to contribute to the on-going research on sustainability performance within the FSC management. It also highlights the importance of government legislation for improving the environmental performance in the FSC. It is evident that there is a need for the introduction of new environmental legislations to drive and further support the Greek SMEs. The other insights generated will equip managers for better managing the sustainability agendas. The study has focused on the environmental dimension of sustainability and other two dimensions, namely, social and economic remains unexplored in this research. However, the work is expected to contribute to the sustainability research by conducting a focused study on one dimension and the associated factors influencing its implementation. Further studies into different policy tools that help in providing financial and social sustainability should be investigated. The research mainly focused on the SMEs and it would be interesting to explore how large enterprises perceived the triple bottom line performance.

This work can be extremely useful to industries that need to transform their traditional SC into the greener SC. Since the SMEs cannot eradicate all the barriers simultaneously they should be ready to afford time to eradicate them one by one. Prioritizing these barriers through a critical analysis will provide structured directions for mitigating them. The study considered only 16 prominent factors influencing environmental friendly practices for adaptation. The future studies can address more factors by including the missing factors from the social and economic dimension.

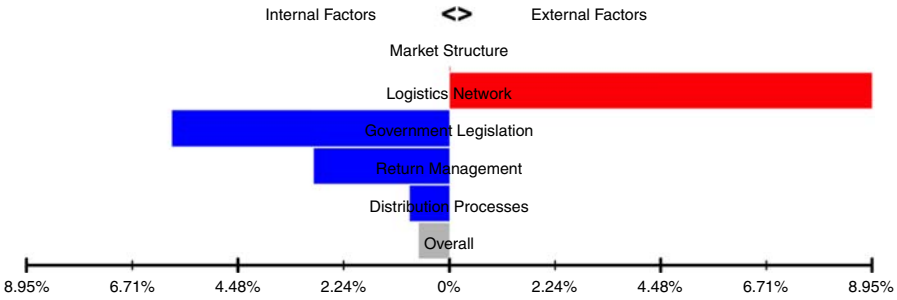

Figure 5. Weighted comparison between external and internal barriers

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Appendix

Questionnaire: Challenges and Barriers for implementing sustainability within Greek SME's in the dairy sector.

The purpose of this questionnaire is to develop a better understanding of factors influencing Greek dairy supply chain in terms of implementing green and reverse logistics practices. The information gathered will help us to determine the issues faced by the food supply chain in general.

Company and Demographic profile

Name of the company:

Number of employees:

Name(s) of product sourced/manufactured/transported:

Region in Greece:

Annual Turnover in Euro (optional):

1. Please indicate the factors significantly influencing your organization for implementing sustainability/green/reverse logistics practices. Please select more than one and provide importance rating out on a scale of 10.

Sustainability performance	**Yes/No**	**If yes, your importance rating**
Internal factors		
1. Misinterpretation of Sustainability		
2. Stakeholder Inertia		
3. Misalignment of strategic goals		
4. Investment cost		
5. Firms capabilities and resources		
6. Size of the firm		
7. Unorganized return management		
8. Complexity		
External factors		
1. Unwillingness to exchange information		
2. Supplier capabilities and resources		
3. Environmental regulations		
4. Insufficient support and guidance		
5. Market structure		
6. Consumer eco-literacy		
7. Product price		
8. Logistics infrastructure		

2. Please identify five prominent barriers facing your firm.

3. Please tick prominent drivers you believe significantly support in driving sustainability.

A. Organizational performance
B. Investors
C. Suppliers
D. Government
E. Competitors
F. Customers

4. Anyother factors (missing from the list) that you feel significantly influence sustainability?

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