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A comparative literature analysis of definitions for green and sustainable supply chain management

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ABSTRACT

The purpose of this paper is to identify and analyze the published definitions of green supply chain management (GSCM) and sustainable supply chain management (SSCM). A total of 22 definitions for GSCM and 12 definitions for SSCM were identified. In order to analyze the identified definitions, two different sets of key characteristics for business sustainability (i.e., economic, environmental, social, stakeholder, volunteer, resilience, and long-term focuses) and SCM (i.e., flow, coordination, stakeholder, relationship, value, efficiency, and performance focuses) were proposed. The identified definitions were analyzed against each other and the two sets of proposed key characteristics. The analysis shows that definitions for GSCM were generally more narrowly focused than those for SSCM and had an emphasis on the characteristics of environmental, flow, and coordination focuses. Though some definitions of SSCM show considerable overlap with definitions of GSCM, it is argued that SSCM is essentially an extension of GSCM. Several identified definitions addressed at least half of the proposed key business sustainability and SCM characteristics. However, no complete definition of GSCM or SSCM was identified. To address this issue, a new definition for SSCM is proposed.

1. Introduction

There is an increasing recognition that organizations must address the issue of sustainability in their operations. Sustainability is commonly defined as utilizing resources to meet the needs of the present without compromising future generations' ability to meet their own needs (WCED, 1987). Considering the ambiguities and vagueness that surrounds this definition, complications frequently arise when attempting to apply the principles of sustainability in practice. The term "sustainability" has been interpreted in a variety of ways, ranging from an inter-generational philosophical position to a multi-dimensional term for business management. Early sustainability initiatives tended to focus on environmental issues but, as time goes on, they are increasingly adopting a triple bottom line (i.e., environment, economic, and social) approach to sustainability. As this approach involves a higher number of interacting factors, a higher degree of complexity can be expected.

There are ongoing debates about the importance and application of sustainability in a business context. Business sustainability has been defined in a number of ways, with one possibility being "the creation of resilient organizations through integrated economic, social and environmental systems" (Bansal, 2010). In a broad sense, business sustainability signifies the resiliency of organizations over time where they are closely connected to healthy environmental, economic and social systems so they are better positioned to respond to internal and external shocks. In this light, organizations are increasingly considering the life cycle implications of their decisions. The management of supply chains is thus receiving increased prominence. A supply chain is a dynamic process that includes the continuous flow of materials, funds and information across multiple functional areas within and between chain members (Jain et al., 2009). Considering the fact that the supply chain contemplates the product from initial processing of raw materials to delivery to the end-user, a focus on supply chains is a step toward the wider adoption and development of sustainability (Ashby et al., 2012). The topic of sustainability in the context of supply chain management (SCM) has been discussed using a number of terms in the literature. The two terms used that most closely link sustainability and SCM concepts are green supply chain management (GSCM) and sustainable supply chain management (SSCM) (Ashby et al., 2012). A number of recent literature reviews on GSCM and SSCM have been published (e.g., Abbasi and Nilsson, 2012; Ashby et al., 2012; Carter and Rogers, 2008; Carter and Easton, 2011; Gimenez and Tachizawa, 2012; Sarkis et al., 2011;

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Seuring and Muller, 2008; Srivastava, 2007). One of the key issues highlighted in these reviews is the profusion of definitions for both of these terms.

The purpose of this paper is to analyze the published definitions of GSCM and SSCM. This is accomplished through a comparison of these definitions against the characteristics of business sustainability and SCM. The definitions of GSCM and SSCM are also compared against each other. The analysis will help highlight the convergences and divergences in the literature as well as the strengths and weaknesses of the existing definitions. The analysis also provides the basis for the development of a new definition for SSCM. This will provide a reference point for future research in these areas.

2. Overview of business sustainability and supply chain management

Sustainability and SCM are two concepts that independently have created many debates over the last decade (Seuring et al., 2008). However, the increasing integration of sustainability into SCM demonstrates an evolving area where they exhibit explicit interactions (Ashby et al., 2012). Therefore, in order to investigate the integration of sustainability into SCM practice, a brief overview of each of these subjects is provided in the following sub-sections. A summary and analysis of representative definitions of business sustainability and SCM is emphasized. This will provide a basis for structuring the analysis of definitions of GSCM and SSCM later in the paper.

2.1. Business sustainability

Sustainability issues are receiving increased attention among businesses. Business sustainability initiatives are often conducted under a variety of titles, with "corporate sustainability" (Steurer et al., 2005) being among the most prominent. Business sustainability initiatives are often closely associated with "corporate social responsibility (CSR)" initiatives. In fact, although there are those who would argue against the practice, sustainability and CSR are often used as synonyms in a corporate context (Van Marrewijk, 2003). An analysis of definitions of corporate sustainability, business sustainability, and CSR shows that they share a number of key features.

Table 1 presents a representative summary of definitions for corporate sustainability and business sustainability. The definitions were identified based on a scan of the literature and the list should be viewed as illustrative rather than comprehensive. Although analyses of definitions for CSR have been published (e.g., Dahlsrud, 2008), no compilations of definitions for these terms were found. The definitions in Table 1 show that sustainability issues in a corporate context should focus on an integrated perspective of the triple bottom line, focus on addressing the needs of key stakeholders, and adopt a long-term perspective. The need to build resilient organizations is also highlighted, as is the voluntary nature of many business sustainability initiatives. Building on the analysis in Table 1, the key characteristics of business sustainability may therefore be expressed as: (1) economic focus, (2) environmental focus, (3) social focus, (4) stakeholder focus, (5) volunteer focus, (6) resilience focus, and (7) long-term focus. Table 1 includes a set of notes explaining how each characteristic was interpreted in the analysis. These characteristics are consistent with a previous analysis of 37 definitions of CSR, which identified the five key CSR dimensions as stakeholder, social, economic, voluntariness, and environmental (Dahlsrud, 2008).

Increasingly, researchers and practitioners in different fields are taking into account the impacts and implications of business sustainability on traditional assumptions and practices in their fields (Gimenez and Tachizawa, 2012). SCM is one of these research areas. With that in mind, an introduction to SCM is provided in the next subsection.

2.2. Supply chain management

Many avenues of research have been pursued under the umbrella of SCM (Mentzer et al., 2001). Since the introduction of the concept in the early 1980s, SCM has been used to describe the planning and control of materials, information flows, and the logistics activities internally within a company and also externally between companies (Cooper et al., 1997). Over time, research on SCM has continued to broaden in focus (Burgess et al., 2006). Initially, SCM focused primarily on material flows. More recent research emphasizes additional aspects of SCM, such as risk (Colicchia and Strozzi, 2012), performance (Hassini et al., 2012), and integration (Fabbe-Costes and Jahre, 2007). There is also a growing emphasis on information flows, internal and external networks of relationships (Stock et al., 2010), and governance of supply networks (Pilbeam et al., 2012).

The growing interest in SCM has led to the development of numerous definitions to describe it. A summary of representative definitions for SCM is presented in Table 2. These definitions have been collected through a scan of literature and should be viewed as illustrative rather than comprehensive. An analysis of the definitions in Table 2 highlights that SCM is focused on managing flows of materials, services, and information. In order to manage these activities, there is a clear emphasis on the need for coordination within and between firms. Furthermore, an emphasis on meeting stakeholder needs, particularly those of customers, feature prominently in the definitions. The management of internal and external relationships also features prominently. The key outcomes of these activities are to create value, improve efficiency, and improve overall performance in the supply chain. Based on an analysis of the SCM definitions summarized in Table 2, the key characteristics of SCM may thus be expressed as: (1) flow focus, (2) coordination focus, (3) stakeholder focus, (4) relationship focus, (5) value focus, (6) efficiency focus, and (7) performance focus. There is a set of notes in Table 2 that explain how each characteristic was interpreted in the analysis. These characteristics are broadly consistent with a previous analysis of 173 definitions of SCM, which identified the three major SCM themes as activities, benefits, and constituents/components, as well as six associated sub-themes: material/physical, finances, services and information flows; networks of relationships (internal and external); value creation; creates efficiencies; customer satisfaction; and constituents or components (Stock and Boyer, 2009, p. 698). Furthermore, the key SCM characteristics listed here are also broadly in line with the findings in Burgess et al. (2006), who identified the key themes in SCM as leadership, intra-and inter-organizational relationships, logistics, process improvement orientation, information system, and business results and outcomes.

SCM shares the stakeholder focus with the concept of business sustainability. There is also a growing effort to incorporate the other characteristics of sustainability into SCM. This is reflected in ongoing research on GSCM and SSCM. However, the many published definitions of GSCM and SSCM have yet to be systematically analyzed to determine the extent to which they address the characteristics of both business sustainability and SCM. The remainder of this paper focuses on this issue.

3. Research methodology

Tranfield et al. (2003) explain that literature reviews have dual purposes. First, the intellectual structure of an identified field needs to be mapped, consolidated and evaluated. Building on that work,

Table 1
Representative definitions of business sustainability.

Definition source	Definition	Characteristics exhibited[a]						
		Economic focus[b]	Environmental focus[c]	Social focus[d]	Stakeholder focus[e]	Volunteer focus[f]	Resilience focus[g]	Long-term focus[h]
IISD, 1992, p. 11	For the business enterprise, sustainable development means adopting business strategies and activities that meet the needs of the enterprise and its stakeholders today while protecting, sustaining, and enhancing the human and natural resources that will be needed in the future.	■	■	■	■			■
Dyllick and Hockerts, 2002, p. 131	Corporate sustainability can accordingly be defined as meeting the needs of a firm's direct and indirect stakeholders (such as shareholders, employees, clients, pressure groups, communities etc), without compromising its ability to meet the needs of future stakeholders as well.				■			■
Van Marrewijk, 2003, p. 102	In general, corporate sustainability and, CSR [corporate social responsibility] refer to company activities – voluntary by definition – demonstrating the inclusion of social and environmental concerns in business operations and in interactions with stakeholders. This is the broad – some would say "vague" – definition of corporate sustainability and CSR.	■	■	■	■	■		
Caldelli and Parmigiani, 2004, p. 159	The approach to CS [corporate sustainability] implies integration of criteria of economic, social and environmental performance (referring to the triple bottom line: people, planet, profit) in company's decision-making processes. To the above aspects we add a fourth dimension, that of principles: every firm is by definition guided by a system of values, which determines its context and orientation.	■	■	■	■			
Steurer et al., 2005, p. 274	While SD [sustainable development] is commonly perceived as societal guiding model, which addresses a broad range of quality of life issues in the long term, CS [corporate sustainability] is a corporate guiding model, addressing the short- and long-term economic, social and environmental performance of corporations.	■	■	■				■
Bansal, 2010, p. 1	Business sustainability *n*. the creation of resilient organizations through integrated economic, social and environmental systems.	■	■	■			■	
Slawinski and Bansal, 2010, p. 1	We define business sustainability as the ability of firms to respond to short-term financial, social and environmental demands, without compromising their long-term financial, social and environmental performance.	■	■	■				■
Hassini et al., 2012, p. 2	We define business sustainability as the ability to conduct business with a long term goal of maintaining the well-being of the economy, environment and society.	■	■	■				■

[a] The identification of the "characteristics exhibited" was inspired by the approach in Dahlsrud (2008).
[b] *Economic focus*: The definition includes language related to the economic dimension of sustainability.
[c] *Environmental focus*: The definition includes language related to the environmental dimension of sustainability.
[d] *Social focus*: The definition includes language related to the social dimension of sustainability.
[e] *Stakeholder focus*: The definition includes explicit reference to stakeholders, including (but not limited to) customers, consumers, and suppliers.
[f] *Volunteer focus*: The definition includes reference to the voluntary nature of business sustainability.
[g] *Resilience focus*: The definition includes reference to resilience, defined as "an ability to recover from or adjust easily to misfortune or change" (Merriam-Webster, 2012).
[h] *Long-term focus*: The definition includes reference to the long-term nature of sustainability. Reference to the future or the long-term was taken as indications of a long-term focus.

the key knowledge gaps and opportunities to address them can be identified. The underlying rationale is to develop and expand the body of knowledge in the field. Following this logic, a systematic research literature review on definitions for GSCM and SSCM was conducted in this paper. Systematic literature reviews are currently playing a major role in evidence based practices (Tranfield et al., 2003). By adopting a scientific, imitable, and transparent process, systematic literature reviews can provide an appropriate audit track for decisions, procedures, and conclusions made by the reviewers (Cook et al., 1997).

As previously noted, the purpose of this paper was to identify and analyze the definitions of GSCM and SSCM published in the peer-reviewed literature. To achieve this purpose, the literature review focused on a search of all articles published in the Scopus database. Scopus was selected due to its broad coverage of management and engineering journals. The search was limited to articles published in English in peer-reviewed journals. To identify the relevant articles, a structured keyword search was conducted. Accordingly, the terms "green supply chain management" and "sustainable supply chain management" were separately searched. The search for each of the keywords was conducted along with the terms "define", "defining" and "definition" by utilizing the "All Fields" category. The data range was set for the papers published from "All years" to "Present", and all of the "Subject Areas" available in Scopus were chosen for each of the conducted searches. References cited in the papers identified through the Scopus search were also used as secondary sources to identify additional relevant publications. As of January 31, 2012, a total of 124 papers for GSCM and 56 papers for SSCM were identified in the Scopus search. Fig. 1 shows a distribution of the published articles by year over the last 10 years. Figs. 2 and 3 show the distribution of reviewed articles by journal for GSCM and SSCM, respectively. The figures highlight the multidisciplinary approach required in a systematic literature review (Burgess et al., 2006; Tranfield et al., 2003). As shown in the

Table 2
Representative definitions of supply chain management.

Definition source	Definition	Characteristics exhibited[a]						
		Flow focus[b]	Coordination focus[c]	Stakeholder focus[d]	Relationship focus[e]	Value focus[f]	Efficiency focus[g]	Performance focus[h]
Lambert et al., 1998, p. 1	The integration of key business processes from end-user through original suppliers that provide products, services, and information that add value for customers and other stakeholders.	■	■	■		■		
Larson and Rogers, 1998, p. 2	The coordination of activities, within and between vertically linked firms, for the purpose of serving end customers at a profit.		■	■		■		
Walters and Lancaster, 2000, p. 160	The management of the interface relationships among key stakeholders and enterprise functions that occur in the maximization of value creation which is driven by customer needs satisfaction and facilitated by efficient logistics management.			■	■	■	■	
Mentzer et al., 2001, p. 18	The systemic, strategic coordination of the traditional business functions and the tactics across these business functions within a particular company and across businesses within the supply chain, for the purposes of improving the long-term performance of the individual companies and the supply chain as a whole.		■	■				■
Lummus et al., 2001, p. 428	All the activities involved in delivering a product from raw material through to the customer, including sourcing raw materials and parts, manufacturing and assembly, warehousing and inventory tracking, order entry and order management, distribution across all channels, delivery to the customer, and the information systems necessary to monitor all of these activities.	■	■	■				■
Gibson et al., 2005, p. 22	Encompassing the planning and management of all activities involved in sourcing and procurement, conversion, demand creation and fulfillment, and all logistic management activities.	■	■					
Eng, 2005, p. 4	Managing the inputs of goods or services including a range of activities not only within a single department in an organization but also from different departments and outside the organization, for final users from procurement of raw materials through to the end of the products' useful life.	■	■	■	■			
Stock and Boyer, 2009, p.706	The management of a network of relationships within a firm and between interdependent organizations and business units consisting of material suppliers, purchasing, production facilities, logistics, marketing, and related systems that facilitate the forward and reverse flow of materials, services, finances and information from the original producer to final customer with the benefits of adding value, maximizing profitability through efficiencies, and achieving customer satisfaction.	■	■	■	■	■	■	

[a] The identification of the "characteristics exhibited" was inspired by the approach in Stock and Boyer (2009).
[b] *Flow focus*: The definition includes language related to the flows of materials, services, or information. Reference to the supply chain was considered to implicitly refer to this focus area.
[c] *Coordination focus*: The definition includes reference to coordination within the organization or between organizations. Reference to the supply chain, the product life cycle, or activities across channels was considered to implicitly refer to this focus area.
[d] *Stakeholder focus*: The definition includes explicit reference to stakeholders, including (but not limited to) customers, consumers, and suppliers.
[e] *Relationship focus*: The definition includes reference to the networks of internal and external relationships. This includes mentioning the coordination of inter-organizational business processes.
[f] *Value focus*: The definition includes reference to value creation, including increasing profit or market share and converting resources into usable products.
[g] *Efficiency focus*: The definition includes reference to efficiency, including a reduction in inputs.
[h] *Performance focus*: The definition includes reference to performance, including applying performance measures, improving performance, improving competitive capacity, monitoring, and achieving goals.

figures, the journals cover a wide range of core topic areas, with an emphasis on sustainability, production, operations, strategy, business, and supply chain management.

Each of the identified papers was searched to identify any explicit definitions of GSCM and SSCM. Statements were considered as definitions if they explicitly expressed "the essential nature of" the terms GSCM or SSCM (adapted from Merriam-Webster, 2012). In cases where a definition was reproduced from another source, the original paper was considered the basis of the definition. Once a database of definitions was developed, two researchers independently examined each group of definitions (i.e., GSCM and SSCM). Each definition was analyzed for both latent and manifest content by using a word-for-word content analysis (Krippendorf, 2004). Content analysis is a useful and efficient tool for performing systematic and transparent literature reviews (Seuring and Gold, 2012). The approach of conducting a keyword analysis and systematically reviewing the literature through content analysis has been employed in a number of recent literature reviews on SCM topics (e.g., Abbasi and Nilsson, 2012; Burgess et al., 2006; Carter and Easton, 2011; Seuring and Muller, 2008). In this study, the key business sustainability and SCM characteristics reflected in each published definition of GSCM and SSCM were identified and recorded. Once each researcher independently completed the analysis, the results were discussed in detail and finalized.

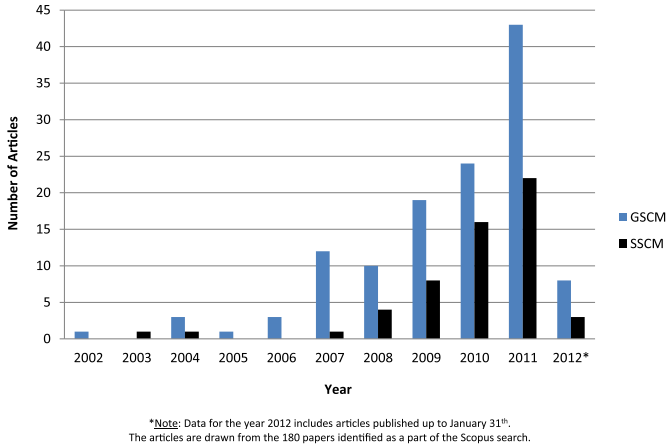


Fig. 1. Distribution of the articles reviewed.

It should be noted that the literature review conducted in this study was extensive, but not exhaustive. While Scopus provides broad coverage of the academic literature, it does not cover every peer-reviewed publication and, hence, it is possible that relevant papers on GSCM or SSCM were missed. As an illustration of this point, this study considered 180 papers. However, a recent literature survey conducted by Seuring and Muller (2008) identified 191 papers on the subject of SSCM. The difference in numbers may be explained by the use of different databases and search terms. In particular, the use of the terms "define", "defining" and "definition" in the search conducted as part of this study may have led to the smaller paper count. Nonetheless, the papers included in this study provided a reasonable representation of the research on GSCM and SSCM.

4. Results and discussion

In this section, results for the published definitions of GSCM will be provided followed by the results for the published definitions of SSCM. In both cases, the results will be presented chronologically in tables. The results are analyzed and discussed in the remaining subsections.

4.1. Green supply chain management definitions

A total of 22 unique definitions for GSCM were identified in the search. A summary of the definitions is provided in Table 3. The last two columns in Table 3 contain a summary of the Scopus citations for the paper containing the definition, and a list of other papers that cited and used a pre-existing definition listed (both as of January 31, 2012). These columns provide some insights into the uptake of the definition.

4.2. Sustainable supply chain management definitions

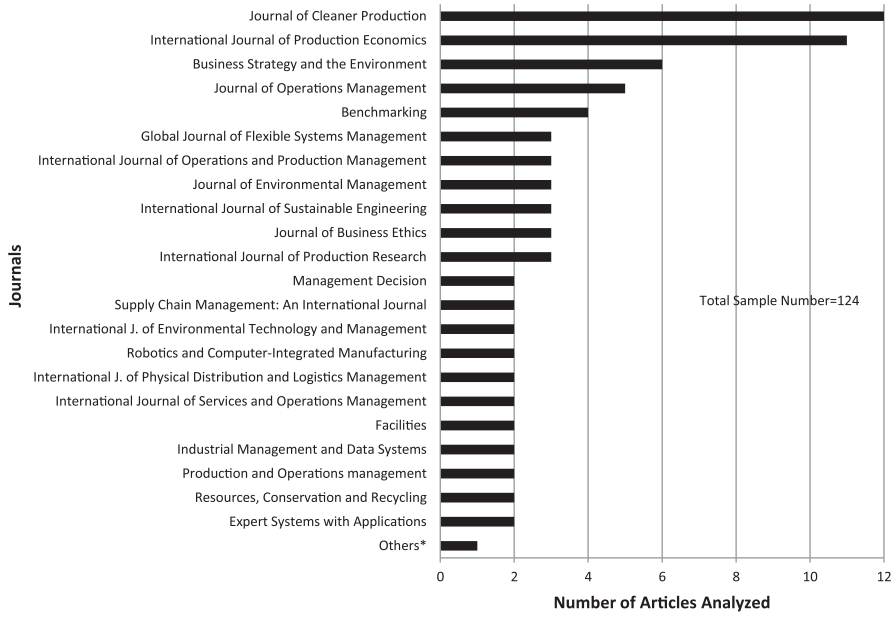
A total of 12 unique definitions for SSCM were identified in the search. A summary of the definitions is provided in Table 4. As in Table 3, the last two columns in Table 4 contain a summary of the Scopus citations for the paper containing the definition and a list of other papers that cited and used a pre-existing definition listed (both as of January 31, 2012).

4.3. Sustainability characteristics addressed by the definitions

A summary of the key business sustainability characteristics addressed by the published definitions of GSCM and SSCM is provided in Table 5. The table includes a set of notes explaining how each characteristic was interpreted in the analysis.

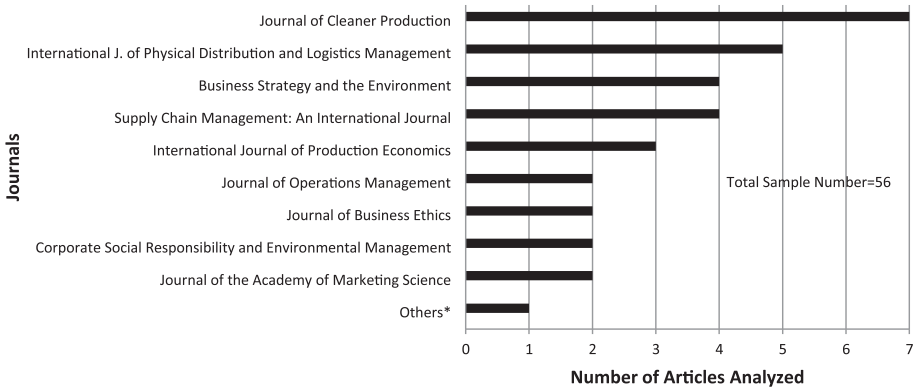
4.3.1. Sustainability characteristics addressed by green supply chain management definitions

In the published definitions for GSCM, only 3 (14%) explicitly addressed multiple dimensions of the triple bottom line. In these papers (Buyukozkan and Cidci, 2012; Yeh and Chuang, 2011; Zhu et al., 2005), both environmental and economic considerations were explicitly addressed. The remaining definitions, with one exception (i.e., Sheu et al., 2005), focused exclusively on the



*Note: The remaining journals published only one relevant paper.

Fig. 2. Distribution of the articles analyzed for GSCM definitions.



*Note: The remaining journals published only one relevant paper.

Fig. 3. Distribution of the articles analyzed for SSCM definitions.

environmental dimension of sustainability. Social issues were not explicitly mentioned in any of the published definitions of GSCM. The focus on environmental issues was to be expected given the nature of the term "GSCM", which clearly emphasizes this dimension of sustainability.

Among the other business sustainability characteristics examined, only the stakeholder focus and long-term focus categories were addressed by some of the definitions. Table 5 shows that 7 (32%) of the definitions demonstrated some focus on stakeholders. The stakeholders that were specifically mentioned included customers (Handfield and Nichols, 1999; Lee and Klassen, 2008), consumers (Srivastava, 2007; Wee et al., 2011), employees (Kim et al., 2011), and suppliers (Gavronski et al., 2011; Lee and Klassen, 2008; Yeh and Chuang, 2011). It is important to note, however, that these definitions generally provided only a passing reference to these stakeholders. Table 5 also shows that 10 (46%) of the definitions demonstrated a long-term focus. This was generally indicated through reference to end-of-life product management, product reuse, product recovery, reverse logistics, and closed-loop supply chains. None of the definitions explicitly mentioned future generations or the management of the supply chain over the long-term.

The volunteer focus and resilience focus categories were not addressed by any of the definitions studied. The voluntary nature of sustainability is rarely made explicit in definitions of business sustainability, though previous research has shown that several definitions of CSR do make the point (Dahlsrud, 2008). Resilience is also rarely addressed in definitions of business sustainability. This may help explain why these characteristics were not incorporated into the published definitions of GSCM.

4.3.2. Sustainability characteristics addressed by sustainable supply chain management definitions

An analysis of the definitions suggested for SSCM found that although all three dimensions of the triple bottom line were explicitly addressed, they were not present in all suggested definitions. Jorgensen and Knudsen (2006) were the only authors that limited their focus to the social dimension. Five (42%) definitions addressed two dimensions of sustainability. Seuring (2008), Badurdeen et al. (2009), and Haake and Seuring (2009) focused on combinations of the environmental and social aspects of sustainability. Wittstruck and Teuteberg (2011) highlighted ethics as part of the social feature of sustainability, and suggested a definition for SSCM that emphasizes the environmental and ethical aspects of sustainability in the supply chain. Closs et al. (2011) focused on a combination of the economic and environmental features of sustainability by highlighting the importance of substantial marketing and consideration of alternative energy platforms in the supply chain. The remaining definitions (50%) addressed all three aspects of the triple bottom line. These included definitions by Carter and Rogers (2008), Seuring and Muller (2008), Ciliberti et al. (2008), Font et al. (2008), Pagell and Wu (2009), and Wolf (2011).

Beyond the triple bottom line dimensions, Table 5 shows that the other sustainability characteristics considered were addressed by one definition or another, with the exception of the volunteer focus. Five (42%) definitions addressed the stakeholder focus characteristic. Stakeholders were broadly referred to in one definition, while the others mentioned resources, suppliers or customers. One-third of the definitions studied addressed the long-term focus characteristic. Carter and Rogers (2008) explicitly mentioned the importance of improving the company's long-term economic performance. The other three definitions addressing the long-term focus characteristic did so more indirectly, as was seen in the definitions of GSCM. Only 1 (8%) of the definitions emphasized the resilience focus characteristic (Closs et al., 2011). This directed clear focus to the many risks involved in SCM and the importance of the company's ability to recover from and adapt to these risks. Overall, the most comprehensive definitions from a sustainability perspective were provided by Carter and Rogers (2008) who addressed 5 of the 7 characteristics, and by Seuring and Muller (2008), Pagell and Wu (2009), Badurdeen et al. (2009), Wolf (2011), and Closs et al. (2011) who each addressed 4.

4.3.3. Summary

Overall, the results show that the definitions for GSCM were generally more narrowly focused than those for SSCM and had an overwhelming emphasis on environmental issues. Though some definitions of SSCM show considerable overlap with definitions of GSCM, it is clear that SSCM is essentially an extension of GSCM. While the integration of environmental thinking into SCM practices is found to be the central point of concern in almost all of the definitions of GSCM, the definitions of SSCM adopt a broader triple bottom line perspective. Both GSCM and SSCM had several definitions that addressed the stakeholder focus and long-term focus of business sustainability. Resilience was addressed by only one of the definitions in both categories, while the voluntary focus of business sustainability was not captured by any of the published definitions. This may reflect the fact that actions do not necessarily need to be voluntary to qualify as GSCM or SSCM. The distribution of the key business sustainability characteristics highlighted in the analysis is shown in Fig. 4.

Table 3
Definitions of green supply chain management (GSCM).

Definition source	Definition	Scopus citations	Used by
Handfield et al., 1997	Application of environmental management principles to the entire set of activities across the whole customer order cycle, including design, procurement, manufacturing and assembly, packaging, logistics, and distribution.	132	
Zhu et al., 2005, p. 450	An important new archetype for enterprises to achieve profit and market share objectives by lowering their environmental risks and impacts while raising their ecological efficiency.	91	
Hervani et al., 2005, p. 334	Green Purchasing + Green Manufacturing/Materials Management + Green Distribution/Marketing + Reverse Logistics	81	
Sheu et al., 2005	Combination of both the product manufacturing supply chain and used-product reverse logistics chain.	85	
Srivastava, 2007, pp. 54–55	Integrating environmental thinking into supply-chain management, including product design, material sourcing and selection, manufacturing processes, delivery of the final product to the consumers as well as end-of-life management of the product after its useful life.	170	Shang et al., 2010; Caniato et al., 2012; DeGiovanni and EspositoVinzi, 2012
H'Mida and Lakhal, 2007, p. 6	The practice of monitoring and improving environmental performance in the supply chain during a product's life cycle.	0	
Lakhal et al., 2007	Olympic green supply chain characterized by five-circled flag of the Olympics as zero emissions, zero waste in activities, zero waste of resources, zero use of toxic substances, zero waste in product life-cycle, in addition to green inputs and green outputs.	2	
Srivastava, 2008, p. 535	Integration of sound environmental management choices with the decision making process for the conversion of resources into usable products.	70	
Lee and Klassen, 2008, p. 575	A buying organization's plans and activities that integrate environmental issues into supply chain management in order to improve the environmental performance of suppliers and customers.	11	
Albino et al., 2009, p. 88	A strategic approach addressed to extend environmental measures to the whole supply chain.	17	
Wee et al., 2011, p. 603	Integration of environment considerations into supply chain management, including product design, material sourcing and selection, manufacturing processes, delivery of the final product to the consumers, and end-of-life management of the greening products.	0	
Gavronski et al., 2011, p. 875	The complex of mechanisms implemented at the corporate and plant level to assess or improve the environmental performance of a supplier base.	0	
Lau, 2011, p. 874	Integrating environmental thinking into closed-loop supply chain management.	0	
El Saadany et al., 2011, p. 1203	Reducing energy and virgin raw material usage and waste generation, and increasing product recovery options. Greening usually refers to the forward supply chain functions such as production, purchasing, materials management, warehousing and inventory control, distribution, shipping, and transport logistics.	0	
Wu and Pagell, 2011, p. 578	The environmental dimension of sustainability in a supply chain context.	2	
Gnoni et al., 2011, p. 129	An approach that aims to integrate environmental issues into SC management procedure starting from product design, and continuing through material sourcing and selection, manufacturing processes, the final product delivery and end-of-life management.	0	
Yeh and Chuang, 2011, p. 4244	Management between suppliers, their products and environment, that is to say, the environment protection principle is brought into suppliers' management system. Its purpose is to add environment protection consciousness into original products and to improve competitive capacity in markets.	1	
Sarkis et al., 2011, p. 3	Integrating environmental concerns into the inter-organizational practices of SCM including reverse logistics.	9	
Kim et al., 2011	A set of practices intended to effect, control and support environmental performance by allocating possible human material resources and redefining organizational responsibilities and procedures.	0	
Parmigiani et al., 2011	The impact of supply chains on environmental performance.	0	
Buyukozkan and Cidci, 2012	A way for firms to achieve profit and market share objectives by lowering environmental impacts and increasing ecological efficiency.	0	
Andic et al., 2012	Minimizing and preferably eliminating the negative effects of the supply chain on the environment.	0	

Note: These 22 unique definitions of GSCM are from a total of 124 identified articles analyzed.

4.4. Supply chain management characteristics addressed by the definitions

A summary of the key SCM characteristics addressed by the published definitions of GSCM and SSCM is provided in Table 6. The table includes a set of notes explaining how each characteristic was interpreted in the analysis.

4.4.1. Supply chain management characteristics addressed by green supply chain management definitions

The analysis showed that the coordination focus and the flow focus were overwhelmingly the most frequently addressed SCM characteristics in the GSCM definitions. The coordination focus was addressed in 20 of the 22 (91%) definitions while the flow focus was addressed in 19 (86%) of the definitions. In many cases, these

Table 4
Definitions of sustainable supply chain management (SSCM).

Definition source	Definition	Scopus citations	Used by
Jorgensen and Knudsen, 2006, p. 450	The means by which companies manage their social responsibilities across dislocated production processes spanning organizational and geographical boundaries.	8	
Carter and Rogers, 2008, p. 368	The strategic, transparent integration and achievement of an organization's social, environmental, and economic goals in the systemic coordination of key inter-organizational business processes for improving the long-term economic performance of the individual company and its supply chains.	68	Preuss, 2009; Subramoniam et al., 2010; Liu et al., 2011; Carter and Easton, 2011
Seuring and Muller, 2008, p. 1700	The management of material, information and capital flows as well as cooperation among companies along the supply chain while taking goals from all three dimensions of sustainable development, i.e., economic, environmental and social, into account which are derived from customer and stakeholder requirements.	117	Preuss, 2009; Ramani et al., 2010; Gold et al., 2010; Wolf and Seuring, 2010; Seuring, 2011
Seuring, 2008, p. 132	The integration of sustainable development and supply chain management [in which] by merging these two concepts, environmental and social aspects along the supply chain have to be taken into account, thereby avoiding related problems, but also looking at more sustainable products and processes.	25	
Ciliberti et al., 2008, p. 1580	The management of supply chains where all the three dimensions of sustainability, namely the economic, environmental, and social ones, are taken into account.	14	Moore and Manring, 2009
Font et al., 2008, p. 260	Adding sustainability to existing supply chain management processes, to consider environmental, social and economic impacts of business activities.	5	
Pagell and Wu, 2009, p. 38	The specific managerial actions that are taken to make the supply chain more sustainable with an end goal of creating a truly sustainable chain.	22	
Badurdeen et al., 2009, p. 57	Involvement of the planning and management of sourcing, procurement, conversion and logistics activities involved during pre-manufacturing, manufacturing, use and post-use stages in the life cycle in closed-loop through multiple life-cycles with seamless information sharing about all product life-cycle stages between companies by explicitly considering the social and environmental implications to achieve a shared vision.	6	
Haake and Seuring, 2009, p. 285	The set of supply chain management policies held, actions taken, and relationships formed in response to concerns related to the natural environment and social issues with regard to the design, acquisition, production, distribution, use, reuse, and disposal of the firm's goods and services.	7	
Wolf, 2011, p. 223	The degree to which a manufacturer strategically collaborates with its supply chain partners and collaboratively manages intra- and inter-organization processes for sustainability.	1	
Closs et al., 2011, p. 102	Reflection of the firm's ability to plan for, mitigate, detect, respond to, and recover from potential global risks. Risks involving substantial marketing and supply chain considerations include product development, channel selection, market decisions, sourcing, manufacturing complexity, transportation, government and industry regulation, resource availability, talent management, alternative energy platforms, and security.	1	
Wittstruck and Teuteberg, 2011, p. 142	An extension to the traditional concept of Supply Chain Management by adding environmental and social/ethical aspects.	0	

Note: These 12 unique definitions of SSCM are from a total of 56 identified articles analyzed.

characteristics were addressed implicitly through reference in the definition to supply chains or SCM. The heavy emphasis on these two characteristics reflects their importance in SCM overall and the need to reflect them in any extensions of the concept, as in GSCM.

Each of the other SCM characteristics were also addressed in the definitions of GSCM. The stakeholder focus was addressed in 7 (32%) of the definitions. As previously mentioned, the stakeholder focus characteristic was the only one that directly overlapped with the characteristics of sustainability. The performance focus characteristic, which was addressed in 8 (36%) of the definitions, was reflected in a number of ways, including reference to environmental performance (Andic et al., 2012; Gavronski et al., 2011; H'Mida and Lakhal, 2007; Kim et al., 2011; Lee and Klassen, 2008; Parmigiani et al., 2011), environmental measures (Albino et al., 2009), and improving competitive capacity (Yeh and Chuang, 2011). The efficiency focus of SCM was reflected in 4 (18%) definitions, including in direct references to efficiency (Zhu et al., 2005), zero waste (Buyukozkan and Cidci, 2012; Lakhal et al., 2007), and reducing resource usage (El Saadany et al., 2011). The value focus was addressed by 3 (14%) of the definitions. This was accomplished through reference to profit and market share (Buyukozkan and Cidci, 2012; Zhu et al., 2005) and conversion of resources into usable products (Srivastava, 2008). Finally, the relationship focus characteristic was addressed by only 2 (9%) of the definitions. Yeh

Table 5
Key business sustainability characteristics addressed by the definitions.

Category	Definition	Business sustainability characteristics						
		Economic focus[a]	Environmental focus[b]	Social focus[c]	Stakeholder focus[d]	Volunteer focus[e]	Resilience focus[f]	Long-term focus[g]
GSCM	Handfield et al. (1997)		■		■			
	Zhu et al. (2005)	■	■					
	Hervani et al. (2005)		■					■
	Sheu et al. (2005)							■
	Srivastava (2007)		■		■			■
	H'Mida and Lakhal (2007)		■					■
	Lakhal et al. (2007)		■					■
	Srivastava (2008)		■					
	Lee and Klassen (2008)		■		■			
	Albino et al. (2009)		■					
	Wee et al. (2011)		■		■			■
	Gavronski et al. (2011)		■		■			
	Lau (2011)		■					■
	El Saadany et al. (2011)		■					■
	Wu and Pagell (2011)		■					
	Gnoni et al. (2011)		■					■
	Yeh and Chuang (2011)	■	■		■			
	Sarkis et al. (2011)		■					■
	Kim et al. (2011)		■		■			
	Parmigiani et al. (2011)		■					
	Buyukozkan and Cidci (2012)	■	■					
	Andic et al. (2012)		■					
SSCM	Jorgensen and Knudsen (2006)			■				
	Carter and Rogers (2008)	■	■	■	■			■
	Seuring and Muller (2008)	■	■	■	■			
	Seuring (2008)		■	■				
	Ciliberti et al. (2008)	■	■	■				
	Font et al. (2008)	■	■	■				
	Pagell and Wu (2009)	■	■	■				■
	Badurdeen et al. (2009)		■	■	■			■
	Haake and Seuring (2009)		■	■				■
	Wolf (2011)	■	■	■	■			
	Closs et al. (2011)	■	■		■		■	
	Wittstruck and Teuteberg (2011)		■	■				

[a] *Economic focus*: The definition includes language related to the economic dimension of sustainability.
[b] *Environmental focus*: The definition includes language related to the environmental dimension of sustainability.
[c] *Social focus*: The definition includes language related to the social dimension of sustainability.
[d] *Stakeholder focus*: The definition includes explicit reference to stakeholders, including (but not limited to) customers, consumers, and suppliers.
[e] *Volunteer focus*: The definition includes reference to the voluntary nature of business sustainability.
[f] *Resilience focus*: The definition includes reference to resilience, defined as "an ability to recover from or adjust easily to misfortune or change" (Merriam-Webster, 2012).
[g] *Long-term focus*: The definition includes reference to the long-term nature of sustainability. Reference to end-of-life management, reuse, product recovery, reverse logistics, the closed-loop supply chain, and the product life cycle were taken as indications of a long-term focus.

and Chuang (2011) addressed this characteristic through reference to management between suppliers and supplier management systems while Sarkis et al. (2011) did so through reference to inter-organizational practices.

Overall, the results show that there was good coverage of the characteristics of SCM in the definitions suggested for GSCM, though different authors certainly emphasized different aspects. The most comprehensive definitions were provided by Yeh and Chuang (2011) who addressed 5 of the 7 SCM characteristics and by Kim et al. (2011) and Lee and Klassen who each addressed 4.

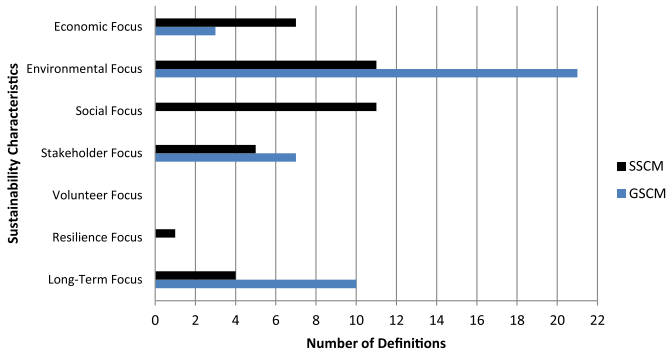


Fig. 4. Distribution of the key business sustainability characteristics addressed by the definitions.

4.4.2. Supply chain management characteristics addressed by sustainable supply chain management definitions

In the definitions for SSCM, the analysis showed that the most commonly addressed SCM characteristics are the coordination focus and the flow focus. The coordination focus was addressed in all 12 of the published definitions, while the flow focus appeared in 10 (83%) of the definitions. As with the GSCM definitions, these characteristics were in many cases addressed implicitly through the use of the terms "supply chain" or "supply chain management" in the definitions.

Of the remaining SCM characteristics, only three (i.e., relationship focus, stakeholder focus and performance focus) were addressed in the SSCM definitions. Five (42%) of the definitions addressed the relationship focus. Haake and Seuring (2009) explicitly mentioned the forming of relationships. The coordination of inter-organizational business processes (Carter and Rogers, 2008; Wolf, 2011), cooperation among companies (Seuring and Muller, 2008), and seamless information sharing between

Table 6
Key SCM characteristics addressed by the definitions.

Category	Definition	SCM characteristics						
		Flow focus[a]	Coordination focus[b]	Stakeholder focus[c]	Relationship focus[d]	Value focus[e]	Efficiency focus[f]	Performance focus[g]
GSCM	Handfield et al. (1997)	■	■	■				
	Zhu et al. (2005)					■	■	
	Hervani et al. (2005)	■	■					
	Sheu et al. (2005)	■	■					
	Srivastava (2007)	■	■	■				
	H'Mida and Lakhal (2007)	■	■					■
	Lakhal et al. (2007)	■	■				■	
	Srivastava (2008)	■	■			■		
	Lee and Klassen (2008)	■	■	■				■
	Albino et al. (2009)	■	■					■
	Wee et al. (2011)	■	■	■				
	Gavronski et al. (2011)		■	■				■
	Lau (2011)	■	■					
	El Saadany et al. (2011)	■	■				■	
	Wu and Pagell (2011)	■	■					
	Gnoni et al. (2011)	■	■					
	Yeh and Chuang (2011)	■	■	■	■			■
	Sarkis et al. (2011)	■	■		■			
	Kim et al. (2011)	■	■	■				■
	Parmigiani et al. (2011)	■	■					■
	Buyukozkan and Cidci (2012)					■	■	
	Andic et al. (2012)	■	■					■
SSCM	Jorgensen and Knudsen (2006)		■					
	Carter and Rogers (2008)		■	■	■			■
	Seuring and Muller (2008)	■	■	■	■			
	Seuring (2008)	■	■					
	Ciliberti et al. (2008)	■	■					
	Font et al. (2008)	■	■					
	Pagell and Wu (2009)	■	■					
	Badurdeen et al. (2009)	■	■	■	■			■
	Haake and Seuring (2009)	■	■		■			
	Wolf (2011)	■	■	■	■			
	Closs et al. (2011)	■	■	■				
	Wittstruck and Teuteberg (2011)	■	■					

[a] *Flow focus*: The definition includes language related to the flows of materials, services, or information. Reference to the supply chain was considered to implicitly refer to this focus area.
[b] *Coordination focus*: The definition includes reference to coordination within the organization or between organizations. Reference to the supply chain, the product life cycle, or activities across channels was considered to implicitly refer to this focus area.
[c] *Stakeholder focus*: The definition includes explicit reference to stakeholders, including (but not limited to) customers, consumers, and suppliers.
[d] *Relationship focus*: The definition includes reference to the networks of internal and external relationships. This includes mentioning the coordination of inter-organizational business processes.
[e] *Value focus*: The definition includes reference to value creation, including increasing profit or market share and converting resources into usable products.
[f] *Efficiency focus*: The definition includes reference to efficiency, including a reduction in inputs.
[g] *Performance focus*: The definition includes reference to performance, including applying performance measures, improving performance, improving competitive capacity, monitoring, and achieving goals.

companies (Badurdeen et al., 2009) were also interpreted as a demonstration of the relationship focus. The stakeholder focus was also addressed by 5 (42%) definitions. Seuring and Muller (2008) referred to customer and stakeholder requirements, Carter and Rogers (2008) and Wolf (2011) mentioned the individual company and the supply chain partners, Closs et al. (2011) highlighted resource availability and talent management, and Badurdeen et al. (2009) implied a focus on suppliers based on the need to achieve a shared vision. The performance focus was addressed by only 2 (17%) of the SSCM definitions. Carter and Rogers (2008) explicitly referred to the long-term economic performance of the company. Badurdeen et al. (2009) indirectly referenced performance through their emphasis of the need to achieve a shared vision.

The value focus and efficiency focus characteristics were not explicitly addressed by any of the published SSCM definitions. It is important to note that this may be a matter of interpretation. In cases where the economic dimension of sustainability was mentioned, this may be considered an indication of the value focus by some analysts. However, in this study, a more explicit reference to value focus was sought. Overall, the most comprehensive definitions from the perspective of the SCM characteristics were offered by Badurdeen et al. (2009) who addressed 5 of the 7 characteristics and by Seuring and Muller (2008), Carter and Rogers (2008), and Wolf (2011) who each addressed 4.

4.4.3. Summary

The results show that the majority of both the GSCM and SSCM definitions addressed the flow focus and coordination focus characteristics of SCM. In both cases, this was largely done through the insertion of words referring to the supply chain or SCM in the definitions. The SSCM definitions showed more definitions placing an emphasis on the stakeholder focus and/or the relationship focus despite the much greater number of definitions of GSCM. Unlike the GSCM definitions that addressed the performance focus in more than a third of the definitions, the SSCM definitions rarely referred to this SCM characteristic. None of the SSCM definitions addressed the value focus or efficiency focus, though these were not widely addressed in the GSCM definitions either. The distribution of the key SCM characteristics highlighted in the analysis is shown in Fig. 5.

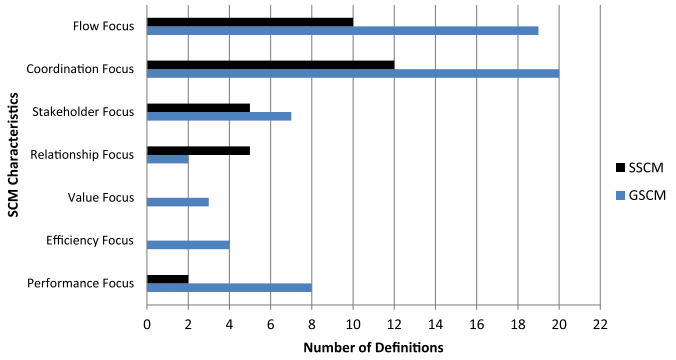


Fig. 5. Distribution of the key SCM characteristics addressed by the definitions.

4.5. Overall summary

Analysis of the results shows that integration of sustainability into SCM began by focusing on merging "green" considerations with SCM practices. The number of published papers addressing GSCM has continued to grow considerably over time (Fig. 1). The need to embed environmental considerations in SCM is thus well established in the literature, a point highlighted by Ashby et al. (2012) and Gimenez and Tachizawa (2012). In parallel to the continued growth of research on GSCM, a more holistic view of sustainability and its integration with SCM has emerged. Fig. 1 also shows growing momentum for research in the area of SSCM.

The results also show that there are a variety of ways in which both GSCM and SSCM have been defined. Considering all of the business sustainability and SCM characteristics examined (i.e., 13 characteristics in total since the stakeholder focus applied to both), the definitions provided by Carter and Rogers (2008) and Badurdeen et al. (2009) addressed the largest number of individual characteristics with a total of 9. The definitions provided by Seuring and Muller (2008), Wolf (2011), and Yeh and Chuang (2011) all addressed 8 characteristics each. Four of these most comprehensive definitions are from the SSCM definition list. This reflects the fact that the SSCM definitions generally did a better job of addressing the sustainability and SCM characteristics. These results also show, however, that none of the studied definitions address all of the identified characteristics of business sustainability and SCM. This is likely a result of the many different definitions of both sustainability and SCM themselves and the desire on the part of the authors to develop a relatively concise definition.

5. A new definition of sustainable supply chain management

The characteristics of business sustainability and SCM identified in this paper provide the basis for proposing new definitions for GSCM and SSCM. Building on the discussions earlier in this paper, SSCM may be defined as:

> "The creation of coordinated supply chains through the voluntary integration of economic, environmental, and social considerations with key inter-organizational business systems designed to efficiently and effectively manage the material, information, and capital flows associated with the procurement, production, and distribution of products or services in order to meet stakeholder requirements and improve the profitability, competitiveness, and resilience of the organization over the short- and long-term."

A separate definition of GSCM is not explicitly offered here. Given that SSCM is viewed in this paper as an extension of GSCM, a definition of GSCM would be similar to the suggested definition of SSCM, but would exclude the integration of economic and social considerations. In any case, the definition suggested above for SSCM meets all 13 of the key characteristics of business sustainability and SCM identified in this paper.

From the perspective of the sustainability characteristics, the need to address the triple bottom line of economic, environmental, and social considerations is clearly highlighted in the definition. As previously explained, the need to address these considerations has been widely recognized in earlier definitions of SSCM. However, many of the other sustainability characteristics identified in this paper have not previously been widely addressed. The new suggested definition explicitly reflects the need for SSCM to adopt a long-term focus, a characteristic that was addressed in only 4 (33%) of the earlier definitions of SSCM (Carter and Rogers, 2008; Haake and Seuring, 2009; Pagell and Wu, 2009; Badurdeen et al., 2009). Resilience was previously highlighted by only one published definition (Closs et al., 2011), while the volunteer focus was not addressed by any of them. Both of these business sustainability characteristics are clearly emphasized in the new suggested definition. The final business sustainability characteristic (i.e., the stakeholder focus) was also shared with the characteristics of SCM. Among the existing definitions of SSCM, this characteristic was most explicitly addressed by Seuring and Muller (2008). Carter and Rogers (2008), Badurdeen et al. (2009), Wolf (2011) and Closs et al. (2011) also addressed the need to focus on stakeholders to varying degrees. The new suggested definition unambiguously addresses this characteristic.

The new suggested definition also addresses the remaining SCM characteristics. As the earlier analysis demonstrated, the flow focus and coordination focus are addressed in the majority of the existing SSCM definitions. They are also explicitly highlighted in the new suggested definition. The relationship focus is addressed through the emphasis on inter-organizational business systems. This focus was captured in only 5 (42%) of the previously published definitions of SSCM (Carter and Rogers, 2008; Seuring and Muller, 2008; Badurdeen et al., 2009; Haake and Seuring, 2009; Wolf, 2011). The value and efficiency characteristics were not captured by any of the existing definitions. However, both are present in the new suggested definition. The former is captured by highlighting the importance of the organization's profitability, while the latter is stressed by addressing the requirement for efficiency in managing flows throughout the life cycle of the products or services. Finally, the performance characteristic is addressed by stressing the need to efficiently and effectively manage the supply chain and through its emphasis on improving competitiveness. The performance characteristic had previously been addressed by only two definitions (Carter and Rogers, 2008; Badurdeen et al., 2009).

The new definition suggested in this paper represents a needed improvement over existing definitions of SSCM. None of the previously published definitions addressed more than 9 of the 13 identified characteristics of business sustainability and SCM. As a result, it is argued that they do not fully capture the meaning of SSCM. The new suggested definition can therefore provide a reference point for future research in GSCM and SSCM.

6. Conclusion

Many different definitions for green supply chain management (GSCM) and sustainable supply chain management (SSCM) have been proposed. In this paper a systematic research literature review was conducted to identify the published definitions of GSCM and SSCM. The paper thus provides a needed reference point on the great variety of definitions published in these areas. The results showed that 22 and 12 distinct definitions have been published to

describe GSCM and SSCM, respectively. The analysis showed that there were many differences, both large and small, among the published definitions. The definitions varied in their coverage of 7 business sustainability characteristics (i.e., economic, environmental, social, stakeholder, volunteer, resilience, and long-term focuses) and 7 SCM characteristics (i.e., flow, coordination, stakeholder, relationship, value, efficiency, and performance focuses). No comprehensive definition of GSCM or SSCM was identified, but there were several definitions that addressed at least half of the identified characteristics. To provide a reference point for future research in these areas, a new comprehensive definition of SSCM was suggested in this paper. The suggested definition captures all of the key characteristics of both business sustainability and SCM. It is important to acknowledge that different researchers may classify the definitions or the characteristics associated with them differently, but the results discussed in this paper nonetheless provide an illustration of broad trends.

Given that research in both areas of GSCM and SSCM is still relatively new, a diversity of perspectives in terms of definitions is useful. However, as research on the integration of sustainability into SCM continues to expand, it will become increasingly important to address the inconsistencies in the various definitions of GSCM and SSCM. The lack of reasonably consistent definitions may lead to confusion regarding the appropriate scope in theory and practice of SSCM initiatives. This confusion can potentially be expanded if related terms, such as “green purchasing”, “closed-loop supply chain”, and “reverse logistics”, are considered. Exploring the implications of and potential resolutions to the many differences in the published definitions provides an avenue for future research.

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