

Sustainable purchasing and supply management: a structured literature review of definitions and measures at the dyad, chain and network levels

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Abstract

Purpose – This paper provides a structured literature review of sustainability in purchasing and supply management, moving beyond the traditional environmental and social sustainability. The paper reviews the concept of sustainability at three levels of inter-organizational analysis – i.e. dyad, supply chain and network. The paper distils the nature and scope of existing research and synthesizes measures used to research sustainability across organizational boundaries.

Design/methodology/approach – This literature review systematically analyzes existing literature. In particular, the review focuses on definitions and measures of sustainable purchasing and supply management to obtain an accurate view of current research.

Findings – This paper uncovers two distinct trends in the type of research carried out. First, internal or dyadic issues are in focus and second, a tendency to deal with environmental, as opposed to social, sustainability. Despite the need to look beyond the dyad given the risks associated with the extended network, few studies do so in any of the sustainability dimensions.

Research limitations/implications – This review is limited by the method employed focusing on definitions and measures. Although the review considers supply chain and network research, it does so purely from a purchasing perspective, thus excluding issues such as logistics and transport.

Practical implications – The paper identifies areas open to future research and provides practical insights into how sustainable purchasing and supply are measured. It also synthesizes existing measures of sustainability at different levels and organizes these into a taxonomy.

Originality/value – The paper examines studies across multiple levels of analysis and integrates multiple fields of knowledge to show how research on sustainability in purchasing and supply is structured.

Keywords Sustainability, Ethical, Environmental, Purchasing, Sourcing, Supply chain, Network, Stakeholders, Supply chain management, Research

Paper type Research paper

1. Introduction

A company is no more sustainable than the suppliers from which it sources (Krause *et al.*, 2009). This puts purchasing and supply management in a central position on the road to achieving sustainability. However, fully understanding a company's sustainability profile requires a view of not only the company's direct suppliers but also its extended supply chain or even the wider network in which it operates. A growing amount of research on sustainability concerns purchasing and supply management, such as ethical sourcing (Preuss, 2009; Roberts, 2003), corporate social responsibility in the supply chain (Faisal, 2010; Maloni and Brown, 2006), socially responsible buying (Maignan *et al.*, 2002; Park and Stoel, 2005) and green supply chains

(Kainuma and Tawara, 2006; Mollenkopf *et al.*, 2010). While significant progress has been made in these areas, it is important to make further advances and consolidate systemic issues that exist at the interface of sustainability and purchasing and supply (Linton *et al.*, 2007).

One difficulty with studying sustainability in this field is the problem of levels of analysis. Authors often describe their research as addressing supply chains when, in fact, the level of analysis is restricted, for example, to an internal or dyadic buyer or supplier perspective. In adopting a purchasing and supply management perspective, this paper seeks to identify those sustainability issues that have been researched that primarily concern purchasing and supply management and, simultaneously, the different levels of analysis. A second significant concern in studying sustainability in purchasing

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and supply is the topic focus. Previous reviews have identified a typical division in research in this area between environmental and social issues (Seuring and Muller, 2008; Srivastava, 2007). However, a general view of sustainability research in this area reveals that many studies have adopted an environmental, or green, perspective. These studies concentrate on issues of buying green inputs, or managing waste and pollution (Holt and Ghobadian, 2009; Hong *et al.*, 2009; Zhu and Sarkis, 2007; Zhu *et al.*, 2005a). Relatively few studies have explicitly adopted a social sustainability viewpoint (Besser *et al.*, 2006; Handfield and Baumer, 2006; Worthington *et al.*, 2008).

This paper provides a comprehensive, critical review of sustainable purchasing and supply research to date. While there have been a number of reviews in this area, our focus is on how sustainability is operationalized from a research perspective. Therefore, the analysis is directed towards how sustainable purchasing and supply are defined and how sustainability is measured in this field. First, definitions of sustainability at the dyad, chain and network levels of analysis are offered. This includes an analysis of the social and environmental aspects of sustainability that can be identified at the different levels. Second, a synthesis of the principal measures used to gauge the degree of sustainability at these different levels of analysis is provided. These measures include those used in empirical and conceptual frameworks as well as those typically used in practitioner models. In sum, we ask: what are the definitions and measures used to describe sustainability at different levels of inter-organizational analysis in the area of purchasing and supply management?

When examining the supply chain and network literature, our interest is in purchasing (in its broad sense) rather than logistics or other supply chain management practices. Hence, the scope of this study is limited to the activities associated with purchasing (or procurement or sourcing), such as the purchasing process, supplier selection and supplier development. The study does not include activities related to transportation (such as vehicle routing), management of inventory (except where suppliers are concerned), reverse logistics or closed-loop systems for waste recovery unless there is a link to purchasing and supply activities.

The paper is organized as follows. The first section explains the logic of considering three levels of analysis in sustainable purchasing and supply management. The second section outlines the methodology employed in the literature review. The third, fourth and fifth sections report the findings from the literature review, with each section focusing on one level of analysis. The final section presents the conclusions from the literature review and outlines implications and limitations.

1.1 Three levels of analysis in sustainable purchasing and supply management

Drawing on existing classifications of levels of analysis in the management of supply chains (Croom *et al.*, 2000; Harland, 1996; Möller *et al.*, 2005; Ritter and Gemünden, 2003), we distinguish between three levels of sustainability analysis pertinent to purchasing and supply management: dyadic relationships, supply chains and industrial networks (Figure 1). Although various levels of inter-organizational analysis have been suggested, this simple classification makes it possible to clearly differentiate among the levels.

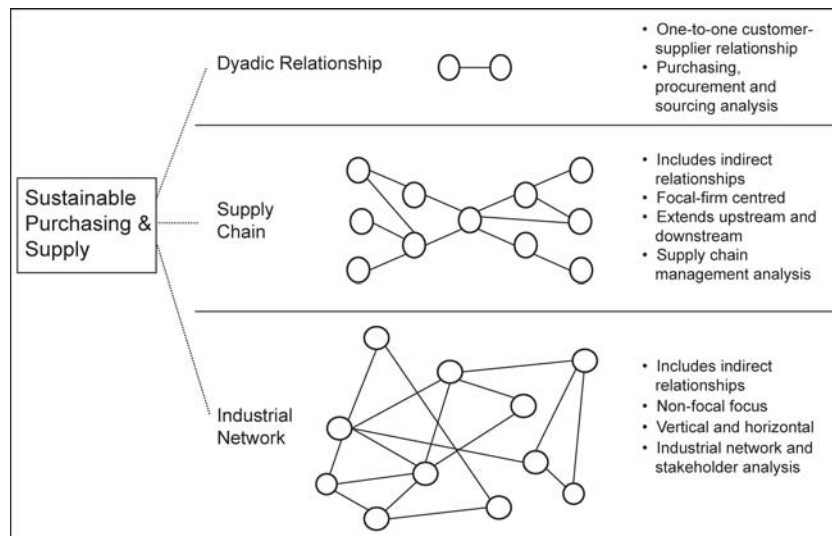
Dyads refer to relationships between two actors. In the purchasing and supply context, we focus on the company-

direct supplier dyad. As companies seek to implement sustainability in their supply chains, their first natural step is to focus on direct supplier relationships. Purchasing and supply activities within dyads involve both discrete one-off exchanges (transactions) and long-term, relationship-development issues, such as the adaptation of business processes to suit other parties and the institutionalization of business practices (Håkansson, 1982). Purchasing, procurement and sourcing decisions typically concern internal buying processes that relate primarily to direct suppliers, i.e. dyadic relationships, including specification, supplier selection, contracting, ordering, expediting and evaluation (see, for example, Van Weele, 2010).

Definitions of purchasing, procurement and sourcing vary in scope and the extent to which these functions extend to indirect suppliers is not always clear. Procurement and sourcing are often defined as more inclusive, or strategic, than purchasing – for example, procurement may be defined as including the make-or-buy decision (Murray, 2009, p. 199) – but this is not always the case. Furthermore, the use of the terms is often industry specific, e.g. the public sector often uses the term “procurement” instead of “purchasing” (see Ramsay and Croom, 2008; Rozemeijer, 2008; for a debate on this issue). Furthermore, the role of purchasing in relation to supply chain management varies; “unionists” view purchasing as part of supply chain management, while others believe that supply chain management has replaced purchasing (Larson and Halldorsson, 2002). For practical reasons, we group purchasing, procurement and sourcing together.

Sustainability problems are likely to stem from indirect supplier relationships that are part of the extended supply chain. Supply chain management focuses on multiple customer-supplier dyads, with the supply chain ultimately spanning from original raw material extractors to final end customers (Harland, 1996). Supply chains tend to be depicted around a focal firm and its upstream and downstream relationships (Christopher, 1998; Lambert *et al.*, 1998), although there has been some debate as to whether supply chains are simple linear structures – chains – or more like “supply chain networks” (or “supply networks”) that include inter-connected supply chains (see, e.g. Lamming *et al.*, 2000; Lockamy, 2008). The consensus seems to be that supply chains should be understood as the latter.

Thus, some authors have argued that sustainability needs to be understood from an even higher level of analysis; this level is typically referred to as network or stakeholder analysis. In this regard we draw from the theoretical perspective of the Industrial Marketing and Purchasing (IMP) group (Håkansson, 1982), which has developed concepts and constructs for the study of industrial networks over the last 30 years. It seems pertinent to study sustainability at a network level – as Roome (2001, p. 70) aptly states, “we increasingly see ourselves as part of a network society living in a network age”, “concerns about complex environmental and social consequences of industrial activity have provoked the need for more frequent and meaningful engagement between companies and stakeholders”, “networks have an identified role in innovation for environmental management and sustainable development” and “knowledge suggests that ecosystems are based on organisms connected through complex networks of energy and material flows”. It is therefore important to identify the extent to which literature on sustainability has embraced this level of analysis.

Figure 1 Three levels of sustainable purchasing and supply analysis

In the sustainability literature, an increasing number of studies analyze and discuss sustainability from a purchasing and supply chain management perspective. However, the issue of the level of analysis seems to be all too often ignored or taken for granted. Studies that claim to adopt a supply chain focus on sustainability may do so purely from a dyadic perspective. The first main objective of this study, therefore, is to: analyze existing research on sustainable purchasing and supply management at the dyad, chain and network levels, with a focus on the definitions that are used.

The second main objective of this study is to understand how sustainable purchasing and supply are operationalized from a research perspective. Although sustainability is still rather immature in its development as a research field in purchasing and supply, a number of empirical works have attempted to show the state of implementation in organizations. A review of the current research provides an opportunity to discuss gaps and opportunities for further research. An examination of the measures used (the actual questions asked of organizations by researchers) can give a good indication of the subject matters covered. However, there appears to be little standardization in these questions and subjects, making comparison problematic and creating an opportunity for consolidation and categorization. It is also important to know how sustainability is integrated into purchasing and supply activities. Therefore, we aim to delineate those types of measures that are used in different purchasing and supply processes (such as supplier selection or development). From this, our second objective is to: identify and categorize the measures used in existing studies of the main purchasing processes.

Given our first objective of understanding the levels of analysis of sustainable purchasing and supply research, and our second objective of identifying and categorizing measures, there is a need to establish a framework that can provide a systematic overview of measures used across the various levels of analysis. Hence, our last objective is to: develop a taxonomy of measures used in sustainable purchasing and supply at the dyad, chain and network levels of analysis.

2. Method

This paper seeks to provide a rigorous, critical analysis of the state-of-the-art research into sustainable purchasing and supply management. One difficulty in defining sustainability at different levels is that authors often describe their research as addressing supply chains when, in fact, the level of analysis is restricted, for example, to a dyadic buyer or supplier perspective. Therefore, we do not limit this review to empirical works (as such research is limited across all levels of analysis) but include conceptual papers as well. At the same time, this review does not consider analytical modeling approaches; although there are significant research studies in this area, we do not consider how sustainability in purchasing and supply is conceptualized mathematically. Furthermore, we search for both explicit and implicit measures used to detect differences in elements of sustainability at the different levels of analysis.

The paper attempts to synthesize a rapidly growing field of knowledge. To do so, we have adopted a structured approach to the literature search and analysis, heeding the call for systematic reviews in the field of management “to provide collective insights through theoretical synthesis into fields and sub-fields” (Tranfield *et al.*, 2003, p. 220). As described by Tranfield *et al.* (ibid), the key steps in a systematic review include the planning phase, the actually undertaking of the review, and reporting and dissemination, steps which are described later. One of the difficulties in carrying out a review of management literature is the range of research approaches encountered. While quantitative studies have clearly defined variables and concepts, and normally detail the measures used, we did not aim to exclude all non-quantitative research. As such, all types of papers – conceptual, qualitative, empirical and quantitative studies – are included in the review. This created some difficulties in extracting definitions and measures from the review articles but widened the review’s scope. Instead of judging the quality of non-quantitative studies, as suggested by Popay *et al.* (1998), we adopted a specific aim: to search for and report on the definitions and measures (or at least, for example, the questions used to survey case study respondents) used in the studies identified.

In the initial search for relevant papers, we used the well-established databases Emerald and EBSCO. For this part of the study, journal article titles were searched. The search terms listed in Table I were used in combination (e.g. “green” and “supply”). They were used in both in keyword and abstract searches, which was less efficient than just focusing on the keywords but ensured that we captured as many relevant papers as possible. We did not include the term “chain”, as we assumed this would be included in “supply”.

The following list shows the journals in which we identified relevant research papers. We should stress that we did not purely search in the listed journals; these journals were simply those with papers found during the search and selection process:

- *Academy of Management Perspectives.*
- *Asian Business & Management.*
- *Benchmarking: An International Journal.*
- *Business Strategy & the Environment.*
- *Corporate Environmental Strategy.*
- *Corporate Social Responsibility & Environmental Management.*
- *European Journal of Innovation Management.*
- *Entrepreneurship & Regional Development.*
- *International Journal of Environmental Technology & Management.*
- *International Journal of Logistics: Research & Applications.*
- *International Journal of Management Reviews.*
- *International Journal of Operations & Production Management.*
- *International Journal of Physical Distribution & Logistics Management.*
- *International Journal of Production Research.*
- *International Journal of Retail & Distribution Management.*
- *International Journal of Production Economics.*
- *Journal of Business Ethics.*
- *Journal of Cleaner Production.*
- *Journal of Economic Geography.*
- *Journal of Operations Management.*
- *Journal of Purchasing & Supply Management.*
- *Journal of Supply Chain Management.*
- *Omega.*
- *Logistics Information Management.*
- *R&D Management.*
- *Journal of Supply Chain Management.*
- *Supply Chain Management: an International Journal.*
- *Sustainable Development.*
- *Transportation Research: Part E.*

From this initial search, we found 1,481 papers. The titles of the papers within this initial sample were checked for relevance, and those papers with a title that was beyond the scope of this review were removed, including those that dealt with green logistics and general logistical issues, as well as those concerning the consumer/marketing end of the supply

chain. This reduced the list to 274 potentially relevant papers. When the relevance was still unclear based on the title, the abstract was checked manually.

All of these papers were then filtered according to the quality of the journal. To ensure that only the highest quality research is considered, the analysis focuses specifically on articles published in major English-language North American and European journals. The analysis considers only those articles published in journals that are included in the latest Association of Business Schools (ABS) ranking (Harvey *et al.*, 2010). The ABS ranking draws from several other highly regarded journal quality rankings. Although any journal ranking is inevitably controversial, the ABS ranking is widely viewed as providing a reliable measure of research rigor and quality. There was one exception to this requirement, the *Journal of Cleaner Production*, which was found to be significant in the volume of the overall production of papers related to sustainability. Of the 113 papers remaining after the quality filter was applied, 73 contained definitions and/or measures and were included in the full review. Figure 2 summarizes this process.

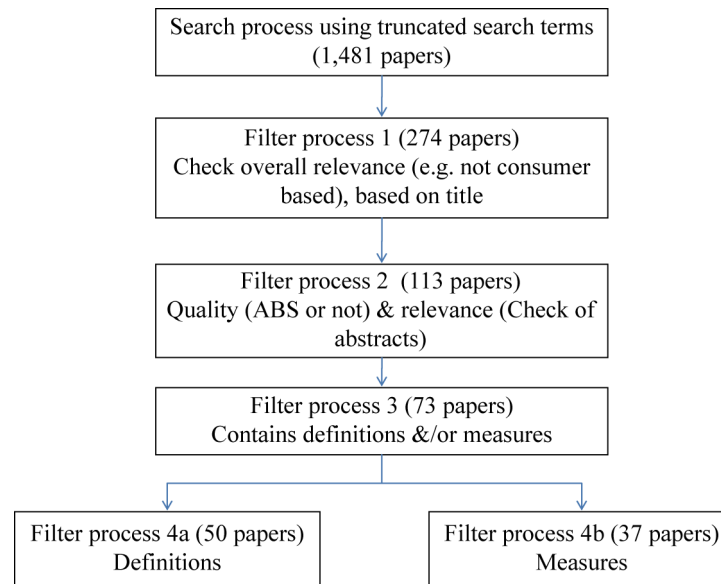
2.1 Analysis and coding

In order to generate a clearer picture of how the field is structured in terms of levels of analysis and the research focus, we undertook a two-stage analysis. In our initial review of the literature, we found that papers typically included a statement indicating that the level of analysis was the supply chain. However, this statement was often contradicted by the fact that the definitions and empirical research in those papers focused only on the internal function of the purchasing department or relationships with immediate suppliers.

Given this inconsistency, we analyzed both the overall emphasis of the articles, including the definitions, and the more detailed operationalization of the questions (i.e. the measures used). Thus, the first analysis was a general review of the papers in which we categorized each paper into one of the three levels of analysis, and determined whether the focus was on environmental or social sustainability. This was done by reviewing each paper in its entirety and completing a database entry for each paper. The database included information on the following variables: study (authors and year), method (conceptual, case-based, empirical, analytical), definition (the definition of sustainability if present in the paper), focus/findings (the main findings of the study), unit of analysis (firm/dyad, supply chain, network), and whether the paper was primarily focused on environmental or social sustainability or both. In order to objectify this process, we developed a checklist of terms and meanings to search for in each paper (Table II).

Table I Search terms used and number of relevant papers

	Supply	Purchasing	Procurement	Sourcing	Network
Green	57	18	13	9	4
Social	33	5	5	51	Not run due to very high return and low relevance
Environment *	10	5	5	2	23
Sustainab *	93	5	18	21	Not run due to very high return and low relevance
Responsib *	15	7	113	62	506
Stakeholder	280	40	57	24	Not run due to very high return and low relevance

Figure 2 Systematic literature review process**Table II** Checklist of terms used to code papers

Level of analysis	
Dyadic (or internal)	Concerns processes with immediate suppliers or simply internal functions of the firm
Supply chain	Concerns suppliers and customers, or suppliers' suppliers
Network	Concerns the extended network, peripheral suppliers, indirect suppliers or other stakeholders with indirect links to the focal firm
Focus of the study	
Environmental	Environmental, green, waste, pollution, energy use, materials, recycling
Social	Community, ethics, diversity, social standards, human rights, child labor

In the second stage of analysis, we identified the measures used in each study (37 papers contained identifiable measures). The measures were entered into a separate database, the duplicates were removed, and the data was coded according to the level of analysis and the main divisions of social and environmental emphasis using the checklist (based on Table II). While most measures were of a dyadic nature, we were able to discern measures that focused solely on internal processes or issues. Therefore, we added "internal" to this first level of analysis. From this, we were able to identify the proportion of papers at each level of analysis and the main subject area. A first-order coding was also undertaken to further break down the division of emphasis to provide a basis for a taxonomy of measures. This coding was based primarily on the Global Reporting Initiative (GRI) reporting standards, which provide clear categorizations of the different elements of environmental and social sustainability. We also categorized the measures according to their place within the main purchasing processes in order to address the second objective.

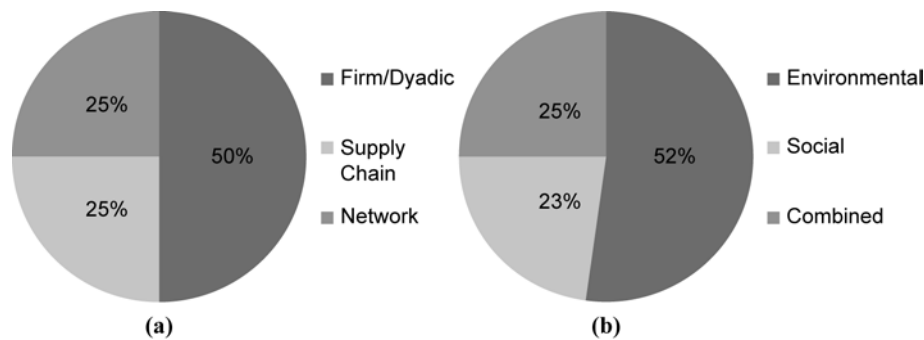
3. Findings

The presentation of the findings follows the ordering of the research objectives developed at the end of the introduction section. First, we examine the differences in perspective across the three levels of analysis identified. To do so, we

primarily examine the definitions used to set the scope of the studies included in the review. We present 32 of the definitions used in these studies (out of a total 50; we remove duplicate or very similar definitions). Second, we identify and categorize the measures used in the papers and discuss how these measures are represented across the main purchasing processes. Third, we examine how these measures reflect the different levels of analysis.

Figures 3a and 3b summarize the study's overall findings. It shows that the majority of papers focus on an internal/functional or dyad level of analysis, while the remainder are split between the supply chain and network levels of analysis. The figures also reveal that environmental research dominates the content of these studies, with the remaining papers split between a focus on social and ethical issues, or a combination of environmental and social aspects.

It is relevant to consider the methodological approaches of the research included in our study, as doing so enables us to obtain a clearer picture of the levels of analysis. The proportions shown in Figure 3a are based on each paper's claimed scope, including the definitions used and the questions asked within empirical studies. However, when examining the methods used (for empirical studies only), we find that the majority are focused on the firm/dyad level (or even only the firm, with one key respondent per company in the case of questionnaires). No studies rely on data from a supply chain perspective, with the exception of Kovács

Figure 3 Proportion of papers across the three levels of analysis and emphasis relating to sustainability

(2008), who carried out case studies across multiple tiers of Finnish supply chains. Indeed, no questionnaire-based research covers the supply chain or network levels in the research design. However, eight papers based on case studies include interviews with multiple tiers in the supply chain and other network stakeholders, such as NGOs. The focus of these papers is often not on purchasing and supply, and definitions and measures are not explicitly given. Therefore, they are not included in the following analysis.

3.1 Sustainable purchasing and supply definitions: dyad or firm level

Almost 50 percent of the papers analyzed focus on the internal processes of the purchasing function or on how direct suppliers are managed in relation to sustainability. A number of studies of sustainability adopt a dyadic or purely internal level of analysis, even though they claim to concern supply chains. An examination of the methods used supports this finding (Bowen *et al.*, 2001; Grankvist and Biel, 2007; Green *et al.*, 1998; Green *et al.*, 1996; Min and Galle, 2001; Min and Galle, 1997). While Walker *et al.* (2008) describe green supply chain practices, their evidence is collected from a purchasing perspective. Sustainable sourcing and ethical sourcing (Blowfield, 2000) are terms often used by practitioners that do not seem to have become mainstream academic constructs. Research in this area tends to focus on guidelines and codes of practice for managing relationships (trading) with suppliers along social and environmental dimensions, with a particular focus on the use of quality control (audit) systems (Hamprecht *et al.*, 2005). Other aspects include organizational integration issues related to supporting new sourcing priorities (Koplin *et al.*, 2007). Table III provides examples of definitions of sustainable purchasing (or procurement or sourcing) that involve the purchasing function or dyadic supplier relationships.

3.2 Sustainable purchasing and supply definitions: supply chain level

For the purpose of this study, we defined the supply chain level as including more than two supply chain actors, i.e. a focal firm and both its suppliers and customers, or a focal firm, its direct suppliers and its indirect suppliers. As others have noted (Seuring and Mueller, 2008), few studies have attempted to address sustainability across the whole supply chain. Purchasing and supply publications that claim to address the supply chain level are fairly diverse in scope (Gavaghan *et al.*, 1998; Handfield *et al.*, 1997; Lambert, 2001; Murphy *et al.*, 1996; Preuss, 2005; Rao and Holt, 2005; Van Hoek, 1999;

Walker *et al.*, 2008a; Walton *et al.*, 1998; Zhu *et al.*, 2005b, 2008). In fact, many of the definitions at this level of analysis treat purchasing and supply as part of supply chain management, which from this perspective extends from the design of green products to the recycling of products at the end of their life. Furthermore, some researchers claim to address the supply chain, while the analytical level is in fact limited to the firm (Matos and Hall, 2007).

Furthermore, many studies provide very specific definitions, such as using “green” to indicate sustainability (Darnall *et al.*, 2008a). For example, in defining green supply chain management, Walker *et al.* (2008, p. 69) view associated practices as “reducing packaging and waste, assessing vendors on their environmental performance, developing more eco-friendly products and reducing carbon emissions associated with transport of goods”. The supply chain level of analysis implies consideration of extra-dyadic issues spanning boundaries upstream and downstream of operations (Andersen and Skjoett-Larsen, 2009). Thus, definitions of sustainable purchasing and supply at the supply chain level tend to include wider responsibility for supporting sustainability not just with respect to direct supply but also with respect to inputs into other parts of the product life cycle, including the end of the product’s life. Similarly, the majority of studies view sustainability in relation to the natural environment (i.e. a product focus). In fact, most definitions appear to describe green supply chain practices – of the definitions collected here, only three explicitly mention the social element of sustainability (Pagell and Wu, 2009; Seuring and Mueller, 2008; Seuring and Muller, 2008).

In summary, the definitions of purchasing and supply at the supply chain level tend to have a product focus and are, thus environmental in nature. Furthermore, they define the sustainability role of purchasing in relation to how other supply chain activities, such as recycling, can be supported through purchasing decisions (Table IV).

3.3 Sustainable purchasing and supply definitions: network level

At the network level, we cast the net further from the companies involved in the supply chain to include the broader network of organizations. Typically, this lens is used in stakeholder studies, which often draw on network theory (Cumming, 2001; Delmas, 2001; Fineman and Clarke, 1996; Matos and Hall, 2007; Peter *et al.*, 2006). The advantage – and the challenge – of adopting this level of analysis is that the stakeholders in sustainable development are many and varied. They include consumers, businesses, governments,

Table III Examples of definitions of sustainability at the firm or dyad level

Definition	Authors
"Socially responsible organizational buying is that which attempts to take the public consequences of organizational buying into account or bring about positive social change through organizational buying behavior"	(Drumwright, 1994, p. 1)
"Green supply refers to the way in which innovations in supply chain management and industrial purchasing may be considered in the context of the environment"	(Green <i>et al.</i> , 1996, p. 188)
"Supply management activities that attempt to improve the environmental performance of purchased inputs, or of the suppliers that provide them"	(Walker <i>et al.</i> , 2008b, p. 75)
"Managing the optimal flow of high-quality, value-for-money materials, components or services from a suitable set of innovative suppliers in a fair, consistent, and reasonable manner that meets or exceeds societal norms, even though not legally required"	(Eltantawy <i>et al.</i> , 2009, p. 101)
"Sustainable procurement (SP) is procurement that is consistent with the principles of sustainable development, such as ensuring a strong, healthy and just society, living within environmental limits, and promoting good governance"	(Walker and Brammer, 2009, p. 128)

Table IV Selected definitions of sustainability at the supply chain level

Definition	Authors
Green supply chain management (SCM) practices include internal environmental management, external green SCM, investment recovery, and eco-design or design for environment practices	(Zhu and Sarkis, 2004, p. 267)
Defines green SCM as "integrating environmental thinking into supply chain management, including product design, material sourcing and selection, manufacturing processes, delivery of the final product to the consumer as well as end-of-life management of the product after its useful life"	(Srivastava, 2007, pp. 54-55)
"Environmental purchasing is defined as the purchasing function's involvement in supply chain management activities in order to facilitate recycling, reuse, and resource reduction"	(Carter and Carter, 1998, p. 660)
"SSCM (sustainable supply chain management) as the strategic, transparent integration and achievement of an organization's social, systemic coordination of key interorganizational business processes for improving the environmental, and economic goals in the long-term economic performance of the individual company and its supply chains"	(Carter and Rogers, 2008, p. 368)
"In order for firms to effectively implement green and lean supply chain strategies in a global context, managers must move beyond their silos, considering the entire supply chain and all of its participants"	(Mollenkopf <i>et al.</i> , 2010, p. 31)
"GSCM practices involve organizations assessing the environmental performance of their suppliers, requiring suppliers to undertake measures that ensure environmental quality of their products, and evaluating the cost of waste in their operating systems (Handfield <i>et al.</i> , 2002). However, GSCM practices also extend to the entire value chain (from supplier to consumer) when organizations inform buyers of ways to reduce their impacts to the natural environment (Handfield <i>et al.</i> , 2004)"	(Darnall <i>et al.</i> , 2008b, p. 33)
"The fully integrated, extended supply chain contains all of the elements of the traditional supply chain . . . but extends the one-way chain to construct a semi-closed loop that includes product and packaging recycling, re-use, and/or remanufacturing operations"	(Beamon, 1999, p. 337)

NGOs, shareholders, activists, competitors, suppliers and individual managers. The achievement of sustainability involves multiple inter-connected actors who are likely to have different ambitions and objectives, and the friction among these network actors may be critical (Araujo and Harrison, 2002). Investigations of the interdependencies among these actors, and analyses of their power and influence are not typically be included in dyadic or supply chain focused analyses of sustainable purchasing and supply issues. Yet, individual companies may find it difficult to implement sustainable purchasing and supply changes if they do not understand the roles and influence of such actors.

It is clear from the literature review that studies examining sustainability at the network level are rare. In reality, few studies adopt this wider view, and the terms "network" and "supply chain" are often used synonymously. An example of the wider network view is research on industrial symbiosis,

which involves the use of one firm's residual resources and by-products as inputs (supplies) for another (Bansal and McKnight, 2009). Many articles attempt to adopt this view but clear definitions are largely absent (Frota Neto *et al.*, 2008; Mehalik, 2000; Roome, 2001; Vachon and Mao, 2008; von Malmborg, 2007; Wheeler *et al.*, 2005; Young and Kielkiewicz-Young, 2001). It is also important to note that most of these studies are not published in mainstream operations or supply chain journals (Table V).

Network or stakeholder analysis is viewed as significant to sustainability, as it highlights the importance of frequent, meaningful interactions between companies and stakeholders (Roome, 2001). As one paper in the sample shows (Nadvi, 2008), the global governance of sustainability involves complex networks of diverse, public and private, local and global actors. Studies on the network level also stress the importance of public and civil society in supporting SMEs

Table V Summary of the definitions used at the network level

Definition	Authors
SRB (socially responsible buying) can be defined as the inclusion of the social issues advocated by organizational stakeholders in purchasing decisions. In this perspective, stakeholders are the agents that bring broad social demands to the attention of individual firms	(Maignan <i>et al.</i> , 2002, p. 642)
"Ethical trade, involving codes of conduct for minimum labor standards in supply chains, contrasts markedly with the more radical, developmental project of fair trade, which has the goals of producer empowerment and equitable trading. However, there can be a blurring of the boundaries between the two movements in some cases (Smith and Barrientos, 2005)"	(Hughes <i>et al.</i> , 2007, p. 491)
"The practice adopted by some large purchasing organizations (LPOs) of promoting greater diversity in the supply chain by intentionally providing selling opportunities for traditionally under-represented suppliers (e.g. small firms, ethnic minority businesses, women-owned enterprises), a process known as supplier diversity"	(Worthington <i>et al.</i> , 2008, p. 320)
SSCM: "... a philosophy of management that involves the management and integration of a set of selected key business processes from end user through original suppliers, that provides products, services and information that add value for customers and other stakeholders through the collaborative efforts of supply chain members (Ho <i>et al.</i> , 2002, p. 4422)"	(Font <i>et al.</i> , 2008, p. 260)
Industrial symbiosis involves the use of one firm's residual resources and by-products as feedstock for another (Chertow, 2000)	(Bansal and McKnight, 2009 p. 26)
The sustainable supply chain discourse differs from mainstream supply chain management, as it involves the recognition of stakeholders within and beyond the supply chain	(Hall and Matos, 2010, p. 128)

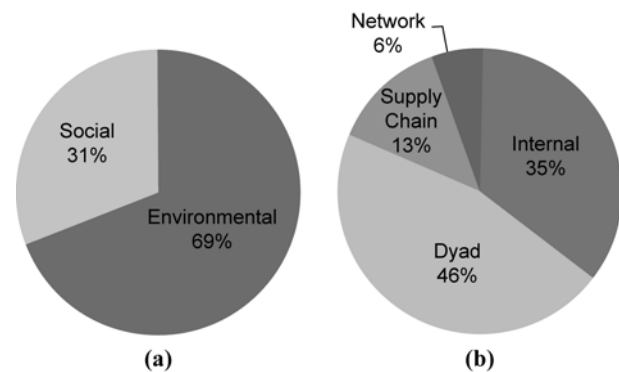
moves towards sustainability (Camison, 2008; Lee *et al.*, 2008). Relationships with different network actors and stakeholders are crucial for efficient sourcing management and effective implementation of codes of conduct (Roberts, 2003). Along these lines, studies on sustainability that adopt a network perspective, such as Araujo and Harrison (2002), demonstrate the limits of an individual firm's actions and the need to understand the embeddedness of individual firms and suppliers within wider stakeholder networks.

3.4 Identification and categorization of measures

In the second part of the findings, we address the second research question, which concerns the identification and categorization of measures. In total, 30 papers provided information on operationalized questions or measures. 330 distinct measures were found. Many of the empirical papers were based on case studies, some of which outlined their operationalized case questions in a protocol. Some of these could be included within the review of measures. The more traditional, survey-style papers often included an explicit description of measures. Our first coding level allowed for the categorization of measures as environmental or social. Each of these categories was further subdivided by grouping similar measures together.

The majority (69 percent) of the measures used in the research are concerned with environmental issues, while 31 percent of the measures refer to social aspects (Figure 4a). A further finding is revealed when we examine the level of analysis associated with the measures (Figure 4b). After separating the first level of analysis into internal and dyadic levels by considering the actual questions used, we find that the majority of research operationalizes questions at the internal and dyadic levels.

Categories for each of the two fields of focus (environmental and social) were developed following the coding process described earlier. These are described below and examples of measures used in each of the category codes are provided (Table VI).

Figure 4 Division of measures according to sustainability emphasis and level of analysis

The "environmental" measures (69 percent of the total; 227 measures in the papers sampled) encompass 11 distinct types of measures, as shown in Table VII. The majority of these are related to internal generic processes within the purchasing function (see Figure 5). The second most common type of measure relate to material usage (avoidance of toxic materials), waste management and recycling. These two types of measures dominate the measures used in all papers.

In the analysis of socially based measures, eight distinct categories of measures were identified. This reflects the overall scarcity of studies in this area.

While social measures represent 31 percent of the measures used (99 in total in the sample of papers), the proportions represented by the various subdivisions are more equal than in the environmental area (Figure 6). The majority of measures focus on social equity (issues of sourcing from diverse suppliers in terms of gender, size, ethnicity, etc.) and the ethical dimension (particularly purchaser behavior). The issue of conflicts of interest dominate here but this result is skewed by one study that extensively examines this issue (Handfield and Baumer, 2006). Therefore, it cannot be inferred that the

Table VI Subdivisions of environmental sustainability measures

Category	Description
Generic internal process	Concerns internal processes of the purchasing function, such as supplier selection and assessment, which include environmental sustainability elements
Material, waste, recycling	Product or process characteristics related to material contents, waste management or recycling (including re-use and energy recovery approaches) involving suppliers
Pollution	Air or water pollution-control activities with suppliers
Cost	Costs of implementing sustainability practices, including investment costs internally and/or with suppliers
Compliance and standards	Verification of supplier compliance with legislation, social norms and standards (including ISO14001, EMAS)
Design	The inclusion of sustainability criteria in the design of products and processes with suppliers
Energy, CO₂, GHG	The measurement and control of energy use and greenhouse gas emissions with suppliers
LCA	The use of life cycle analysis principles
Strategy	The development of activities on the purchasing strategy level to support sustainability
Monitoring	Monitoring activities (at suppliers) to track performance
Product	The development of "sustainable" products with suppliers
Risk	Taking into account the risk elements of sustainability, for example accidents and spills, or risks to reputation

Table VII Subdivisions of social sustainability measures

Category	Description
Generic internal process	Concerns internal processes of the purchasing function, such as supplier selection and assessment, which include social sustainability elements
Social equity	Ensure equality in employment and among suppliers in terms of diversity, gender, etc.
Compliance and standards	Verify supplier compliance with legislation, social norms and standards (minimum wage, etc.)
Community	Support for community
H&S	Support for health and safety imperatives
(Non-) ethical behavior	The behavior of purchasing employees (accepting bribes, sharing competitively sensitive info, etc.)
Conflict of interest	Controls on declaring conflicts of interest (e.g. purchasing personnel linked financially or relationally to suppliers)
Codes of practice and conduct	Implementation of codes to monitor and control personnel and suppliers

Figure 5 Subdivisions of environmental sustainability measures as a percentage of the total

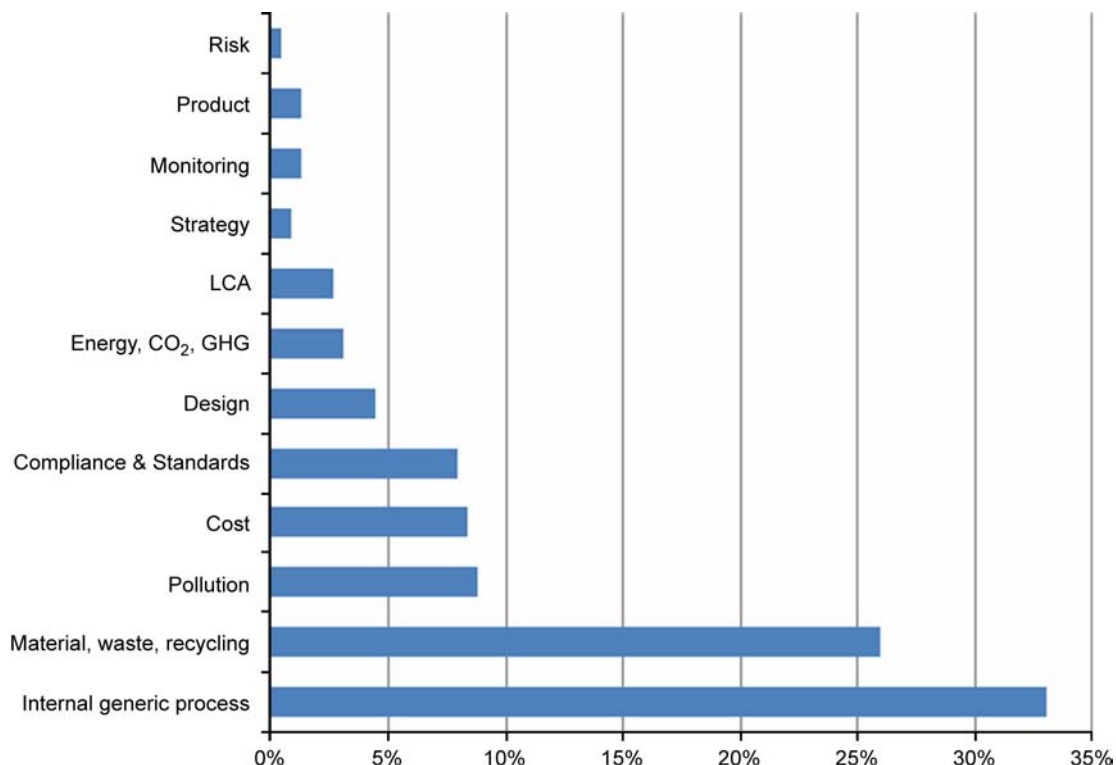
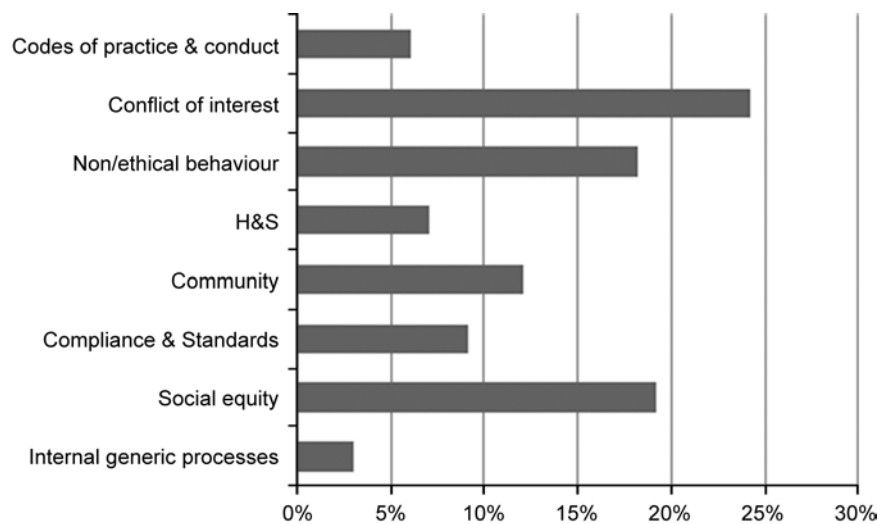


Figure 6 Subdivisions of social sustainability measures as a percentage of total

field is mainly concerned with conflicts of interest (Table VIII).

In addition to the categorization of measures into overall themes, a further analysis was conducted to show how measures are linked to the main purchasing and supply processes, thereby addressing the second part of the second objective of the paper. Table VIII shows how and where measures are used to address these processes, and which categories of measures they treat. It also provides examples of measures used in current research. In this analysis, we identified 93 measures in total, which implies that the remainder relate to more general sustainability practices or measures of performance (such as waste or recycling) and not to specific purchasing or supply tasks.

The initial analysis reveals several gaps in the way sustainability is being researched in the field of purchasing and supply. First, in our review, we find no measures that simultaneously address the issues of make or buy and sustainability. However, as we did not search for articles concerning outsourcing *per se*, we cannot conclude that there are no studies linking these issues. The second purchasing process that has yet to be treated is the integration of suppliers in the order fulfillment process through planning and execution systems. In this regard, although there appear to be few logical links between this and sustainability, we cannot state that this has not been addressed.

Studies examining the environmental elements of sustainability are more developed and show more maturity and diversity in terms of the measures used than studies concerning social elements of sustainability. An examination of social sustainability specifically reveals that its influences on specification definitions, new product development, order fulfillment and collaboration processes have not yet been addressed. Instead, the focus has been on supplier selection, contracting and evaluation.

3.5 Differences in measures used across the levels of analysis

The measures analysis shows that 81 percent of the measures in the 37 papers reviewed here concern the firm-dyad level of analysis. This may reflect a methodological problem, as it may

be more feasible to ask questions at this level. The focus of these measures is on environmental sustainability, and they are dominated by generic internal process issues (31 percent), material, waste or recycling issues (21 percent), and pollution and cost issues (each 10 percent). Hence, the focus of most studies is on how sustainability is organized at the purchasing function level and with direct suppliers, looking mainly at how firms reduce waste and recycle materials in the supply chain. The social measures used in the internal and dyadic level of analysis focus on conflicts of interest (30 percent), social equity (21 percent) and ethics (17 percent).

In terms of measures on the supply chain level (13 percent of the total), we again find that internal generic processes (38 percent), and material, waste and recycling (38 percent) are the focus of most operationalized questions. One example of measuring green supply chain management is found in Darnell *et al.* (2008), who use OECD-established metrics for the assessment of the environmental performance of suppliers, such as requiring suppliers to establish environmental practices and tracking the cost of waste throughout the supply chain. Surprisingly, questions about life cycle assessment and strategy are not present. This perhaps reflects the difficulty of managing these issues across supply chains or it may indicate that LCA is more of a design engineering tool, but this appears to be a missed opportunity for research. Measures of social sustainability are scarcer, which reflects the scope of definitions discussed earlier. In fact, only four types of measures can be identified: social equity, compliance and standards, codes of practice and conduct, and health and safety. Examples include Preuss (2009), who uses “values of principles customers commit to” as elements of codes of conduct, and Baden *et al.* (2009) who use “have you had to satisfy customers on the following issues? Health and safety; employees/staff issues; social/community issues equal opportunities or investors in people, or SA8000”. The asking of these questions of customers and suppliers provides a wider view of social practices.

Only 6 percent of the measures identified explicitly cover the network level of analysis. On the environmental side, these typically relate to industry-level measures of environmental practices as well as managerial attitudes to broader

Table VIII Measures in relation to the main purchasing processes

	Number and type of measure		Examples
	Green	Social	
Make or buy	–	–	–
Supply market analysis	1 Material, waste, recycling		By-product auction and exchange (Camison, 2008)
Spend analysis	1 Cost	1 Equity	Track the cost of waste throughout the supply chain (Darnall, 2008) Use of minority suppliers (Maignan <i>et al.</i> , 2002)
Sourcing strategy	6 Material, waste, recycling; Generic internal process; Strategy	4 Equity	Formal policy on green procurement/purchasing (Holt and Ghobadian, 2009) Purchases from minority/women-owned enterprises (Carter and Jennings, 2004)
Specs definition	6 Material, waste, recycling; Generic internal process; Design	–	Provide design specifications to suppliers that include environmental requirements for purchased items (ElTayeb <i>et al.</i> , 2010) Optimization of environmental compatibility of purchased goods ("product-based green supply") (Koplin <i>et al.</i> , 2007)
Supplier selection and contracting	11 Compliance; Material, waste, recycling; Generic internal process	11 Equity and ethics	A supplier wishing to deliver to a certain company must have an ecological management system in place (Thun and Müller, 2010) Use of obscure contract terms to gain an advantage over suppliers (Carter and Jennings, 2004)
Supplier development	8 Cost, Generic internal process	1 Generic internal process	Arrange funds to help suppliers' environmental programs or guide/help suppliers to establish their own environmental programs (Rao, 2005) Educate suppliers through written material (Holt and Ghobadian, 2009)
Management of the order cycle	–	1 H&S	Ensure the safe movement of product to the company's facilities (Carter and Jennings, 2004)
Supplier involvement in NPD (New Product Development)	6 Design; LCA; Material, waste, recycling; Generic internal process; Product	–	Supplier's advances in developing environmentally friendly goods (Zhu <i>et al.</i> , 2005) Use and development of eco-friendly technologies in cooperation with suppliers (Thun and Müller, 2010)
Supplier integration in order fulfillment	–	–	–
Supplier evaluation	15 Compliance and standards; Material, waste, recycling; Monitoring; Generic internal process	4 Equity compliance H&S	Send company auditors to appraise environmental compliance of suppliers (Rao, 2005) Evaluate suppliers based on specific environmental criteria (ElTayeb <i>et al.</i> , 2010) Ensure that suppliers comply with child labor laws (Carter and Jennings, 2004)
Collaboration processes	17 Material, waste, recycling; Generic internal process; Strategy		Share company know-how and expertise in environmental management and technologies with suppliers (Vachon and Klassen, 2006) Joint perspective on what has to be achieved in sustainability and sustainable supply chain management, as well as learning and innovation (Seuring and Mueller, 2008)

stakeholders, e.g. reactive, defensive, accommodative and proactive (Henriques and Sadosky, 1999). However, our review failed to find measures at the network level that show the degree of engagement within a sustainable network (including the supply chain and extending beyond typical supply chain companies to encompass other stakeholders). As this domain of research is relatively new, we might expect the methods used to study this phenomenon to be restricted to case studies where measures can be embedded within a narrative analysis.

In summary, two measures were identified in the papers reviewed at the network level. These focus on the environmental aspects of material, waste and recycling (20 percent), and generic internal processes (80 percent). Zhu *et al.* (2005) measure competitors' green strategies and industrial professional group activities. Cheng *et al.* (2008, p. 288) judge the wider influence of media networks in "sharing green knowledge obtained from newspapers magazines, journals, television and other sources". These sets of measures appear to support institutional views of networks, which suggest that how "others" behave within a network creates normative pressure. Camison (2008) adopts an industrial ecology perspective in a measure of "by-product auction and exchange", which reflects the inclusion of the broader network in flows of waste products.

Two social measures were identified at the network level – "community" and "non-ethical behavior". Besser *et al.* (2006) lists a range of measures focused on community support, whereas Park and Stoil's (2005) measures are related to peers being highly ethical and socially responsible; decisions being highly socially responsible; behavior being highly ethical and socially responsible; and buying decisions being highly ethical and socially responsible.

3.6 Discussion: towards a taxonomy of sustainable purchasing and supply measures

3.6.1 Definitions

In reviewing the definitions used in the extant literature, we found that most research claims to adopt a supply chain level approach but, in reality, only treats internal or dyadic level questions. Surprisingly, no definition expressly focuses on sustainable purchasing and supply, although we found definitions for sustainable procurement (mainly from the public sector perspective) and other more limited terms, such as socially responsible buying or green supply. Thus, in seeking to fill this obvious gap, we propose a definition of sustainable purchasing and supply that incorporates sustainability. We build on Van Weele's (2010) well-known definition of purchasing:

Sustainable purchasing is the consideration of environmental, social, ethical and economic issues in the management of the organization's external resources in such a way that the supply of all goods, services, capabilities and knowledge that are necessary for running, maintaining and managing the organization's primary and support activities provide value not only to the organization but also to society and the economy.

We do not claim that this should be the single, unifying definition, but suggest that definitions used in research should reflect what is actually studied. Furthermore, we stress that the use of definitions that allude to different levels of analysis (purchasing functions, supply chains or networks) create a confusing picture of the focus of the study. Therefore, we also advise that the levels of analysis be carefully delineated early on future research work and that this delineation be closely linked to the definitions used.

3.6.2 Measurement issues

The second objective of this study relates to the use of measures in sustainable purchasing and supply research. The results show a diversity of measures cutting across environmental/green and social perspectives. In order to clarify the issues treated, we categorize these measures within distinct groups with a view to obtaining a clearer view of what is being operationalized in the research, and, to a certain degree, the extent to which research focuses on limited issues or is more inclusive. We cross-checked these categories with those suggested in the Global Reporting Initiative (GRI), which similarly groups environmental and social issues into sub-themes for firm-level reporting purposes. This comparison indicates that the measures used are exhaustive in terms of the dimensions used in the GRI, but the focus in most research is primarily on the environmental side, particularly internal generic processes, and material waste and recycling.

Given that the internal generic process form a major part of the questions used in studies, we decided to examine in the measures in detail to determine how they related to specific purchasing and supply processes. To do so, we carried out an analysis of the operationalized measures in order to link them to different elements of the purchasing process. As described in the justification for the review, purchasing activities range from make-or-buy decisions to evaluations of suppliers to collaborative actions between buyers and suppliers. In Table VIII, we showed the number of measures that corresponded to the primary purchasing and supply processes. The table serves to demonstrate where the main focus of research has been and identifies gaps in the way sustainability has been integrated into purchasing and supply research.

From this analysis, we see that most research focuses on supplier evaluation and selection/contracting activities. Many of the papers reviewed include questions on how sustainability has been integrated into selection criteria, and how suppliers were subsequently evaluated and monitored. For example, such questions might ask whether ISO14001 certification is a prerequisite in supplier selection. There is also a significant focus on collaboration processes in which buyers share knowledge with suppliers (or vice versa) in order to improve sustainability performance. Some questions also specifically ask about supplier development in which buying organizations support their suppliers in their efforts to improve their own sustainability. Some research also covered how sourcing strategies have been influenced by sustainability imperatives (often at the corporate level).

Given the importance of products in sustainability, especially from an environmental perspective, relatively few papers investigate how product specifications and integration into product development are affected by sustainability. Even fewer articles measure and discuss how spending (e.g. the percentage of spending used on "sustainable" suppliers) and supply market analyses integrate sustainability issues. In light of the importance of these activities in purchasing and supply management, this is a major shortcoming. The small number of examples focus on social issues related to the use of minority suppliers (Maignan *et al.*, 2002), the proportion of spending attributed to local businesses (Besser *et al.*, 2006), or exchanges and auctions of by-products (Camison, 2008). Issues relating to the order cycle and order fulfillment are seldom treated, even though one might expect research to ask

whether there are links to these processes as well (Carter and Jennings, 2004). Finally, make-or-buy decisions have not been considered in the papers reviewed despite the fact that this is a major issue in purchasing and supply research. However, as our focus was not on outsourcing *per se*, a further review of the outsourcing literature may reveal research exploring the link to sustainability (e.g. outsourcing to “unsustainable” suppliers).

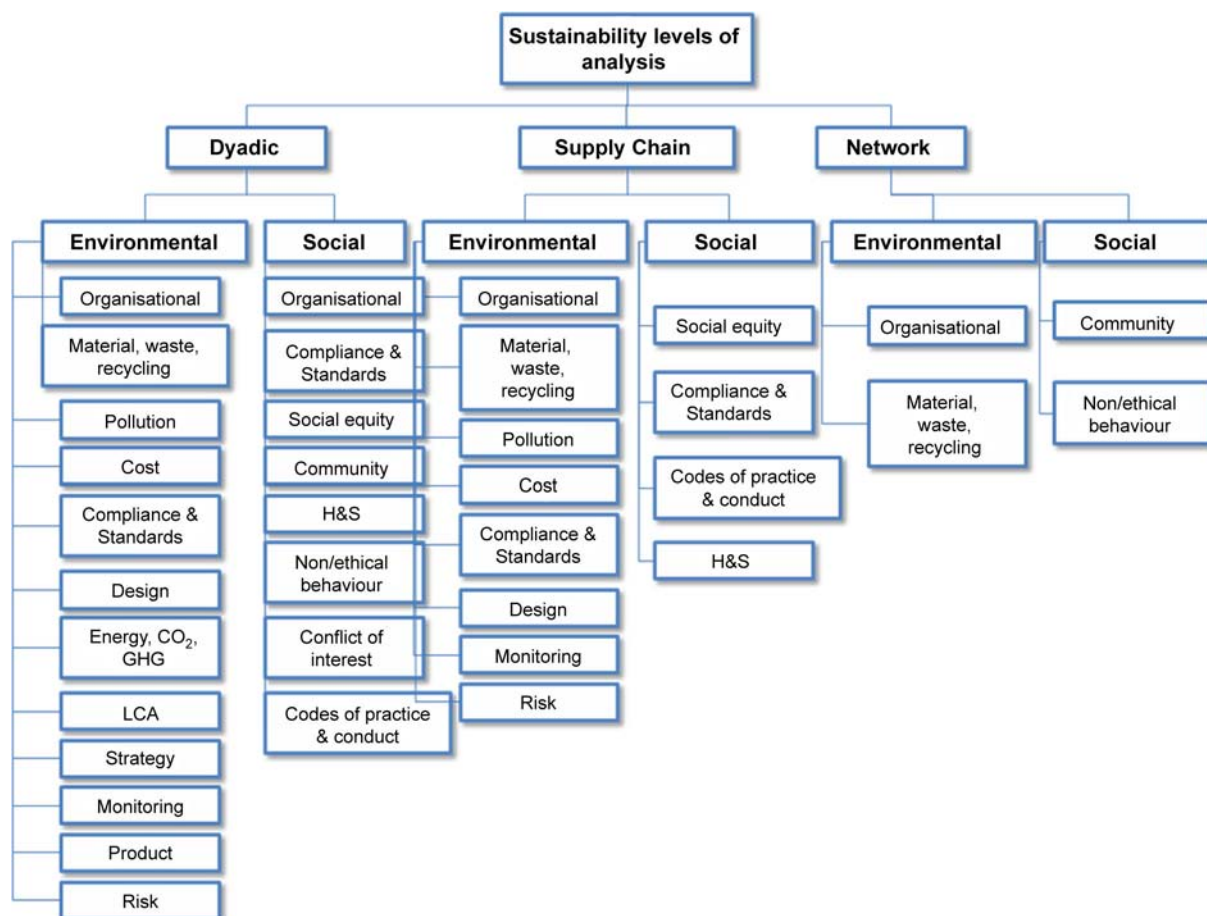
In order to address our third objective, we develop a taxonomy of the measures used at each of the levels of analysis chosen for this study (Figure 7). This is an empirical taxonomy derived from the data available in papers, rather than a normative taxonomy, which could be used to suggest what “should” be measured at the different levels. However, an examination of the taxonomy highlights areas that could be developed in future studies, particularly areas relating to social sustainability at the supply chain and network levels. Surprisingly, some measures do not translate across the types of measures (environmental and social) or across the different levels of analysis. One example of this is risk – researchers might be expected to be concerned about how risk is managed in a complex industry network, especially when companies face challenges of global sourcing and extended lines of supply. Linked to this concept are compliance and standards, and monitoring. While we find that research has examined this issue from a supply chain perspective (although not social monitoring), these types of measures have not been applied to

the wider network (or the extended supply chain), where the risks of non-compliance may be highest and monitoring may be difficult.

Measures of other issues are also missing at the supply chain level, including strategy and product development with suppliers. For example, manufacturers may bypass direct suppliers to develop green technologies with indirect suppliers, as is the case with new materials from the third or fourth tier in the car industry.

In general, the scarcity of empirical research at the network level highlights many opportunities for research, despite the methodological challenges. There is a clear need to understand issues related to compliance and standards, monitoring processes, and the use of codes of conduct, especially across the extended network where the risks involved may be considerable. Furthermore, on the network level, researchers are not asking how stakeholders are involved in organizational processes of decision making, i.e. in setting specifications or evaluating suppliers. We also know that companies are increasingly using third parties to help identify “sustainable” suppliers (e.g. www.sedex.org.uk) but researchers are not asking about the role of such suppliers in purchasing and supply processes, a topic that should be investigated at the network level. We return to future research opportunities in the final section of the paper.

Figure 7 A taxonomy of measures used in sustainable purchasing and supply research



4. Conclusions

This review considers the scope and structure of purchasing and supply research in the area of sustainability. A total of 113 papers are reviewed in detail with the specific aim of understanding how definitions and measures in current research vary across levels of analysis. A total of 73 papers contain definitions or measures that could be analyzed. Given the number of studies in this area, the field appears relatively mature on the surface. Yet, the review reveals there is still a great deal of heterogeneity in the definitions and measures used. Furthermore, there is even greater variability across levels of analysis, with a distinct lack of research on the true supply chain and network levels.

Even at the dyadic or firm level, sustainable purchasing and supply are defined in many different ways. Definitions vary according to the focus of the study and tend to highlight specific issues of interest in the study. Some definitions focus purely on green issues, such as buying green inputs, or exclusively on social issues, such as ethical/non-ethical buying behavior. Many papers claim to use a supply chain level definition but in reality only focus on the internal activities of the firm or, at best, on the activities of immediate suppliers. Of those studies at the supply chain level, the scope of definitions widens and they focus on practices that cut across the supply chain. Typically, such studies address customers downstream and suppliers upstream (e.g. recycling). This links to the idea that supply chains are viewed in terms of the product life cycle, which ranges from raw material acquisition to end-of-life disposal (cradle to grave) and much of the extant research examines the roles of purchasing and supply in these stages. Hence, the majority of purchasing and supply research at the supply chain level is focused on green or environmental issues, while very little research examines social sustainability. Surprisingly, our review found no existing definitions of sustainable purchasing and supply. We sought to fill this obvious gap in sustainable purchasing and supply theory by proposing a definition of sustainable purchasing and supply that draws from an existing definition of purchasing and supply (Van Weele, 2010):

Sustainable purchasing is the consideration of environmental, social, ethical and economic issues in the management of the organization's external resources in such a way that the supply of all goods, services, capabilities and knowledge that are necessary for running, maintaining and managing the organization's primary and support activities provide value not only to the organization but also to society and the economy.

The extension of this definition to the supply chain level implies the inclusion of direct and indirect suppliers as well as customer demands. A significant finding of this research is that network-level research is relatively rare with less than 25 per cent of papers adopting this perspective. Looking deeper, we found even fewer studies that actually define sustainability at this level – only six definitions reflect this level, all of which include other factors, such as stakeholder engagement. This is an important point because, in the extended network, sustainability issues can have an important impact on firms (for example, the reputational damage to Unilever and Nestlé arising from the use of palm oil and its link to deforestation). This apparent lack of studies at the network level can be addressed through the development of appropriate, new measures. However, there are at least two plausible explanations for the current deficiency in the research. The first is that examining purchasing and supply at the supply chain and network levels is methodologically

challenging. In-depth case studies (e.g. Matos and Hall, 2007) may be required to capture the complexities of supply chains and networks. The second is that, in reality, managing chains and networks is problematic. For example, in more general supply chain research, findings often reflect the fact that companies rarely adopt a complete supply chain view (Fawcett and Magnan, 2002) and are poorly equipped to manage supply networks let alone encompass indirect stakeholders, such as non-economic actors, in the purchasing and supply of goods and services.

The second main finding and contribution of this paper is its categorization of measures, which provides an overview of how research to date has been operationalized. Environmental issues, especially internal generic processes, and the management of materials, waste and recycling, dominate existing research in terms of the measures used (69 percent). This finding is fairly consistent across all levels of research. Social measures are less prevalent (31 percent of all measures), reflecting the lower number of studies overall. Here we find that conflicts of interest, buyer ethics and social equity dominate the measurement approaches. Even greater differences in focus are evident across the levels of analysis when analyzing the measures. While firm/dyad level measures are well-developed there are relatively few instances of studies in which the field is empirically examined at the supply chain or network level. In particular, there is a distinct lack of research into risk and monitoring in the extended network, and into the way that stakeholders or non-economic actors are involved in purchasing and supply processes. Our recommendation, therefore, is for researchers to reduce heterogeneity by choosing well-established measures (such as those from GRI). In this regard, we hope that our categorization of measures will aid future researchers in structuring their measures to ensure that important elements are not missing.

A third major contribution of this paper is the highlighting of gaps in the way that sustainability in purchasing and supply activities has been researched. In our examination of the questions addressed in relation to specific purchasing processes, we found that the majority of research focuses on the selection and contracting process, and on the evaluation process of suppliers. However, few papers actually address other purchasing processes, such as supplier development, spending analysis and supply market analysis. Even fewer deal with issues relating to sustainability and the order cycle (e.g. the actual execution of orders, activities to ensure more efficient delivery or the recovery of waste packaging).

The development of a taxonomy of measures served two objectives. The first was to organize the measures into main categories within the main environmental and social pillars of sustainability. The second objective was to obtain an overview of the spread of research across the three levels of analysis. In general, the taxonomy reveals that the range of measures decreases as the level of analysis increases. We can attribute this to conceptual and methodological difficulties in undertaking purchasing and supply research at the supply chain and, especially, network levels. This exercise highlighted specific gaps in the research, at least from an empirical standpoint. For example, risk and monitoring within the extended network were not operationalized in the studies included in this review. This reflects not only the overall lack of socially based sustainability measures but also the restricted scope of most studies.

4.1 Future research directions

The study shows that there are many avenues for future research. These are briefly outlined in this subsection.

4.1.1 Analysis of sourcing risks within wider networks

The first possible avenue for future research stems from the main finding that there is generally a need for research to adopt a wider view in terms of levels of analysis. Researchers should ensure that when stating a level of analysis, they actually operationalize it in the definitions used, the questions they ask (in interview-based research), the measures they use (in questionnaire-based research) and the research methodology they employ. The network level of analysis is particularly neglected and offers excellent opportunities to examine practices that involve the integration of a wider set of stakeholders in the processes of purchasing and supply. This stakeholder network can range from suppliers in the extended chain to non-economic actors who may influence end markets, or purchasing and supply processes. Two opportunities appear particularly pertinent. The first is the examination of how companies evaluate and develop their extended networks of suppliers, especially on a global basis, where suppliers are geographically distant and “hidden” within the supply chain or network. The second opportunity is the integration or consideration of stakeholders, such as NGOs or regulators, in the purchasing decision-making process, and the benefits and challenges of this. Given the problems companies face in gaining an understanding of their extended networks and the risks associated with, for example, global sourcing, there is not only an academic but also a strong practical rationale for such a research agenda.

4.1.2 Development of measures to explore and test sustainability across supply chains

Our taxonomy highlights research opportunities related to the operationalization of measures, including how these reflect different levels of analysis. While research addressing the internal or dyadic level is fairly comprehensive, there are some specific gaps at the supply chain level. At this level, purchasing and supply research focuses on product life-cycle stages (particularly in relation to recycling). However, the measures typically do not reflect this focus in the way in which questions are asked. Hence, product-based measures should be developed to assess how LCA and product eco-efficiency, for example, are adopted across supply chains and even include customer demands, such as the demand for eco-labels. Companies claim to address sustainability across supply chain tiers, but research has failed to develop appropriate measures to verify whether this is truly the case. On the social side, explicit measures of how community support, conflicts of interest and non-ethical behavior are managed by indirect suppliers is largely missing. As these are areas in which many risks exist, they are particularly important.

4.1.3 Influence of non-economic stakeholders on purchasing and supply processes

From a network perspective, there is a need for research to address how non-economic stakeholders can support or hinder product sustainability, especially in terms of identifying and managing risks, and how non-economic actors, such as NGOs, can facilitate the monitoring of smaller suppliers (e.g. SEDEX UK). This issue could be addressed across both the environmental and social categories of measures. Furthermore, with regard to non-ethical behavior,

researchers should also examine the role of stakeholders in providing normative pressure in order to reduce the prevalence of such behavior, possibly by adopting an institutional theory lens. Such a perspective is rare in purchasing and supply research.

4.1.4 Supplier development and involvement in sustainable new product development (NPD)

An additional avenue for future research is purchasing and supply, irrespective of the level of analysis. We found that while a significant amount of research treats the evaluation and selection of suppliers, there is relatively little research into supplier development and involvement in sustainable NPD. In fact, research on supplier evaluation shows that such an evaluation is unlikely to result in a performance improvement unless it is supported by knowledge-transfer efforts, such as supplier development (Prahinski and Benton, 2004). In terms of other purchasing and supply processes, few studies examine how sustainability is integrated into spending analysis, supply market analysis or the order-fulfillment process. Hence, we suggest that future research be more structured in terms of treating the main elements of the purchasing and supply processes.

4.1.5 Social sustainability

Finally, we encourage more research into social sustainability. As Table VIII highlights, researchers rarely ask questions about social sustainability related to sourcing strategies. Given that, theoretically, companies “should” differentiate their strategies according to importance and risk, social risks should be included in these models. Furthermore, there is an opportunity to examine how sustainability on the social side is integrated into supplier development programs. The majority of research focuses on the selection and evaluation side, but if suppliers do not meet desired sustainability performance, are buyers seriously engaged in developing this element of performance? Researchers do not appear to be asking this question. Furthermore, the difficult question of non-ethical behavior is rarely treated except in relation to supplier selection. To what extent do buyers attempt to reduce this risk through collaborative or developmental processes? The fact that this question is not addressed is a shortcoming given the importance of forms of governance (relational) used to overcome these types of risks (such as opportunism). However, the question presents its own methodological challenges (such as social desirability biases).

4.2 Limitations

The main limitation of this study relates to the methodology used. Any literature review reflects a snapshot in time and this is especially true for the rapidly developing sustainability field. As the papers reviewed were published in the period 2000–2010, the change over time was significant. Reviews following this method in the future may arrive at different results. In particular, the balance between levels and environmental/social foci is likely to change. However, we are confident that a review using exactly the same time period would reveal similar results.

The second limitation is the coding process for the papers and measures, and their allocation to levels and categories. Keywords were used to decide where to place measures in the taxonomy, yet a certain level of ambiguity was found in some of the measures. Therefore, the allocation relied on a more rounded understanding of the measure or questions.

A third possible limit of the study is the fact that we focused on definitions and measures. In a sense, this is a strength, as it provided a specific method. However, the review excluded the analysis of some elements. In particular, the research design of each paper was not examined or coded in detail (although a high-level methods review of the empirical papers showed support for our arguments in general). Such an analysis may have revealed more in terms of the scope of the research reviewed, i.e. who exactly the respondents were (function) and at which level of the supply chain they were located.

Finally, we did not include supply chain studies that did not concern purchasing and supply in our review. Therefore, there may be some papers focusing on logistics or transportation that go some way towards examining the gaps in research that we have identified. However, these are unlikely to have much relevance to scholars primarily interested in purchasing and supply.

References

- Andersen, M. and Skjoett-Larsen, T. (2009), "Corporate social responsibility in global supply chains", *Supply Chain Management: An International Journal*, Vol. 14 No. 2, pp. 75–86.
- Araujo, L. and Harrison, D. (2002), "Path dependence, agency and technological evolution", *Technology Analysis and Strategic Management*, Vol. 14 No. 1, pp. 5–19.
- Baden, D.A., Harwood, I.A. and Woodward, D.G. (2009), "The effect of buyer pressure on suppliers in SMEs to demonstrate CSR practices: an added incentive or counter productive?", *European Management Journal*, Vol. 27 No. 6, pp. 429–41.
- Bansal, P. and McKnight, B. (2009), "Looking forward, pushing back and peering sideways: analyzing the sustainability of industrial symbiosis", *Journal of Supply Chain Management: A Global Review of Purchasing & Supply*, Vol. 45 No. 4, pp. 26–37.
- Beamon, B.M. (1999), "Designing the green supply chain", *Logistics Information Management*, Vol. 12 No. 4, pp. 332–42.
- Besser, T.L., Miller, N. and Perkins, R.K. (2006), "For the greater good: business networks and business social responsibility to communities", *Entrepreneurship & Regional Development*, Vol. 18 No. 4, pp. 321–39.
- Blowfield, M. (2000), "Ethical sourcing: a contribution to sustainability or a diversion?", *Sustainable Development*, Vol. 8 No. 4, pp. 191–200.
- Bowen, F., Cousins, P.D., Lamming, R.C. and Faruk, A.C. (2001), "The role of supply management capabilities in green supply", *Production and Operations Management*, Vol. 10 No. 2, pp. 174–89.
- Camison, C. (2008), "Learning for environmental adaptation and knowledge-intensive services: the role of public networks for SMEs", *Service Industries Journal*, Vol. 28 No. 6, pp. 827–44.
- Carter, C.R. and Carter, J.R. (1998), "Interorganizational determinants of environmental purchasing: initial evidence from the consumer products industries", *Decision Sciences*, Vol. 29 No. 3, pp. 659–84.
- Carter, C.R. and Jennings, M.M. (2000), "The role of purchasing in corporate social responsibility: a structural equation analysis", *Journal of Business Logistics*, Vol. 25 No. 1, pp. 145–86.
- Carter, C.R. and Rogers, D.S. (2008), "A framework of sustainable supply chain management: moving toward new theory", *International Journal of Physical Distribution & Logistics Management*, Vol. 38 No. 5, pp. 360–87.
- Cheng, J.-H., Yeh, C.-H. and Tu, C.-W. (2008), "Trust and knowledge sharing in green supply chains", *Supply Chain Management: An International Journal*, Vol. 13 No. 4, pp. 283–95.
- Chertow, M.R. (2000), "Industrial symbiosis: literature and taxonomy", *Annual Reviews in Energy and the Environment*, Vol. 25 No. 1, pp. 313–37.
- Christopher, M. (1998), *Logistics and Supply Chain Management. Strategies for Reducing Costs and Improving Services*, 2nd ed., FT Prentice Hall, London.
- Croom, S., Romano, P. and Giannakis, M. (2000), "Supply chain management: an analytical framework for critical literature review", *European Journal of Purchasing & Supply Management*, Vol. 6, pp. 67–83.
- Cumming, J.F. (2001), "Engaging stakeholders in corporate accountability programmes: a cross-sectoral analysis of UK and transnational experience", *Business Ethics: A European Review*, Vol. 10 No. 1, pp. 45–51.
- Darnall, N., Jolley, G.J. and Handfield, R. (2008), "Environmental management systems and green supply chain management: complements for sustainability?", *Business Strategy and the Environment*, Vol. 17 No. 1, pp. 30–45.
- Delmas, M. (2001), "Stakeholders and competitive advantage: the case of ISO14001", *Production and Operations Management*, Vol. 10, pp. 343–58.
- Drumwright, M.E. (1994), "Socially responsible organizational buying: environmental concern as a noneconomic buying criterion", *Journal of Marketing*, Vol. 58 No. 3, pp. 1–19.
- Eltantawy, R.A., Fox, G.L. and Giunipero, L. (2009), "Supply management ethical responsibility: reputation and performance impacts", *Supply Chain Management: An International Journal*, Vol. 14 No. 2, pp. 99–108.
- Faisal, M.N. (2010), "Analysing the barriers to corporate social responsibility in supply chains: an interpretive structural modelling approach", *International Journal of Logistics: Research & Applications*, Vol. 13 No. 3, pp. 179–95.
- Fawcett, S.E. and Magnan, G.M. (2002), "The rhetoric and reality of supply chain integration", *International Journal of Physical Distribution & Logistics Management*, Vol. 32 No. 5, p. 339.
- Fineman, S. and Clarke, K. (1996), "Green stakeholders: industry interpretations and response", *Journal of Management Studies*, Vol. 33 No. 6, pp. 715–30.
- Font, X., Tapper, R., Schwartz, K. and Kornilaki, M. (2008), "Sustainable supply chain management in tourism", *Business Strategy & the Environment*, Vol. 17 No. 4, pp. 260–71.
- Frota Neto, J.Q., Bloemhof-Ruwaard, J.M., van Nunen, J.A.E.E. and van Heck, E. (2008), "Designing and evaluating sustainable logistics networks", *International Journal of Production Economics*, Vol. 111 No. 2, pp. 195–208.
- Gavaghan, K., Calahan Klein, R., Olson, J.P. and Pritchett, T.E. (1998), "The greening of the supply chain", *Supply Chain Management Review*, Vol. 2 No. 2, pp. 76–84.
- Grankvist, G. and Biel, A. (2007), "The impact of environmental information on professional purchasers'

- choice of products”, *Business Strategy & the Environment*, Vol. 16 No. 6, pp. 421-9.
- Green, K., Morton, B. and New, S. (1996), “Purchasing and environmental management: interactions, policies and opportunities”, *Business Strategy and the Environment*, Vol. 5 No. 3, pp. 188-97.
- Green, K., Morton, B. and New, S. (1998), “Green purchasing and supply policies: do they improve companies’ environmental performance?”, *Supply Chain Management*, Vol. 3 No. 2, pp. 89-95.
- Håkansson, H. (1982), *International Marketing and Purchasing of Industrial Goods: An Interaction Approach*, Chichester, Wiley.
- Hall, J. and Matos, S. (2010), “Incorporating impoverished communities in sustainable supply chains”, *International Journal of Physical Distribution & Logistics Management*, Vol. 40 Nos 1/2, pp. 124-47.
- Hamprecht, J., Corsten, D., Noll, M. and Meier, E. (2005), “Controlling the sustainability of food supply chains”, *Supply Chain Management: An International Journal*, Vol. 10 No. 1, pp. 7-10.
- Handfield, R., Sroufe, R. and Walton, S. (2004), “Integrating environmental management and supply chain strategies”, *Business Strategy and the Environment*, Vol. 14, pp. 1-19.
- Handfield, R., Walton, S., Sroufe, R. and Melnyk, S. (2002), “Applying environmental criteria to supplier assessment: a study in the application of the analytical hierarchy process”, *European Journal of Operational Research*, Vol. 141, pp. 70-87.
- Handfield, R.B. and Baumer, D.L. (2006), “Managing conflict of interest issues in purchasing”, *Journal of Supply Chain Management: A Global Review of Purchasing & Supply*, Vol. 42 No. 3, pp. 41-50.
- Handfield, R.B., Walton, S.V., Seegers, L.K. and Melnyk, S.A. (1997), “‘Green’ value chain practices in the furniture industry”, *Journal of Operations Management*, Vol. 15 No. 3, pp. 293-315.
- Harland, C. (1996), “Supply chain management: relationships, chains and networks”, *British Journal of Management*, Vol. 7, pp. S63-S80.
- Harvey, C., Morris, H., Kelly, A. and Rowlinson, M. (2010), “The Association of Business Schools: Academic Journal Quality Guide”, March, available at: www.the-ABS.org.uk
- Henriques, I. and Sadorsky, P. (1999), “The relationship between environmental commitment and managerial perceptions of stakeholder importance”, *Academy of Management Journal*, Vol. 43 No. 1, pp. 87-99.
- Ho, D.C., Au, K.F. and Newton, E. (2002), “Empirical research on supply chain management: a critical review and recommendations”, *International Journal of Production Research*, Vol. 40 No. 17, pp. 4415-30.
- Holt, D. and Ghobadian, A. (2009), “An empirical study of green supply chain management practices amongst UK manufacturers”, *Journal of Manufacturing Technology Management*, Vol. 20 No. 7, pp. 933-56.
- Hong, P., Kwon, H.-B. and Roh, J.J. (2009), “Implementation of strategic green orientation in supply chain: an empirical study of manufacturing firms”, *European Journal of Innovation Management*, Vol. 12 No. 4, pp. 512-32.
- Hughes, A., Buttle, M. and Wrigley, N. (2007), “Organisational geographies of corporate responsibility: a UK-US comparison of retailers’ ethical trading initiatives”, *Journal of Economic Geography*, Vol. 7 No. 4, pp. 491-513.
- Kainuma, Y. and Tawara, N. (2006), “A multiple attribute utility theory approach to lean and green supply chain management”, *International Journal of Production Economics*, Vol. 101 No. 1, pp. 99-108.
- Koplin, J., Seuring, S. and Mesterharm, M. (2007), “Incorporating sustainability into supply management in the automotive industry: the case of the Volkswagen AG”, *Journal of Cleaner Production*, Vol. 15 Nos 11/12, pp. 1053-62.
- Kovács, G. (2008), “Corporate environmental responsibility in the supply chain”, *Journal of Cleaner Production*, Vol. 16 No. 15, pp. 1571-8.
- Krause, D.R., Vachon, S. and Klassen, R.D. (2009), “Special topic forum on sustainable supply chain management: introduction and reflections on the role of purchasing management”, *Journal of Supply Chain Management: A Global Review of Purchasing & Supply*, Vol. 45 No. 4, pp. 18-25.
- Lambert, A.J.D. (2001), “Life-cycle chain analysis, including recycling”, in Sarkis, J. (Ed.), *Greener Manufacturing and Operations*, Greenleaf Publishing, Sheffield.
- Lambert, D., Cooper, M. and Pagh, J. (1998), “Supply chain management, implementation issues and research opportunities”, *International Journal of Logistics Management*, Vol. 9 No. 2, pp. 1-19.
- Lamming, R.C., Johnsen, T., Zheng, J. and Harland, C. (2000), “An initial classification of supply networks”, *International Journal of Operations & Production Management*, Vol. 20 Nos 5/6, pp. 675-92.
- Larson, P.D. and Halldorsson, A. (2002), “What is SCM, where is it?”, *Journal of Supply Chain Management*, Vol. 38 No. 4, pp. 36-44.
- Lee, R.P., Chen, Q., Kim, D. and Johnson, J.L. (2008), “Knowledge transfer between multinational corporations’ headquarters and their subsidiaries: influences on and implications for new product outcomes”, *Journal of International Marketing*, Vol. 16 No. 2, pp. 1-31.
- Linton, J.D., Klassen, R. and Jayaraman, V. (2007), “Sustainable supply chains: an introduction”, *Journal of Operations Management*, Vol. 25 No. 6, pp. 1075-82.
- Lockamy, A. (2008), “Examining supply chain networks using V-A-T material flow analysis”, *Supply Chain Management: An International Journal*, Vol. 13 No. 5, pp. 343-8.
- Maignan, I., Hillebrand, B. and McAlister, D. (2002), “Managing socially-responsible buying: how to integrate non-economic criteria into the purchasing process”, *European Management Journal*, Vol. 20 No. 6, p. 641.
- Maloni, M. and Brown, M. (2006), “Corporate social responsibility in the supply chain: an application in the food industry”, *Journal of Business Ethics*, Vol. 68 No. 1, pp. 35-52.
- Matos, S. and Hall, J. (2007), “Integrating sustainable development in the supply chain: the case of life cycle assessment in oil and gas and agricultural biotechnology”, *Journal of Operations Management*, Vol. 25 No. 6, pp. 1083-102.
- Mehalik, M.M. (2000), “Sustainable network design: a commercial fabric case study”, *Interfaces*, Vol. 30 No. 3, pp. 180-9.
- Min, H. and Galle, W.P. (1997), “Green purchasing strategies: trends and implications”, *International Journal of Purchasing and Materials Management*, August, pp. 10-17.

- Min, H. and Galle, W.P. (2001), "Green purchasing practices of US firms", *International Journal of Operations & Production Management*, Vol. 21 No. 9, p. 1222.
- Mollenkopf, D., Stolze, H., Tate, W.L. and Ueltschy, M. (2010), "Green, lean, and global supply chains", *International Journal of Physical Distribution & Logistics Management*, Vol. 40 Nos 1/2, pp. 14-41.
- Möller, K., Rajala, A. and Svahn, S. (2005), "Strategic business nets – their type and management", *Journal of Business Research*, Vol. 58 No. 9, pp. 1274-84.
- Murphy, P.R., Poist, R.F. and Braunschweig, C.D. (1996), "Green logistics: comparative views of environmental progressives, moderates and conservatives", *Journal of Business Logistics*, Vol. 17 No. 1, pp. 191-211.
- Murray, J.G. (2009), "Towards a common understanding of the differences between purchasing, procurement and commissioning in the UK public sector", *Journal of Purchasing and Supply Management*, Vol. 15 No. 3, pp. 198-202.
- Nadvi, K. (2008), "Global standards, global governance and the organization of global value chains", *Journal of Economic Geography*, Vol. 8 No. 3, pp. 323-43.
- Pagell, M. and Wu, Z. (2009), "Building a more complete theory of sustainable supply chain management using case studies of 10 exemplars", *Journal of Supply Chain Management: A Global Review of Purchasing & Supply*, Vol. 45 No. 2, pp. 37-56.
- Park, H. and Stoel, L. (2005), "A model of socially responsible buying/sourcing decision-making processes", *International Journal of Retail & Distribution Management*, Vol. 33 No. 4, pp. 235-48.
- Peter, T., Beat, G. and Niels, F. (2006), "Risk management in sustainable supply chain management (SSCM): lessons learnt from the case of GMO-free soybeans", *Corporate Social Responsibility and Environmental Management*, Vol. 13 No. 1, pp. 1-10.
- Popay, J., Rogers, A. and Williams, G. (1998), "Rationale and standards for the systematic review of qualitative literature in health services research", *Qualitative Health Research*, Vol. 8 No. 3, pp. 341-51.
- Prahinski, C. and Benton, W.C. (2004), "Supplier evaluations: communication strategies to improve supplier performance", *Journal of Operations Management*, Vol. 22 No. 1, pp. 39-62.
- Preuss, L. (2005), "Rhetoric and reality of corporate greening: a view from the supply chain management function", *Business Strategy and the Environment*, Vol. 14, pp. 123-39.
- Preuss, L. (2009), "Ethical sourcing codes of large UK-based corporations: prevalence, content, limitations", *Journal of Business Ethics*, Vol. 88 No. 4, pp. 735-47.
- Ramsay, J. and Croom, S. (2008), "The impact of evolutionary and developmental metaphors on supply chain practice: a literature critique and pilot study", *Journal of Purchasing and Supply Management*, Vol. 14 No. 3, pp. 192-204.
- Rao, P. and Holt, D. (2005), "Do green supply chains lead to competitiveness and economic performance?", *International Journal of Operations & Production Management*, Vol. 25 No. 9, pp. 898-916.
- Ritter, T. and Gemünden, H.G. (2003), "Interorganizational relationships and networks: an overview", *Journal of Business Research*, Vol. 56, pp. 691-7.
- Roberts, S. (2003), "Supply chain specific? Understanding the patchy success of ethical sourcing initiatives", *Journal of Business Ethics*, Vol. 44 Nos 2/3, pp. 159-70.
- Roome, N. (2001), "Conceptualizing and studying the contribution of networks in environmental management and sustainable development", *Business Strategy & the Environment*, Vol. 10 No. 2, pp. 69-76.
- Rozemeijer, F. (2008), "Purchasing myopia revisited again?", *Journal of Purchasing and Supply Management*, Vol. 14 No. 3, pp. 205-7.
- Seuring, S. and Mueller, M. (2008), "Core issues in sustainable supply chain management – a Delphi study", *Business Strategy and the Environment*, Vol. 17 No. 8, pp. 455-66.
- Seuring, S. and Muller, M. (2008), "From a literature review to a conceptual framework for sustainable supply chain management", *Journal of Cleaner Production*, Vol. 16 No. 15, pp. 1699-710.
- Smith, S. and Barrientos, S. (2005), "Fair trade and ethical trade: are there moves towards convergence?", *Sustainable Development*, Vol. 13, pp. 190-8.
- Srivastava, S.K. (2007), "Green supply-chain management: a state-of-the-art literature review", *International Journal of Management Reviews*, Vol. 9 No. 1, pp. 53-80.
- Thun, J.R.-H. and Mueller, A. (2010), "An empirical analysis of green supply chain management in the German automotive industry", *Business Strategy & the Environment*, Vol. 19 No. 2, pp. 119-32.
- Tranfield, D., Denyer, D. and Smart, P. (2003), "Towards a methodology for developing evidence-informed management knowledge by means of systematic review", *British Journal of Management*, Vol. 14 No. 3, pp. 207-22.
- Vachon, S. and Mao, Z. (2008), "Linking supply chain strength to sustainable development: a country-level analysis", *Journal of Cleaner Production*, Vol. 16 No. 15, pp. 1552-60.
- Van Hoek, R.I. (1999), "From reversed logistics to green supply chains", *Supply Chain Management*, Vol. 4 No. 3, pp. 129-35.
- Van Weele, A. (2010), *Purchasing and Supply Chain Management*, 5th ed., Cengage Learning, London.
- von Malmborg, F. (2007), "Stimulating learning and innovation in networks for regional sustainable development: the role of local authorities", *Journal of Cleaner Production*, Vol. 15 No. 17, pp. 1730-41.
- Walker, H. and Brammer, S. (2009), "Sustainable procurement in the United Kingdom public sector", *Supply Chain Management: An International Journal*, Vol. 14 No. 2, pp. 128-37.
- Walker, H., Di Sisto, L. and McBain, D. (2008), "Drivers and barriers to environmental supply chain management practices: lessons from the public and private sectors", *Journal of Purchasing and Supply Management*, Vol. 14 No. 1, pp. 69-85.
- Walton, S.V., Handfield, R.B. and Melnyk, S.A. (1998), "The green supply chain: integrating suppliers into environmental management processes", *International Journal of Purchasing and Materials Management*, Vol. 34 No. 2, pp. 2-12.
- Wheeler, D., McKague, K., Thomson, J., Davies, R., Medalye, J. and Prada, M. (2005), "Creating sustainable local enterprise networks", *MIT Sloan Management Review*, Vol. 47 No. 1, pp. 33-40.

- Worthington, I., Ram, M., Boyal, H. and Shah, M. (2008), "Researching the drivers of socially responsible purchasing: a cross-national study of supplier diversity initiatives", *Journal of Business Ethics*, Vol. 79 No. 3, pp. 319-31.
- Young, A. and Kielkiewicz-Young, A. (2001), "Sustainable supply network management", *Corporate Environmental Strategy*, Vol. 8 No. 3, pp. 260-8.
- Zhu, Q. and Sarkis, J. (2004), "Relationships between operational practices and performance among early adopters of green supply chain management practices in Chinese manufacturing enterprises", *Journal of Operations Management*, Vol. 22 No. 3, pp. 265-89.
- Zhu, Q. and Sarkis, J. (2007), "The moderating effects of institutional pressures on emergent green supply chain

- practices and performance", *International Journal of Production Research*, Vol. 45 Nos 18/19, pp. 4333-55.
- Zhu, Q., Sarkis, J. and Geng, Y. (2005), "Green supply chain management in China: pressures, practices and performance", *International Journal of Operations & Production Management*, Vol. 25 No. 5, pp. 449-68.
- Zhu, Q., Sarkis, J. and Lai, K.-H. (2008), "Confirmation of a measurement model for green supply chain management practices implementation", *International Journal of Production Economics*, Vol. 111 No. 2, pp. 261-73.

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