

From a literature review to a conceptual framework for sustainable supply chain management

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ABSTRACT

Academic and corporate interest in sustainable supply chain management has risen considerably in recent years. This can be seen by the number of papers published and in particular by journal special issues. To establish the field further, the purpose of this paper is twofold. First, it offers a literature review on sustainable supply chain management taking 191 papers published from 1994 to 2007 into account. Second, it offers a conceptual framework to summarize the research in this field comprising three parts. As starting point related triggers are identified. This allows putting forward two distinct strategies: (1) supplier management for risks and performance, and (2) supply chain management for sustainable products. It is evident that research is still dominated by green/environmental issues. Social aspects and also the integration of the three dimensions of sustainability are still rare. Both practitioners in companies and academics might find the review useful, as it outlines major lines of research in the field. Further, it discusses specific features of sustainable supply chains as well as limitations of existing research; this should stimulate further research.

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1. Introduction

Production processes are often dispersed around the globe. Suppliers, focal companies and customers are linked by information, material and capital flows. In line with the value of the product comes the environmental and social burden incurred during different stages of production. With regard to this, focal companies of supply chains might be held responsible for the environmental and social performance of their suppliers. Focal companies are those companies that usually (1) rule or govern the supply chain, (2) provide the direct contact to the customer, and (3) design the product or service offered [208,220]. This is especially the case for brand-owning companies, as they are likely to come under pressure from stakeholders, e.g., non-governmental organizations (NGOs) [22,96]. These companies are asked to consider the environmental and social problems present in their entire supply chain. For example, apparel distributors such as Nike, Disney, Levi Strauss, Benetton, Adidas or C&A have been blamed in recent years for problems occurring during the production of their clothing. Inhumane working conditions [127,64] or contaminations of the (local) environment [140] were frequently mentioned as problems.

Based on this, operations, purchasing and supply chain managers have seen the integration of environmental and social issues, including those embedded in related standards (e.g., ISO 14001) into their daily tasks [200]. Such triggers have increased interest in green/environmental or sustainable supply chain management. The literature is still limited in quantity, and no major reviews of the field have been presented. Among the papers identified in the related search, only eight papers that attempt to review part of the literature were found [45,191,6,1,91,144,150]. De Burgos and Lorente [45] deal with environmental performance as an operation's objective, where supply chain issues are only secondarily addressed. In a similarly specialized perspective with only limited coverage of supply chain issues, Baumann et al. [6] centre their review on green product development. Zisdisin and Siferd [191] provide a review on environmental purchasing which is based on only 38 publications, i.e., they do not aim to cover all related publications. Abukhader and Jönson [1] look at the intersection of environmental issues with logistics. Their review has two major limitations: first, they only focus on logistics management journals. Second, supply chain issues are treated as a subset of logistics management. The recent paper by Kleindorfer et al. [91] comes closest to what is attempted here. In their contribution they review papers in the field of "Sustainable Operations Management" published in the first 50 issues of "Production and Operations Management". While they title their paper as operations, they cover related supply chain issues. The emphasis of their

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paper is more on discussing individual issues, but they only provide limited insights into the overall development and status of the field. Seuring and Müller [144] also provide a specific literature review only. They address the emergence and development of integrated chain management (Stoffstrommanagement) in Germany. While this has close links to sustainable supply chain management, the different schools also identified incorporate close links to industrial ecology and closed-loop supply chain management. A much wider attempt is made in the paper of Srivastava [150], but, as the author already states in the introduction “primarily taking a reverse logistics angle”. This perspective, as will be discussed in more detail below, is excluded here.

Hence, a literature review was conducted aiming to collect and analyze all relevant papers in the field by means of a structured search for literature. The last search for papers was conducted in January 2008. Based on this, the major aim of this paper is to outline the results of a literature review on the field of sustainability and supply chain management as well as to provide a conceptual framework capturing related research. (1) The research methodology is described while (2) some of the major results are portrayed. Moving beyond the analysis of specific issue, (3) a conceptual framework for the research field will be offered and discussed. Here, distinctive features of sustainable supply chain management will be outlined and limitations of the research will be addressed. Some suggestions for future research conclude the paper.

1.1. Basic terminology

To prepare the groundwork for the subsequent literature review, key terms are defined: “The supply chain encompasses all activities associated with the flow and transformation of goods from raw materials stage (extraction), through to the end user, as well as the associated information flows. Material and information flow both up and down the supply chain. Supply chain management (SCM) is the integration of these activities through improved supply chain relationships to achieve a sustainable competitive advantage” [208]. In line with this definition, but extending to related terms, *purchasing*, *sourcing*, *supply* and *supply chain* were all used for identifying related publications. This is justified as the review in particular wanted to address inter-organisational issues. Hence, papers on purchasing were also included.

Sustainable development is defined as “a development that meets the needs of the present without compromising the ability of future generations to meet their own needs” [225]. While diverse comprehensions of sustainability exist, one central concept helping to operationalize sustainability is the triple bottom line approach, where a minimum performance is to be achieved in the environmental, economic and social dimensions [203]. This can be comprehended as being in line with the notion of order qualifiers a company has to fulfil before it is able to even compete for orders [210]. Still, this is only one particular comprehension of sustainability. Dyllick and Hockerts [202] have framed the three dimensions of sustainability as the business case (economic), the natural case (environmental), and the societal case (social). Related keywords are sustainable/sustainability, sustainable development, environment(al), ecology/ecological, green, social and ethics/ethical. Keywords from the supply chain management side and from the sustainability side were combined for the search.

As it forms the major theme of this paper, we define sustainable supply chain management as the management of material, information and capital flows as well as cooperation among companies along the supply chain while taking goals from all three dimensions of sustainable development, i.e., economic, environmental and social, into account which are derived from customer and stakeholder requirements. In sustainable supply chains, environmental and social criteria need to be fulfilled by the members to

remain within the supply chain, while it is expected that competitiveness would be maintained through meeting customer needs and related economic criteria. This definition is rather wide and combines those given for sustainability and supply chain management. It is also able to integrate green/environmental supply chain management as one part of the wider field.

2. Research methodology

Fink [205] provides the following definition: “A literature review is a systematic, explicit, and reproducible design for identifying, evaluating, and interpreting the existing body of recorded documents”. The analysis of documents pursues the aim of opening up material that does not have to be created on the basis of a data collection by the researcher. Literature reviews usually aim at two objectives: first, they summarize existing research by identifying patterns, themes and issues. Second, this helps to identify the conceptual content of the field [215] and can contribute to theory development (see the related discussion in [209]). One problem derives from the challenge that it is impractical to read everything. Only for emerging or narrowly defined issues might it be possible to provide complete reviews.

From a methodological point of view, literature reviews can be comprehended as content analysis, where quantitative and qualitative aspects are mixed to assess structural (descriptive) as well as content criteria [201]. A process model proposed by Mayring [214] contains four steps:

1. Material collection: The material to be collected is defined and delimited. Furthermore, the unit of analysis (i.e., the single paper) is defined.
2. Descriptive analysis: Formal aspects of the material are assessed, e.g., the number of publications per year, providing the background for subsequent theoretical analysis.
3. Category selection: Structural dimensions and related analytic categories are selected, which are to be applied to the collected material. Structural dimensions form the major topics of analysis, which are constituted by single analytic categories.
4. Material evaluation: The material is analyzed according to the structural dimensions. This should allow identification of relevant issues and interpretation of results.

For the material analysis (steps 3 and 4), Fig. 1 provides a detailed description of the process. While it includes a feedback loop for the analysis of the collected material only, such a loop might be needed for the overall process.

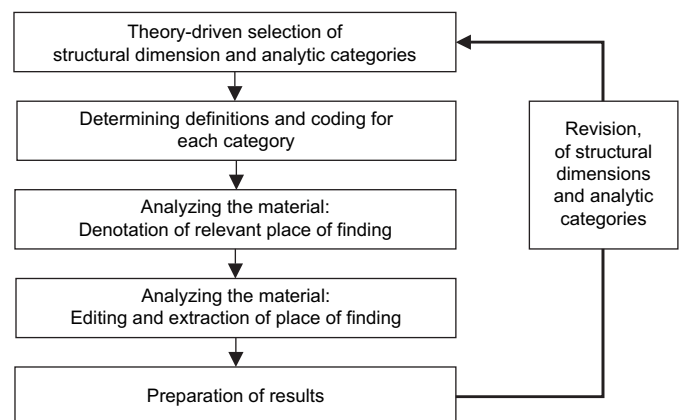


Fig. 1. Research process of a structuring content analysis [213].

Structural dimensions and related analytic categories which allow classification of the reviewed literature can be derived deductively or inductively. In a deductive approach they are selected before the material is analyzed; when using an inductive method, they are developed from the material by means of generalization [214]. In either case, they should have a clear relation to existing theory.

In content analysis the analyst makes various decisions about how the paper is to be comprehended. Such risk can be reduced by involving two or more researchers when searching for and analyzing the data. It might be necessary to redo steps 3 and 4, as the dimensions and underlying categories need to be revised [213]. In the particular approach chosen, we started with a number of dimensions and categories. Papers were classified accordingly, where the dimensions and categories were revised during the early analysis. This method forms the background for the literature review presented in this paper.

2.1. Delimitations and the search for literature

For a literature review it is particularly important to define clear boundaries to delimitate the research. In this context four important notes are made:

1. This analysis aimed only at papers in peer-reviewed scientific journals in English with a management focus. This excludes papers in other languages as well as those with, e.g., a technical or political science focus.
2. Publications with the main topic of public purchasing were not considered. This debate includes vital public law aspects and differs from the discussion of supply (chain) management in companies.
3. Articles which focused only on ethical demands placed on purchasing staff (e.g., acceptance of gifts) were excluded. Respective papers mainly focus on codes of conduct for purchasers, so there is no direct link to sustainable development.
4. Papers focusing on reverse logistics and remanufacturing were not included. In this field the focus of the discussion is on the end of the product life-cycle with an emphasis on reverse logistics and remanufacturing [206,150], while the research presented centres on the forward supply chain.

The search for related publications was mainly conducted as a structured keyword search. Major databases were used to search for related articles, such as those provided by major publishers, Elsevier (www.sciencedirect.com), Emerald (www.emeraldinsight.com), Springer (www.springerlink.com), Wiley (www.wiley.com) or library services (e.g., Ebsco www.ebsco.com; Scopus www.scopus.com, Metapress www.metapress.com, or Subito www.subito-doc.de). After a first quick content check, identified articles were in- or excluded from the analysis. To increase the reliability of the research, databanks and journals as well as the individual papers were checked by a second researcher. Reading the papers, cited references were used as a secondary source, but did not yield many additional papers, which can be taken as an indication of the validity of the research. Taking the stated delimitations into account, a total of 191 papers were identified.

2.2. Content analysis

In a first step of the evaluation, descriptive dimensions were used to classify the papers. The content of the papers was further assessed by means of a descriptive analysis: (1) how is the distribution of publications across the time period? (2) In which journals are such articles published? (3) What research methodologies are applied? (4) Which dimensions of sustainability are addressed? For

these classifications, each paper was assigned to exactly one category. The selection of these categories is rather straight forward, as such descriptions are “normal” for literature reviews. These dimensions will be used for the subsequent analysis.

We will give a brief example on how we conducted the process, taking Bowen et al. [14] as an example. This paper presents a survey, so it clearly falls into the category regarding the research methodology. As it does not cover social issues, it is placed into the environmental category regarding sustainability. Further, it talks about competitive advantage as a trigger for sustainable supply chain management, and mentions, e.g., company-overlapping communication and training of purchasing staff as supporting factors, where additional coordination needed with suppliers is seen as a barrier. For the subsequent discussion, we will first present a (qualitative) conceptualization of the field and then supplement some topics with a more detailed (quantitative) analysis.

2.3. Rigor of the research process

The research process and related methodology also have their limitations. The structured process and systematic approach ensures the objectivity of the research process. Validity was aimed for by following the guidelines [212]. Constructs were compared to other research both from within as well as from outside of the particular field. As already briefly mentioned, a further means to ensure validity was presenting this research work at various conferences, so that other researchers and practitioners could comment on it.

Reliability was addressed by having all steps of the formal analysis conducted by two researchers. This is the minimum requirement, but given the time consuming process, it is somehow unrealistic to include more than this. While inter-rater reliability was quite high (which can be attributed to the fact that the two investigators have been cooperating for years), different judgments were individually accessed and resolved.

3. Descriptive analysis

3.1. Distribution across the time period and main journals

The basic body of literature identified comprises 191 papers. The allocation of the publications in the researched period (1994–2007) is shown in Fig. 2. While 1990 is the first year of publication where works were sought, the first published papers found were from the year 1994. The start of the time period covered was chosen allowing the Brundtland-Report [225] to be taken as a starting point. High numbers of publications are found for the time period between 2001 and 2003, but remain on a substantial level since. In 2001

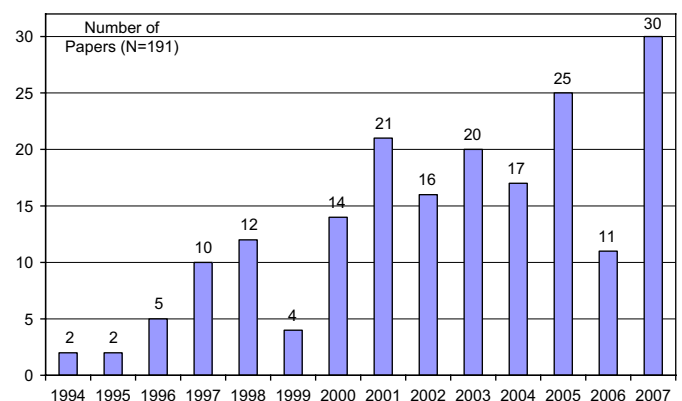


Fig. 2. Distribution of publications per year across the period studied.

[136] and in 2003 [228], special issues of *Greener Management International* containing seven articles each were published. It is interesting to note that recently a number of other special issues have appeared or are in print, also capturing more traditional operations management journals, such as: *Journal of Operations Management* [211], *International Journal of Production Research* [219], *International Journal of Production Economics* [218], and *Journal of Cleaner Production* [223]. This shows the wide acceptance of the topic among research, where the two special issues appearing in 2007 explain the record number of publications in this year. Still, it should be noted that many of the papers published in these special issues focus on closed-loop supply chain management and related issues and are, therefore, not taken into account in this review (see the note on this above).

There is an equal distribution among environmental and sustainability management related journals (81 papers), and traditional operations and supply chain management journals capture (surprisingly) almost the same number (83 papers), while journals dealing with social and ethical topics remain (11 papers) in the minority. There is a final group of 16 papers published in journals which are mainly of a technical nature, but also contain natural resource or policy related ones. Most were published in the *Journal of Business Ethics* (six papers) and *Business Ethics: A European Review* (four papers). The environmental literature has three journals offering most of the papers. The leading role is now held by the *Journal of Cleaner Production* with 23 papers, followed *Greener Management International* accounts for 22 papers, mainly due to the two special issues already mentioned. *Business Strategy and the Environment* (13 papers) holds the third place. Hence, these three journals capture almost three quarters (59 out of 81) of the papers published in environmental and sustainability related journals.

Within the operations literature, a greater number of journals provide publication outlets: *International Journal of Operations & Production Management* (10), *Supply Chain Management – An International Journal* (10), *Journal of Operations Management* (7), *Production and Operations Management* (6), *International Journal of Production Research* (5), and *The Journal of Supply Chain Management* (formerly *International Journal of Purchasing and Materials Management*) (5) indicating a distribution across a wider range of journals.

3.2. Research methodologies applied

Five research methodologies were differentiated: (1) theoretical and conceptual papers; (2) case studies; (3) surveys; (4) modelling papers; and (5) literature reviews. Fig. 3 shows the assignments of the papers to the research methodologies.

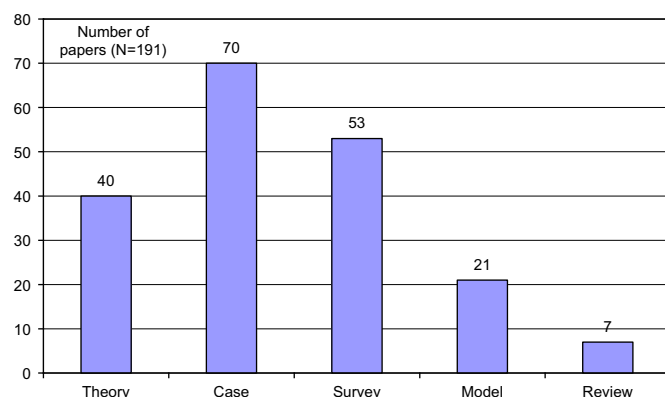


Fig. 3. Research methodologies employed.

In order to make our classification of papers transparent to the reader, for each analyzed paper listed in the bibliography the categorisation according to the research methodology, and treatment of sustainability issues is provided at the end of the references given. As example given, [case, social] summarizes that the paper deals predominantly with social issues and offers a case study or case example.

Forty papers do not present empirical research, and instead are of a rather theoretical or conceptual nature. For a new, unexplored field, this is not surprising, and continues into the large portion of case study papers (70). This method allows the field to be researched and provides illustrative evidence [229]. Several papers classified as case studies are often rather case *examples*, where descriptions of an industry practice are given without aiming at theory development or testing. Still, we did not assess the methodological rigor of the papers, so this neither disqualifies the case papers nor assumes that the papers placed in the other categories are somehow “better.” Surveys account for 53 of the paper, while 21 mathematical models and finally seven literature reviews (see their summary in the introduction) have been published.

3.3. Dimensions of sustainable development

The articles were differentiated into three categories in relation to sustainable development. It should first be mentioned that the economic dimension was assumed as being covered by all papers, as only management related publications and journals form part of the assessment. Hence, three categories were formed, i.e., does the content address (1) environmental or (2) social issues, or (3) have both dimensions (environmental and social) been considered? Papers falling into the last category were classified as sustainable. Table 1 shows the results of this differentiation, while Table 2 additionally shows the distribution across the time period studied. Most of the articles (140) deal with environmental problems. This can be explained, as related issues have been on the agenda for a longer period of time. The high number of papers in 2001 is explained by a journal special issue of *Greener Management International*, which particularly looked at green topics.

Still, it should be mentioned that the first paper included in the literature review by Drumwright (1994) [49] deals with social issues. Only 20 papers focused on the social dimension, and a further 31 papers were classified as sustainable, as they integrate environmental and social issues. For the sustainable ones, it is interesting that this integration only appears about 2002, from which year on a considerable number of papers is published. Figures on social aspect are more erratic in publication numbers. There are five each in 2002 and 2003, which account for half of all related papers. Carter and co-authors [17–23] account for seven of the papers on the social aspects. New (1997) [120], Kärnä and Heiskanen (1998) [86] and Sarkis (2001) [136] are the first papers to integrate all three dimensions.

This reveals a clear deficit in supply chain management and purchasing literature on social issues as well as on the amalgamation of all three dimensions of sustainable development. Future research on these topics would be one of the clear recommendations towards researchers in the field. The relatively high number of eight paper incorporating sustainability issues might point into this direction [15,47,95,99,103,119,154,179].

Table 1
Dimensions of sustainable development addressed in the papers

| Dimension(s) | Number of papers (N = 191) |
|---------------|----------------------------|
| Environmental | 140 |
| Social | 20 |
| Sustainable | 31 |

Table 2

Distribution of the papers according to the three dimensions of sustainability and time

| | Environmental (140) | Social (20) | Sustainable (31) |
|------|---------------------|-------------|------------------|
| 1994 | 1 | 1 | |
| 1995 | 3 | | |
| 1996 | 5 | | |
| 1997 | 8 | 1 | 1 |
| 1998 | 10 | 1 | 1 |
| 1999 | 4 | | |
| 2000 | 11 | 3 | |
| 2001 | 20 | | 1 |
| 2002 | 7 | 5 | 4 |
| 2003 | 10 | 5 | 5 |
| 2004 | 12 | 2 | 3 |
| 2005 | 19 | 2 | 4 |
| 2006 | 8 | | 4 |
| 2007 | 22 | | 8 |

4. Towards a conceptual framework

The overall starting point was mentioned in Section 1 of this paper. Both sustainability management and supply chain management form the background against which the review is conducted. Now, we are aiming to conceptualize the field, which can be seen as a first step towards theory building [226]. Meredith [215] calls this a philosophical conceptualization, which here is based on reading the papers over and over again. Further, earlier versions of the literature review and some aspects of the conceptualization were presented at conferences and, therefore, discussed with a large number of researchers in the field. The framework will be presented in three parts, which are called:

- Triggers for sustainable supply chain management,
- supplier management for risks and performance, and
- supply chain management for sustainable products.

4.1. Triggers for sustainable supply chain management

As an initial step, the triggers for the field and related action are identified. This is presented in Fig. 4, which will be outlined in full before detailed aspects are subsequently discussed. Kleindorfer et al. [91] propose a similar figure, although they argue more on the individual elements constituting it. There is no equivalent to the further two parts of the framework presented here.

The starting points are external pressure and incentives set by different groups. While stakeholders form the widest possible description, two groups are of particular relevance. On the one hand, customers are of great importance, as operating the supply

chain is only justified if the products and services are finally “accepted” by customers. On the other hand, all modes of governmental control, be it from local municipalities, national or multi-national governments, are of great relevance. An early paper pointing towards this normative level is New [120]. He “advocates an expanded scope for supply chain management research which accounts for the social function and the political and economic implications of supply chain developments”. Cramer [40] proposes an approach which “monitors new developments and trends in the environmental debate and changes in pressure exerted by external stakeholders”. Roberts [134] emphasizes that action from NGOs, which hold focal companies responsible for environmental and social problems at earlier stages of their supply chain, can lead to a reputation loss for the focal company. The following criteria are frequently listed: legal demands/regulation, response to stakeholders, competitive advantage, customer demands, reputation loss, and environmental and social pressure groups (see e.g. [13,75,127,130,134,136,185,174,165,99,186]).

When the focal company is pressured, it usually passes this pressure on to suppliers. Here, one distinctive feature of sustainable supply chain management emerges. Looking at the overall supply chain (or life-cycle) of the product, the focal company quite often has to take a longer part of the supply chain into account than needed for “pure” economic reasons (see e.g. [75,93,141,128]). Related to this, barriers and supporting factors are mentioned, which support or hinder the cooperation with suppliers (see e.g. [98,26,14,22,68]). This holds true for having information on the environmental and social performance at the single production stages, as well as on improving the performance of main suppliers.

Based on these factors, a range of strategies can be identified regarding how companies deal with such issues. To put it more simply, two different strategies can be used to summarize them. Bowen et al. [14] distinguish between “greening the supply process” and “product based green supply” (see also [75]). Building on this, the two strategies are labelled as “supplier management for risks and performance” and “supply chain management for sustainable products”. While upon first glance these strategies seem to oppose each other, they nevertheless complement each other, as will also be outlined in Sections 4.2 and 4.3. Before this, a closer (quantitative) look is taken at pressure and incentives.

In Table 3 the barrier and incentive categories are listed according to the number of papers that refer to them, and where several or all categories could have been addressed. Legal demands (99 entries) are the most frequently mentioned, closely followed by response to stakeholders (90), where environmental and social pressure groups (38) form a subgroup. Interesting is the high level of competitive advantage (96) and the low level of reputation loss (30). This is in line with other studies, e.g., on the implementation of environmental management systems, which is often not due to the direct demand enforced by a legal act, but instead because the companies aim to reduce related risks (see e.g. [109,38,131,95]). This, however, might partly be due to the dominance of case related papers where “success stories” are presented. Similarly, in a survey, desired behavior might be reported, but not actually displayed. Several publications call pressure groups a “central trigger,” but

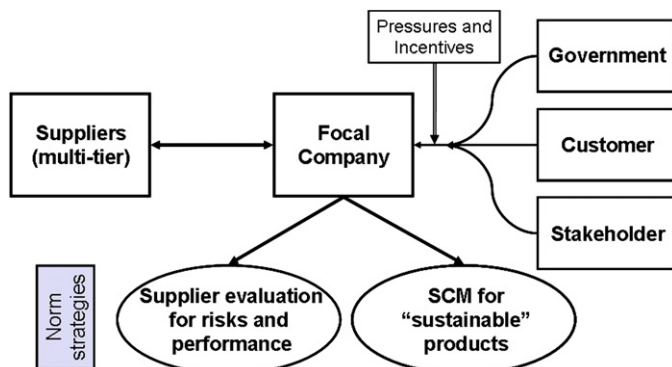


Fig. 4. Triggers for sustainable supply chain management.

Table 3

Pressures and incentives for sustainability in supply chains

| Pressures and incentives | Number of papers (N = 191) |
|--|----------------------------|
| Legal demands/regulation | 99 |
| Customer demands | 96 |
| Response to stakeholders | 90 |
| Competitive advantage | 71 |
| Environmental and social pressure groups | 38 |
| Reputation loss | 30 |

companies might more often fear that (private) customers would boycott their products if environmental or social problems in their supply chain were reported. This would also lead to a loss in reputation.

There is a second aspect of customer demands: Focal companies increasingly ask their suppliers to perform according to the guidelines set by environmental and social standards, which might be documented by implementing related management systems for environmental (e.g., ISO 14001) and social (SA 8000) issues. Using the example of ISO 14001, Corbett and Kirsch [36] provide evidence that this is an important model for the spread of such management systems. In some industries, such as the textile and apparel industry, they are increasingly implemented [64,102]. The brief example shows how much the mentioned issues are interrelated, so boundaries between them are often hard to ascertain.

4.2. Supplier management for risks and performance

While the previous dimension looks more at the factors that are external to the supply chain, there is also the internal perspective. To achieve set goals, it is important to know which factors act as barriers and which ones support such developments (see Tables 4 and 5). Three aspects were frequently mentioned as barriers for implementing sustainable supply chains: (1) higher costs, (2) coordination effort and complexity, and (3) insufficient or missing communication in the supply chain. It is interesting to note that the supporting factors clearly relate to this, as communication is again mentioned, while monitoring, evaluation, reporting and sanctions are the ones most often alluded to (see e.g. [26,38,75,124,129,136,141,82]). This causes higher costs, although joint efforts of all supply chain partners can help to control costs (see e.g. [140,61]).

Management systems play an important role in this regard, and can be related to the minimum performance required. They mainly centre on environmental management systems, namely ISO 14001 [36,37,28]. Socially related approaches, such as SA 8000 (Social Accountability 8000, see [64,37]) or codes of conduct [42,43] have not come to the forefront so far. This corresponds to the result that social aspects in the discussion are much less developed than environmental ones. The second category is also in line with this, as monitoring, evaluation, reporting, and implementation of enforcing sanctions (that can include the delisting of suppliers) is the second most often pointed out category. Company-overlapping communication and training of purchasing staff and supplier staff are more proactive measures which should allow an improvement in the supply relations as well as performance on both sides. Surprisingly, the integration of related goals into corporate policy receives much less attention. In some cases, extending goals for purchasing staff to environmental and social issues are seen as a valid measure, as these are usually evaluated and paid on the basis of hard, economic figures only. Following this discussion on triggers, we will discuss the two strategies in greater detail.

Increased global development and competition have pushed many industries to operate on a much more global level. Together with increased outsourcing, the number of companies involved in a typical supply chain has greatly increased. As a response to the above-mentioned pressures and incentives, a number of companies

Table 5

Supporting factors for sustainable supply chain management

| Supporting factors | Number of papers (N = 191) |
|--|-------------------------------|
| Company-overlapping communication | 89 |
| Management systems (e.g., ISO 14001, SA 8000) | 69 |
| Monitoring, evaluation, reporting, sanctions | 68 |
| Training education of purchasing employees and suppliers | 40 |
| Integration into the corporate policy | 38 |

have introduced supplier evaluation schemes which integrate environmental and social criteria [158,95,200]. Related measures include supplier self evaluation [158] where suppliers have to declare how they deal with environmental and social issues. An important means for implementing this are environmental and social standards which set minimum requirements. This often captures a kind of double aim: the first objective is to avoid related risk, which can be related to all three dimensions of sustainability [108,38,156]. Risks can derive from environmental or social performance, but also from disruptions of operational processes as discussed in “conventional” supply chain risk management [217].

The second one is to improve the overall supply chain performance, where frequently the focus is on the relation between environmental and economic performance [66,89,131,185,76,162,161,179]. Often, a positive correlation between these two dimensions is observed, although this might be a bit too simple: currently, long term studies are not yet available, and the social dimension has been rarely addressed. Thereby, a second distinctive feature of sustainable supply chains can be identified. Performance has been mentioned in the context of the “usual” operations objectives such as quality, speed, dependability, flexibility and cost [227]. Additionally, the quest for reaching the performance frontier [221] has to include the environmental and social dimension as well (also [91]), taking the trade-off debate to a further, broader level.

Further insights are offered on how these dimensions relate to each other. This is assessed via the goal relations. Three categories were formed in this dimension, which are not mutually exclusive, so a paper can address more than one of these categories (see Table 6): 124 papers, and thereby the majority, point at win-win-(win-) situation(s), which are frequently observed in environmental and sustainability management literature. Newton and Harte [216] have criticized much of the related publications for pointing out only the “easy wins,” and feel that these should not be mistaken as long term results. Still, trade-offs between the three dimensions are brought up 72 times.

A third category was identified in this dimension. In 37 papers, the environmental and social performances were seen as the pre-requisites for suppliers that allowed them to provide materials or service(s) to operate as part of the supply chain. From the focal company's perspective, this implies that environmental and social criteria for supplier evaluation guarantee that the supplier acts according to set standards [98,110,38,143]. Therefore, they can be comprehended as order qualifiers [210], while orders are won based on economic performance, i.e., the third dimension of sustainability.

Building on the issue mentioned in the previous sections, related standards both for management systems (i.e., ISO 14000, SA

Table 4

Barriers for sustainable supply chain management

| Barriers | Number of papers (N = 191) |
|--|----------------------------|
| Higher costs | 59 |
| Coordination complexity/effort | 48 |
| Insufficient/missing communication in the supply chain | 29 |

Table 6

Goal relations

| Goal relation | Number of papers (N = 191) |
|---------------------|----------------------------|
| Win-win-situations | 124 |
| Trade-offs | 72 |
| Minimum performance | 37 |

8000, codes of conducts), which suppliers have to implement upon focal company/customer request, or specific products (e.g., coffee: [10,37,42]) play a central role. In one recently published example, Mamic [102] collected data from 22 multi-national companies and 74 of their suppliers to gain insights how such standards (i.e., codes of conduct) are implemented in the footwear, apparel and retail industry. Relating this to the idea of greening the supply process [14], comprehensive supplier audits are required [110,64,129,102, 185]. This might even trigger further partnering where joint process improvements are conducted [75].

4.3. Supply chain management for sustainable products

The second strategy is labelled as “supply chain management for sustainable products”. *Sustainable products* is the term used to comprehend all kinds of products that have or aim at an improved environmental and social quality, which can be related back to the already mentioned implementation of environmental and social standards. The ultimate aim is to satisfy customers and gain a competitive advantage in the market [106,14,63,96,131].

For specifying product related requirements, life-cycle assessment is the method to be relied on most often [98,29,124,53,70,107]. In a line of research paralleling sustainable supply chain management, this has led to the establishment of life-cycle management [142]. Again, the focal company is in charge of addressing this and requesting it from suppliers, but joint initiatives would help to implement this product based green supply ([13]; also [75]).

In line with this, the cooperation with suppliers increases in importance. This does not just extend to first-tier suppliers, who are often the focus of conventional supply chain management [207]. In supply chain management for “sustainable” products, ensuring the quality of the product and the performance of the operational process might be as much of an issue as building partnerships for new product introductions, so the complete supply chain from raw materials to final customers has to be integrated [106,140,93,63,141,128].

Criteria for improvement do not only relate to the final products. Environmental criteria, e.g., being free of contaminants, can be tested. This is possible neither for the processing technologies applied which might cause environmental harm, nor for social impacts such as child labor that occur. This links the issue back to the use of environmental and social standards, and extends beyond this. As several cases report, supplier developments were required before focal companies were even able to offer “sustainable” products to their customers. Several authors report that textile and apparel producers/retailers had to make sure they had an organic cotton supplier before they were able to offer such products [30,106,93,63]. This triggered considerable investments at partner locations to develop this supply structure and to help improve their production facilities and processes, and was required before they could meet the set environmental standards for the production processes as well as the final product. What is implied is that suppliers are trained and their overall performance is improved even though the focal company usually buys less than 10% of the total output [172,79,128]. King and Lenox [89] characterize these as “lean and green” suppliers (also [144]). This demands much “deeper” information flows along the supply chain, where suppliers have to gain detailed insights into the subsequent stages of the life-cycle and supply chain as a way to comprehend why such improvements are required [124]. DeBakker and Nijhof [44] offer a framework on how internal (i.e., inside the focal company) as well as external (i.e., along the supply chain) capabilities have to be developed to reach such goals. Overall, there seems to be a need for cooperation among a wider range of companies along the supply chain than is usually discussed in conventional supply chain management literature. This has established a third specific feature

of sustainable supply chains: Handfield et al. [74] outline how related strategies might be formulated and implemented along the supply chain.

4.4. Complementing issues among the two strategies

As already mentioned in the previous sections, the two strategies are not mutually exclusive. While they emerge as two different, distinguishable approaches, their relation to each other might be called ambivalent, thereby opposing but also supporting each other at the same time. In the above-mentioned example of organic cotton production, some of the companies aimed for environmentally improved and socially sound products. When they started to offer them in their product line, they experienced the need to monitor the environmental and social performance of the suppliers [74]. Conversely, companies starting with supplier development initiatives for risk minimization [110,38,102] might then see opportunities for further win-win-win situations, and look at product performance as well.

5. Discussion

5.1. Distinctive features of sustainable supply chain management

This concluding section will point out some of the most important findings of the research and point out some directions for future research. The major contribution of this paper is to provide a comprehensive review of peer-reviewed journal publication on sustainable supply chain management. In our view three major topics need to be emphasized in this respect.

- Sustainable supply chain management has to take into account a wider range of issues and, therefore, look at a longer part of the supply chain.

This statement emerges as one of the most distinctive features of sustainable supply chain management, which also requires a different approach in conducting empirical research. Several case studies have collected data from several or even all stages of the supply chain [140,37,93] which, although rarely done in conventional supply chain management literature, has been identified as an urgent need in research on supply chain management [222]. This might also trigger consequences for supply chain management on a wider scale. When avoiding the risks associated with sourcing in global supply chain, focal companies might find themselves in a situation, where the must spend more attention on the sourcing of minor components. Here, the intersection among sustainable supply chain management with risk management starts to emerge. So far only two papers [38,156] carry the word risk in their title. Yet, this imposes a major challenge as it would ask for a major effort in purchasing transactions for minor products. This might return to the argument about the value of standards for reducing related transactions costs.

- Sustainable supply chain management deals with a wider set of performance objectives, thereby taking into account the environmental and social dimension of sustainability.

One implication of sustainability for companies and, therefore, for supply chains is the wider set of criteria that have to be met, often called the *triple bottom line approach* [203,91]. Environmental and social issues are increasingly on the public agenda, which provides triggers as well as opportunities to include them in managing the supply chain. The debate on the interrelation of the three dimensions has continued for some time for single companies [216,224], although the implications for supply chain management have not been fully explored. As mentioned already, several surveys

report a positive correlation for environmental and economic performance [185,131,163]. Still, the underlying question offers a major avenue for future research. Again, the interrelation with more traditional supply chain performance management proposes a full range of research issues.

- There is a much increased need for cooperation among partnering companies in sustainable supply chain management.

While supply chain integration can be considered a hot topic, much of the academic discussion as well as findings from empirical research point towards the limited integration that can be observed [207,204]. Several case studies have outlined how far the co-operation has to reach and how much effort focal companies have to invest before they can make the supply chains operational. Linking this back to the performance issue, this imposes the question, how companies might use supply chain integration to reach a sustainable performance?

These three distinctive features together place sustainable supply chain management well within the overall area of research, and offer evidence on which additional issues have to be addressed. This might also feedback into conventional supply chain literature.

5.2. Shortcomings of existing research

As a second issue, the limitations of present research are addressed. Here, two major points are highlighted.

- Sustainable development is often reduced to environmental improvements.

The comprehension of sustainable development is often rather simplistic. Mostly the Brundtland definition cited above [225] is referred to. It is, however, not discussed whether a more technical, positivist comprehension or a social science-based approach is taken, i.e., where sustainability is comprehended as a regulative idea. Consequently, the understanding of sustainable development is fragmented and mostly one-dimensional, i.e., environmentally based. An integrated perspective is required for future research where social issues in particular and the interrelation of the three dimensions need to be investigated much further.

- A theoretical background is often missing.

From a general perspective, there is a deficit in the take-up of theoretical background, both from within supply chain or operations management, as well as from a wider perspective, such as new institutional economics or strategic management. This conclusion is mainly derived from working with the material for a considerable time. Future research should take this into account.

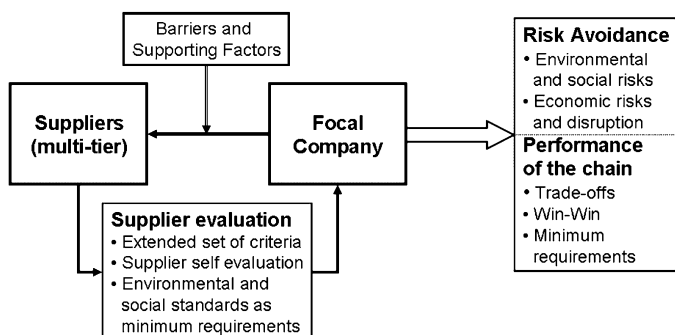


Fig. 5. Supplier management for risks and performance.

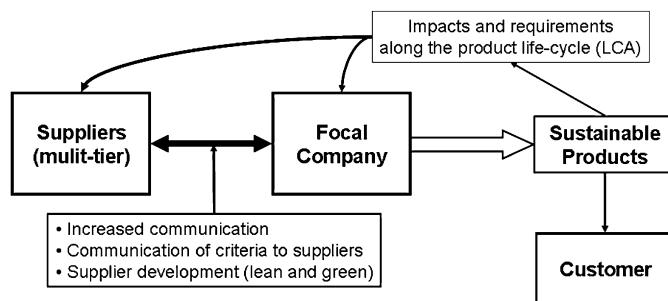


Fig. 6. Supply chain management for "sustainable" products.

In particular, empirical research, as carried out in case studies and surveys, needs to build on a stronger theoretical basis. Yet, this should also be seen as an opportunity to develop theory. The framework presented in this paper is one such step towards theorizing [226].

Two thoughts should be taken into account. First, related developments also continue in traditional supply chain management. Second, academic papers have to say what they are trying to say within a certain word count, so authors might often choose to focus on empirical findings which are unique to their research rather than those relating to well-known theories.

6. Conclusion

This study has taken a broad look at sustainable supply chain management and the issues emerging in this field. It offers a conceptualization (embedded in Figs. 4–6) based on a literature review. Frequently, external triggers are put forward which are placed on focal companies by governing agencies, customers and stakeholders. Such pressure as well as incentives might lead to action by focal companies. In their relation to suppliers, several barriers and incentives are observable which hinder or further sustainable supply chain management. Based on these triggers, two strategies are identified. The first one is labelled as "supplier management for risks and performance". One major fear of companies following such a strategy is a loss of reputation if related problems are raised. Hence, additional environmental and social criteria are taken up to complement economically based supplier evaluation. Environmental and social standards play a central role in enabling this.

The second strategy is called "supply chain management for sustainable products". This usually demands the definition of life-cycle based standards for the environmental and social performance of products, which are then implemented throughout the supply chain. As mentioned already, several measures have been taken to ensure the quality of research conducted. However, in conceptual research, the knowledge, experience, and mindset of the researcher or research group have a strong impact on the results.

Future work might improve this framework by taking a closer look at particular sub-bodies of publications, i.e., from a research methodology perspective. This might allow specific features to be identified in greater detail.

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¹ The references for this paper are given in two parts: nos. [1] to [191] present the papers contained in the literature review. To make it easier to distinguish referenced papers not contained in the review, they are listed from [200] onwards.

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