

Sustainability **2010**, *2*, 859-870; doi:10.3390/su2040859

OPEN ACCESS

sustainability

ISSN 2071-1050

www.mdpi.com/journal/sustainability

Article

Supply Chain Management and Sustainability: Procrastinating Integration in Mainstream Research

Marisa P. de Brito ^{1,2,*} and Erwin A. van der Laan ³

¹ Delft University of Technology, Postbus 5015, 2628 GA, Delft, The Netherlands

² Afl-NHTV University of Applied Sciences, Postbus 3917, 4800 DX Breda, The Netherlands

³ Rotterdam School of Management, Erasmus University, P.O. Box 1738, 3000DR, Rotterdam, The Netherlands; E-Mail: elaan@rsm.nl

* Author to whom correspondence should be addressed; E-Mail: m.p.debrito@tudelft.nl;
Tel.: +31-15-278-7135; Fax: +31-15-278-3450.

Received: 10 January 2010; in revised form: 2 February 2010 / Accepted: 25 February 2010 /

Published: 25 March 2010

Abstract: Research has pointed out opportunities and research agendas to integrate sustainability issues with supply chain and operations management. However, we find that it is still not mainstream practice to systematically take a sustainability approach in tackling supply chain and operations management issues. In this paper, we make use of behavioral theory to explain the current lack of integration. We conclude through abductive reasoning that the reasons for procrastinating integration of sustainability in supply chain and operations management research are the conflicting nature of the task and the inherent context, which is the focus on operations rather than environmental or social issues.

Keywords: abductive reasoning; supply chain management; sustainability; procrastination; behavioral theory

1. Introduction

There is an increasing awareness of the need for sustainable development in academia and business (see e.g., [1]). Nowadays, top global companies, such as Exxon Mobil, General Electric, Royal

Dutch/Shell, Daimler Chrysler, Toyota Motor, Hitachi, Sony, *etc.*, put headings like ‘Sustainability and Environment’, ‘Environmental Initiatives’, ‘Environmental Activities’, or ‘Environmental Leadership’ on the front pages of their websites. Already for more than ten years, papers in the scientific literature have recognized the importance of explicitly addressing sustainability issues in supply chain and operations management (see [2-6]). Yet, there appears to be a lack of systematic integration of the environmental and/or social component of sustainability in addressing supply chain and operations management (SCM&OM) issues. For instance, [7] show that in absolute terms, the number of papers that mention the concept of sustainability in the management literature as a whole increased explosively between 1996 and 2005. However, as a percentage of total publications, these still form a tiny minority. Although the increase in relative contribution is encouraging, we show in this paper that it cannot validate the claim that the integration of sustainability in management is routinely done, or that it is in any way a mainstream practice.

Although many definitions of sustainability are put forward in the literature, here we adopt the definition of [8], who define sustainable supply chain management as ‘...the strategic, transparent integration and achievement of an organization’s social, environmental, and economic goals in the systemic coordination of key inter-organizational business processes for improving the long-term economic performance of the individual company and its supply chains’. As we will explore in Section 2, there certainly are some important lines of research dealing with the integration of environmental and/or social issues. However, articles dealing with both environmental *and* social issues are very scarce and integration of sustainability issues in mainstream research has not yet happened. We use abductive reasoning (Section 3) as our methodology to identify the reasons for this lack of integration (Section 4). Finally, Section 5 discusses possible paths of transition toward effective integration.

2. Sustainability and the Status of Supply Chain Management (SCM) Research

2.1. Recognition of the Importance of Sustainability

Academics, practitioners and policy makers agree that it is a priority to understand the impact of human activities on the environment. Thus, it is important to do so also within the scope of SCM&OM, because manufacturing and distribution make up a large portion of human activity, and there is a big margin for improvement (see [3,9]). Furthermore, integrating sustainability with more traditional targets can add value to businesses and offer a competitive edge (see [10-12]), and cases that combine outstanding economic and environmental performance have been reported in the context of product recovery (see [13,14]).

A recent study [7] found that ‘consideration to the concept of sustainability is increasingly found in the management literature’, by counting the appearance of the keywords ‘sustainability’ and ‘sustainable development’ in economics, business and management articles between 1990 and 2005. In that period, the frequency of appearance increased five-fold from 3 per 1,000 to 15 per 1,000 articles, with the growth really starting from 1996 onwards. We may conclude that the perceived importance of sustainability issues has increased considerably since 1995.

2.2. *Towards Integrating Sustainability Issues with Supply Chain and Operations Management*

Facing the lack of integration, researchers in the late 90s called repeatedly for holistic approaches, launching a debate about the operations management research agenda [5]. For example, [6] carried out an extensive review of research on environmentally conscious manufacturing and product recovery and concluded there was ‘a lack of ... research and a lot of work’ to be done. In addition, [15] insisted that research should move beyond the partial contribution of reverse logistics so that the ‘ecologic footprint of supply chains’ really could be reduced. At the same time, research on reverse logistics and closed-loop supply chains intensified, with more articles showing and exemplifying the added value of recovery (see e.g., [14,16,17]).

SCM&OM researchers also established guidelines to address sustainability in a more complete way. For instance, [18] developed an environmental supply chain framework where environmental performance measures were added to the more traditional supply chain targets. In the same year, [19] put forward a research agenda outlining how to integrate environmental issues into mainstream operations management research, based on an expert focus group. In [1], a framework is proposed tying together logistics social responsibility issues, drivers, barriers, moderators, and consequences. Their work is based on the review of literature and 26 semi-structured interviews with supply chain managers. More recently, [8] reviewed how sustainability issues have been dealt with in the supply chain context, and put forward a framework in the form of propositions based on resource dependence theory, transaction cost economics, population ecology, and the resource-based view of the firm. Moreover, several special issues [7,20-22] and monographs [23-26] have been published on sustainability related issues in supply chain and operations management.

2.3. *Tools and Methods for Analysis*

Today, the literature documents a kaleidoscope of tools, methodologies and frameworks for sustainability analysis. These include tools to aid decision as the analytical hierarchy process with environmental indicators [27], system dynamics to incorporate sustainable principles in the operations’ strategy of companies [28], the ‘The Natural Step’ framework to create a vision of how companies can pursue sustainability while satisfying customer needs [29], industrial symbiosis as an alternative to classic supply-chain thinking [30], Environmental Management Systems as a tool to manage the environmental goals and performance [31,32], contingency planning for closed-loop supply chains [33], the more standard operations research tools (see e.g., [24,25]), and other well-known quantitative and qualitative methodologies such as surveys (see e.g., [34]) and case study research [26]. There are also other tools, developed in other fields of research that can be adapted to the operations management field, such as environmental or social life cycle assessment (see [35-37]), ecological foot prints [38] and material flow analysis (see e.g., [39]).

2.4. *Lack of Holistic Integration of Sustainability with SCM*

We would expect that the integration of sustainability and supply chain management research would already have taken place, since

1. the importance of sustainability has been recognized in the literature of SCM&OM for more than a decade (see Section 2.1),
2. guidelines and research frameworks to integrate sustainability issues with SCM&OM have been established (see Section 2.2), and
3. there are multiple tools for analysis (see Section 2.3).

Yet, in a recent survey [40] of about 30 refereed international academic journals, the authors showed that the ties between environment and SCM&OM research is still not as strong as desired. The main exceptions are on either greening the supply chain or reverse logistics and closed-loop supply chain management. The conclusion was clear: the research on the impact of SCM&OM on the environment is tiny when compared to other topics, let alone sustainability as a whole.

This is also illustrated by [7], who show that the appearance frequency of the terms ‘sustainability’ and ‘sustainable development’ rose five-fold in the period 1990–2005 to 15 per 1,000 articles (1.5%). Therefore, although the steep increase is encouraging, still 98.5% of the articles tackling issues in economics and business management do not refer to sustainability. In order to validate whether this also holds for research in SCM&OM in particular, we did a similar study for articles that appeared in ‘Journal of Manufacturing’ one of the most prestigious journals on operations management, and ‘Supply Chain Management’, one of the few journals that specializes in SCM research. Note that we considerably extended the number of keywords beyond those used by [7]. We also extended the search period in the sense that we look at all registered papers up to and including 2008.

Table 1 (Journal of Operations Management) corresponds to 17 unique references in 12 years time (note that one article can refer to multiple key words). There does not seem to be an observable trend, probably due to the low numbers. The frequency of articles is relatively large in the period 2004–2008 due to the 2007 special issue on ‘Supply Chain Management in a Sustainable Environment’. Table 2 (Supply Chain Management) corresponds to 24 unique references. Also here there does not seem to be an observable trend. It appears that in both journals sustainability issues have increased since 1996, but the frequency of relevant articles is tiny compared to the total number of articles published during 1997–2008. This strongly coincides with the results of [7]. Furthermore, recent work [41] finds that of the studied 197 SCM articles that do deal with sustainability, the great majority focuses on environmental sustainability only, while ‘Social aspects and also the integration of the three dimensions of sustainability are still rare’. We therefore conclude that in the operations and supply chain management literature there has been no integration of sustainability issues in mainstream research.

Table 1. Number of sustainability related articles in Journal of Operations Management (...–2008).

Keywords	...–1996	1997–2000	2001–2004	2004–2008
Sustainability	–	–	–	2
Environmental Issues	–	5	–	2
Environmental Management	–	2	1	3
Closed-Loop Supply Chain Management	–	–	1	3
Green Supply Chain Management	–	–	1	–
Corporate Social Responsibility	–	1	–	–
Total	–	8	3	10

Table 2. Number of sustainability related articles in Supply Chain Management (...–2008).

Keywords	...–1996	1997–2000	2001–2004	2004–2008
Sustainability	–	1	–	2
Environmental Issues	–	–	2	–
Environmental Management	–	2	1	3
Closed-Loop Supply Chain Management	–	–	–	1
Green Supply Chain Management	–	1	0	2
Sustainable Supply Chain Management	–	0	0	2
Corporate Social Responsibility	–	–	1	1
Sustainable Development	–	3	0	0
Total	–	7	4	11

3. Abductive Reasoning and Behavioral Theory

In the previous section we put forward evidence of the lack of integration of sustainability in the SCM&OM literature. In spite of many valuable contributions (established relevance, the existence of guidelines and tools), sustainable supply chain management research is not yet mainstream. Next we investigate possible reasons for this lack of integration. To do so, we have to pursue possible ways of explaining the evidence and for that we employ abductive reasoning and behavioral theory.

3.1. Abductive Reasoning

Though abductive reasoning is a rather novel form of reasoning in SCM&OM research (when compared with deductive or inductive reasoning), abductive reasoning can be traced back to Aristotle (see [42]). Abductive reasoning involves pursuing a variety of potential reasons to explain the evidence (by matching it with additional theory—in this case we will use behavioral theory). In the end, some reasons will be more compelling than others, *i.e.*, some reasons will ‘abduct’ others.

Most readers are familiar with inductive (from observations to theory) or deductive (testing theory from pre-determined hypothesis) research. Avoiding unnecessary philosophical discussions, which are outside the scope of this paper, we highlight the differences between those two approaches and abductive reasoning. In [43], three distinguishing dimensions are proposed: departing point, aim, and the way conclusions are drawn. Table 3 characterizes these for each of the three approaches.

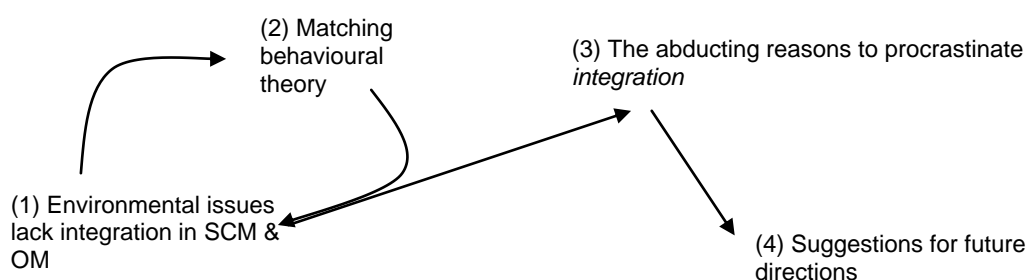
Table 3. Characterization of abductive, inductive and deductive reasoning.

Reasoning	Departing point	Aim	Drawing conclusions
Abduction	Empirical observations (unmatched by/deviating from theory)	Developing new understanding	Suggestions (for future directions, theory/paradigm/tool)
Induction	Empirical observations (theory is absent)	Developing theory	Generalization/ Transferability of results
Deduction	Theoretical framework	Testing/evaluating theory	Corroboration or falsification

As explained by [43], the trigger for abductive research is deviating observations from previous knowledge. In our case, in spite of the awareness, the key contributions, the frameworks and research agendas, there is a lack of routinely integration of sustainability in SCM&OM research as a whole. In the quest to explain this, we will make use of behavioral and control theory.

The abductive research involves mainly four steps (Figure 1): it starts with an interactive cycle between (1) the object needing understanding (sustainability lacks integration in supply chain management research) and (2) a matching with theory (in our case behavioral theory). From there, (3) new insights are derived, and (4) from this insights, future directions are proposed. We discuss some future directions in Section 5.

Figure 1. The abductive process followed in this paper.

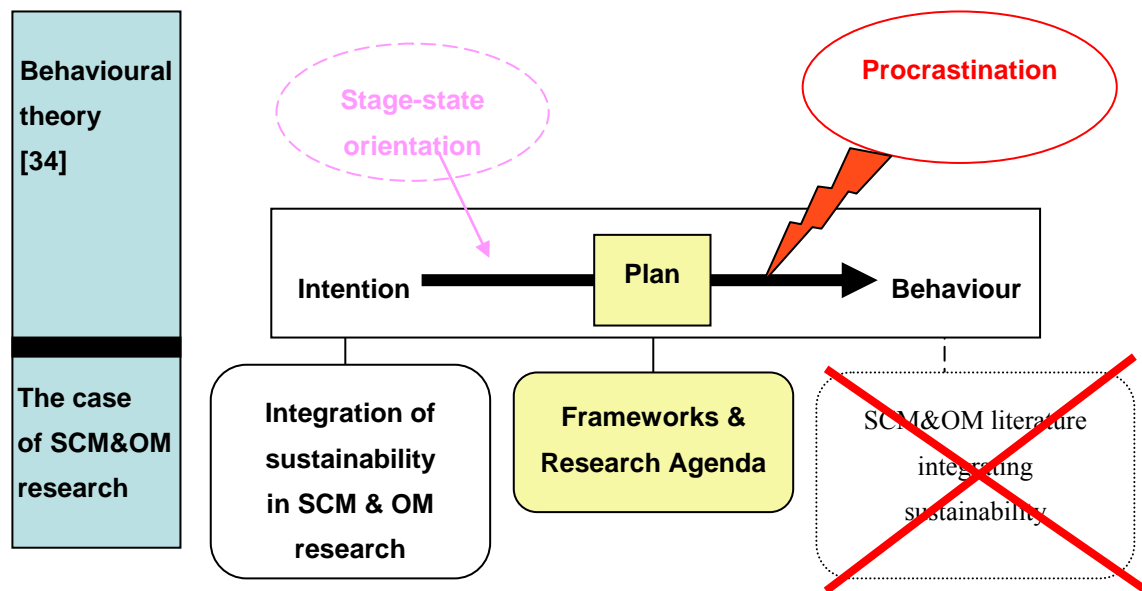


3.2. Behavioral Theory

As mentioned before, in spite of many valuable contributions establishing the relevance of sustainability and putting forward frameworks and research agendas, sustainability is not yet integrated in the majority of supply chain management research. Thus, there is a gap between intention and behavior, to which behavioral theory can offer valuable insights.

The process of transforming intention into behavior has been modeled by [44], and is depicted in Figure 2. The mediator or second step in the process is to convert the intention into a plan (referred to in behavioral sciences respectively as ‘goal intention’ and ‘implementation intention’). There are thus two transmutations: from an intention to a plan and then from a plan to behavior.

In the context of this paper, we can observe that the first transmutation was successful: the intention to integrate sustainability in the field of operations management was developed into a plan in the form of guidelines, frameworks and a research agenda. The same cannot be said about the second transmutation, that is from these plans, frameworks and agendas into a large volume of research that integrates sustainability and supply chain management research. Therefore, we will focus on the causes of procrastination, as defined by [44] and [45]: an unintended delay of transforming ‘implementation intention’ into behavior.

Figure 2. From intention to behavior: mediator and moderators.

Most of the behavioral science studies on procrastination focus on the individual, with self-reports and personality indicators. The phenomena analyzed here is of a meta-group nature, *i.e.*, the research in SCM research. Therefore, we exclude individual/personality related indicators. The work of [46] suggests that procrastination can be viewed as the result of several processes, determined not only by individual personality, but also by the following factors:

- availability of information;
- availability of opportunities and resources;
- skills and abilities;
- dependence on cooperation with others.

In addition, in a review of more than 100 studies on procrastination, [45] add that the following additional items are likely to influence procrastination:

- the nature of the task, and
- the context.

Next, we will employ abductive reasoning to evaluate which of the aforementioned potential reasons is dominating the lack of integration of sustainability in mainstream supply chain and operations research.

4. The Dominating Reasons for Procrastination

In the previous section, by making use of behavioral theory, we have identified six factors, potentially influencing the process of procrastination. Although all the factors are *a priori* key to the process of transforming a plan into action, let us have a closer look into which factors may be the dominant ones.

We do not consider the first two (*availability of information; availability of opportunities and resources*) to be crucial to the current situation in SCM research. This is because, as described in the previous section, the importance of sustainability in SCM&OM research has been recognized precisely through the collection of information. In addition, SCM&OM academic journals and conferences have provided many opportunities for papers dealing with sustainability issues.

Regarding the *skills and abilities*, there is a variety of methods and techniques for analysis: ranging from life-cycle analysis, ecological footprints, mass flow analysis, analytical hierarchy process, and so on. These tools have been applied also in the supply chain/operations context, thus in the pool of SCM researchers there is a diversity of skills and abilities for instance in advanced quantitative decision-making tools, like in operations research. The dependence on *cooperation with others* definitely plays a role, due to the multidisciplinary character of the questions and because some aspects are the kernel of other fields of research such as Industrial Ecology. Fortunately, SCM&OM researchers are significantly aware of the need for multidisciplinary approaches and there is evidence of some well established platforms to bring cooperation such as the Closed-Loop Supply Chain workshops (see [19]).

Though there is evidence that a variety of *skills and abilities* is available in the pool of SCM&OM researchers, we cannot conclude whether, or not, these apply to the majority of SCM&OM researchers. The same applies to the *cooperation with others*: it is not clear how vast multidisciplinary cooperation is. Thus, we consider the evidence inconclusive regarding to, whether or not, the potential lack of skills and abilities and the potential lack cooperation with others are dominant factors.

The last two factors, the *nature of the task* and the *context*, are unquestionably important and have not been resolved by recent developments in supply chain management research. The nature of the task of integrating sustainability in supply chain management is complex and tends to result in conflicts. Furthermore, where conflicts have arisen a resolution framework in supply chain management research is not yet available. The roots of supply chain management research are broadly planted in operations management and therefore the context is *operations* and not the environmental or social aspects, and that has not changed as it is inherent to the field. The *nature of the task* and *context* presently overcome (or ‘abduct’) other factors that may justify the unintentional procrastination of changing supply chain management into *sustainable* supply chain management. Table 4 summarizes the potential factors for procrastination, the evidence and the conclusion on whether, or not, those are abductive reasons.

Next we discuss possible venues to change the status-quo of procrastinating integration in mainstream research.

Table 4. The potential factors for procrastination, the evidence and the conclusion on whether, or not, those are abductive reasons (X = not abductive; ± = possibly abductive; ✓ = abductive).

Factors	Evidence	Abductive reason?
Unavailability of information	The relevance of sustainability has been recognised <u>precisely though the collection of information</u>	X
Unavailability of opportunities	SCM&OM academic journals and conferences have provided <u>many opportunities</u> for papers dealing with sustainability issues + <u>there are multiples tools for analysis</u>	X
Lack of skills and abilities	<u>In the pool of SCM&OM researchers</u> , there is a diversity of skills and abilities.	±
Dependence on cooperation with others	There is evidence of some well established platforms to bring cooperation across disciplines	±
The nature of the task	The nature of the task is complex and tends to generate conflicts	✓
The context	The roots of supply chain management are broadly rooted in operations management and therefore the context is operations/logistics and that is inherent to the field	✓

5. Discussion

The importance of integrating sustainability issues in SCM&OM research has been established for more than a decade and many researchers have produced guidelines, frameworks and research agendas identifying crucial topics. However, we have shown through recent surveys of academic literature [7,40] and our own research that mainstream integration has not yet occurred. In this paper, we investigated the reasons why mainstream integration of sustainability is still lacking in order to feed the discussion on how to overcome it.

Through abductive reasoning we concluded that the reasons for procrastinating are the *conflicting nature of the task* and the *inherent context*, that is, the focus is inherently on operations and not on the environmental or social issues. Addressing sustainability means that analysis is multi-objective and multi-disciplinary. Both are unappealing for different reasons. Multi-objective studies are more complex and often no clear-cut conclusions can be made, since conclusions depend on the decision-maker's preferences regarding the weights to be assigned to the three dimensions of sustainability. Therefore, no simple formulas or rules of thumb can be given, which may be a barrier for dissemination of the results. At the same time, multidisciplinary research is often hard to publish as journals typically specialise within only one of the three dimensions. It may be imperative that editorial boards acknowledge the need for multi-objective and multi-disciplinary research and that referees are instructed to pay special attention to sustainability impacts. Of course, this may be difficult if specialized knowledge on sustainability issues is lacking. The latter will need to be resolved through

interaction with researchers that operate outside of the realm of sustainability and academic education in general, but this may be a slow process. Interaction may indeed prove to be a bottleneck as researchers in sustainability tend to present their work in specialized journals (for instance *Journal of Cleaner Production*, *Journal of Industrial Ecology*, *etc.*) and special sessions and tracks at conferences. This does not promote interaction, but rather risks more ‘preaching to the choir’. Also in academic education sustainability is far from being integrated, but efforts to stimulate this are there (see for instance the ‘Beyond Grey Pinstripes’ ranking of business schools that integrate issues of social and environmental stewardship at www.beyondgreypinstripes.org). Summarizing to provoke a structural change it is essential to take into account the conflicting nature of the task and the context of supply chain management research. Otherwise, the analysis of sustainability issues in supply chain management research will long remain an add-on for special-interest groups instead of an integral part of mainstream research as it should be.

Acknowledgements

We would like to thank TRANSUMO-ECO for their financial support.

References and Notes

1. Carter, C.R.; Jennings, M.M. Logistics social responsibility: An integrative framework. *J. Bus. Logist.* **2002**, *23*, 145–180.
2. Angell, L.C. Environmental and operations management face the future. *Decis. Line* **1999**, *30*, 9–11.
3. Sarkis, J. Manufacturing strategy and environmental consciousness. *Technovation* **1995**, *15*, 79–97.
4. Gupta, M.C. Environmental management and its impact on the operations function. *Int. J. Oper. Prod. Manag.* **1995**, *15*, 34–51.
5. Welford, R. Corporate environmental management, technology and sustainable development: Postmodern perspectives and the need for a critical research agenda. *Bus. Strategy Environ.* **1998**, *7*, 1–12.
6. Gungor, A.; Gupta, S.M. Issues in environmentally conscious manufacturing and product recovery: A survey. *Comput. Ind. Eng.* **1999**, *36*, 811–853.
7. Linton, J.D.; Klassen, R.; Jayaraman, V. Sustainable supply chains: An introduction. *J. Oper. Manag.* **2007**, *25*, 1075–1082.
8. Carter, C.R.; Rogers, D.S. A framework of sustainable supply chain management: Moving toward new theory. *Int. J. Phys. Distrib. Logist. Manag.* **2008**, *38*, 360–387.
9. Gonzaléz, S.G.; Perera, A.G.; Correa, F.A. A new approach to the valuation of production investments with environmental effects. *Int. J. Oper. Prod. Manag.* **2003**, *23*, 62–87.
10. Brady, A.K.O. *The Sustainability Effect, Rethinking Corporate Reputation in the 21st Century*; Palgrave/Macmillan: New York, NY, USA, 2005.
11. Maxwell, J.; Rothenberg, S.; Bricoe, F.; Marcus, A. Green schemes: Comparing environmental strategies and their implementation. *Calif. Manag. Rev.* **1997**, *39*, 118–134.

12. Pullman, M.E.; Maloni, M.J.; Carter, C.R. Food for thought: Social *versus* environmental sustainability practices and performance outcomes. *J. Supply Chain Manag.* **2009**, *45*, 38–54.
13. Thierry, M.; Salomon, M.; van Nunen, J.A.E.E.; van Wassenhove, L.N. Strategic issues in product recovery management. *Calif. Manag. Rev.* **1995**, *37*, 114–135.
14. Corbett, C.J.; DeCroix, G.A. Shared savings contracts for indirect materials in supply chains: Channel profits and environmental impacts. *Manag. Sci.* **2001**, *47*, 881–893.
15. van Hoek, R.I. From reversed to green supply chains. *Supply Chain Manag.: Int. J.* **1999**, *4*, 129–135.
16. De Brito, M.P.; Dekker, R. A framework for reverse logistics. In *Quantitative Approaches to Reverse Logistics*; Dekker, R., Inderfurth, K., van Wassenhove, L.N., Fleischmann, M., Eds.; Springer-Verlag: Berlin, Germany, 2004; pp. 1–27.
17. Fleischmann, M.; van Nunen, J.A.E.E.; Gräve, B.; Gapp, R. *Reverse Logistics—Capturing Value in the Extended Supply Chain*; ERIM Report Series, ERS-2004-091-LIS; Erasmus University Rotterdam: Rotterdam, The Netherlands, 2004.
18. Beamon, B.M. Designing the green supply chain. *Logist. Inform. Manag.* **1999**, *12*, 332–342.
19. Angell, L.C.; Klassen, R.D. Integrating environmental issues into the mainstream: An agenda for research in operations management. *J. Oper. Manag.* **1999**, *17*, 575–598.
20. Verter, V.; Boyaci, T. Foreword to the special issue on reverse logistics. *Comput. Oper. Res.* **2007**, *34*, 295–298.
21. Seuring, S.; Sarkis, J.; Müller, M.; Rao, P. Sustainability and supply chain management: An introduction to the special issue. *J. Clean. Prod.* **2008**, *16*, 1545–1551.
22. Krause, D.R.; Vachon, S.; Klassen, R. Special topic forum on sustainable supply chain management: Introduction and reflections on the role of purchasing management. *J. Supply Chain Manag.* **2009**, *45*, 18–24.
23. Rogers, D.S.; Tibben-Lembke, R.S. *Going Backwards: Reverse Logistics Trends and Practices*; Reverse Logistics Executive Council: Pittsburgh, PA, USA, 1999.
24. Guide, V.D.R., Jr.; van Wassenhove, L.N. *Business Perspectives in Closed-Loop Supply Chains*; Carnegie Mellon University Press: Pittsburgh, PA, USA, 2003.
25. *Quantitative Approaches to Reverse Logistics*; Dekker, R., Inderfurth, K., van Wassenhove, L.N., Fleischmann, M., Eds.; Springer-Verlag: Berlin, Germany, 2004.
26. *Managing Closed Loop Supply Chains*; Flapper, S.D.P., van Nunen, J.A.E.E.; van Wassenhove, L.N., Eds.; Springer-Verlag: Heilderberg, Germany, 2005.
27. Korpela, J.; Kyläheiko, K.; Lehmusvaara, A.; Tuominen, M. The effect of ecological factors in distribution network evaluation. *Int. J. Logist.: Res. Appl.* **2001**, *4*, 257–269.
28. Marshall, R.S.; Brown, D. The strategy of sustainability: A systems perspective on environmental initiatives. *Calif. Manag. Rev.* **2003**, *46*, 101–126.
29. Broman, G.; Holmberg, J.; Robért, K.-H. Simplicity without reduction: Thinking upstream towards the sustainable society. *Interfaces* **2000**, *30*, 13–24.
30. Bansal, P.; McKnight, B. Looking forward, pushing back and peering sideways: Analyzing the sustainability of industrial symbiosis. *J. Supply Chain Manag.* **2009**, *45*, 26–37.
31. Florida, R.; Davison, D. Gaining from Green: Environmental management systems inside and outside the factory. *Calif. Manag. Rev.* **2001**, *43*, 64–84.

32. Melnyk, S.A.; Sroufe, R.P.; Calantone, R. Assessing the impact of environmental management systems on corporate and environmental performance. *J. Oper. Manag.* **2003**, *21*, 329–351.
33. Guide, V.D.R., Jr.; Jayaraman, V.; Linton, J.D. Building contingency planning for closed-loop supply chains with product recovery. *J. Oper. Manag.* **2002**, *21*, 259–279.
34. Klassen, R.D.; Angell, L. An international comparison of environmental management in operations: The impact of manufacturing flexibility in the U.S. and Germany. *J. Oper. Manag.* **1998**, *16*, 177–194.
35. Abukhader, S.M.; Jönson, G. E-commerce and the environment: A gateway to the renewal of greening supply chains. *Manag. Environ. Qual.: Int. J.* **2003**, *14*, 460–476.
36. Gabel, H.L.; Weaver, P.M.; Bloemhof-Ruwaard, J.M.; van Wassenhove, L.N. Life cycle analysis and policy options: The case of the European pulp and paper industry. *Bus. Strategy Environ.* **1996**, *5*, 156–167.
37. Hutchins, M.J.; Sutherland, J.W. An exploration of measures of social sustainability and their application to supply chain decisions. *J. Clean. Prod.* **2008**, *16*, 1688–1698.
38. van Vuuren, D.P.; Bouwman, L.F. Exploring past and future changes in the ecological footprint for world regions. *Ecol. Econ.* **2005**, *52*, 43–62.
39. Ayres, R.U.; Ayres, L.W. *A Handbook of Industrial Ecology*; Edward Elgar: Cheltenham, UK, 2002.
40. Abukhader, S.M.; Jönson, G. Logistics and the environment: Is it an established subject? *Int. J. Logist.* **2004**, *7*, 137–149.
41. Seuring, S.; Müller, M. From a literature review to a conceptual framework for sustainable supply chain management. *J. Clean. Prod.* **2008**, *16*, 1699–1710.
42. Peirce, C.S. *The Collected Papers of C. S. Peirce*; Hartshorne, C., Weiss, P., Eds.; Volumes 1–6; Burks, A.W., Ed.; Volumes 7–8; Harvard University Press: Cambridge, MA, USA, 1931–1958.
43. Kovács, G.; Spens, K.M. Abductive reasoning in logistics research. *Int. J. Phys. Distribu. Logist. Manag.* **2005**, *35*, 132–144.
44. van Hooft, E.A.J.; Born, Ph.M.; Taris, T.W.; van der Flier, H.; Blonk, R.W.B. Bridging the gap between intentions and behavior: Implementation intentions, action control, and procrastination. *J. Vocat. Behav.* **2005**, *66*, 238–256.
45. van Eerde, W. A meta-analytically derived nomological network of procrastination. *Pers. Individ. Differ.* **2003**, *35*, 1401–1418.
46. Ajzen, I. From intentions to actions: A theory of planned behavior. In *Action Control: From Cognition to Behavior*; Kuhl, J., Beckmann, J., Eds.; Springer-Verlag: Berlin, Germany, 1985; pp. 11–39.