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Performance measurement of sustainable supply chains

A literature review and a research agenda

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Abstract

Purpose – The purpose of this paper is to develop the body of knowledge in the area of sustainable supply chains by providing a critical literature review in the field of sustainable supply chain performance measurement (SSCPM) and suggesting paths for future research.

Design/methodology/approach – At a macro level, the evolution of the research field is analysed with the use of citation and co-citation analysis techniques. Further, the evolution of research on performance measurement (PM), supply chain PM, sustainability measurement and SSCPM is presented so as to highlight the criticalities of the research field.

Findings – The paper highlights a research field that is immature, but is growing very fast. Moreover, key issues are highlighted in order to help scholars in planning future research.

Research limitations/implications – The research presented in this paper is mainly limited to work that is referred directly with PM, operations management and supply chain management. Related research, such as literature on strategy or accounting has only been partially considered, even if future researches could include it.

Originality/value – Research in this area is receiving large attention from both academic and practitioners due to the significant relevance of the sustainability debate and the key role of supply chains in this discussion. The body of knowledge is yet immature, and the paper provides an updated state of the art, a critical analysis of the available literature and guidelines for future research.

Keywords Performance measurement, Supply chain management, Literature review, Sustainable supply chains

Paper type Literature review

1. Introduction

Supply chain sustainability has been of great interest in the last decade for academia and the industrial world because of pressures from various stakeholders to adopt a commitment to sustainability practices. Sustainable supply chains (SSC) are a key component of sustainable development in which the environmental and social criteria need to be fulfilled by supply chain members to remain within the supply chain, while it is expected that competitiveness would be maintained through meeting customer needs and related economic criteria. The above definitions implies that companies practicing SSC management (SSCM) have to satisfy multiple and conflicting objectives such as maximising profits while reducing operating costs, minimising the environmental impacts and maximising the social well-being. Supply chain managers have also other challenges: dealing with multiple decision makers and assessing the environmental impacts and social benefits in a multi-party supply chain based on an inter-organisations

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approach and concerning diverse processes for designing, sourcing, producing and distributing products in global markets.

Many different definitions of SSC and SSCM practices exist, starting from the concept of green supply chain management (GSCM) and related green topics, with evident evolutions and variations over the years, as listed below:

- sustainable supply network management (Cruz and Matsypura, 2009; Young and Kielkiewicz-Young, 2001);
- supply and demand sustainability in corporate social responsibility networks (Cruz and Matsypura, 2009; Kovacs, 2004);
- green purchasing (Min and Galle, 1997) and procurement (Gunther and Scheibe, 2006);
- environmental purchasing (Carter *et al.*, 2000; Zsidisin and Siferd, 2001);
- green logistics (Murphy and Poist, 2000) and environmental logistics (Gonzalez-Benito and Gonzalez-Benito, 2006);
- supply chain revision incorporating the multi-player concept (Chopra and Meindl, 2007);
- satisfying the triple-bottom-line (TBL) concept (Kleindorfer *et al.*, 2005; Svensson, 2007; Carter and Rogers, 2008);
- SSC (Linton *et al.*, 2007; Bai and Sarkis, 2010); and
- SSCM (Seuring and Müller, 2008; Hassini *et al.*, 2012).

Considering these latter definitions, for Seuring and Müller (2008) SSCM is defined as "[…] the management of material and information 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", while for Hassini *et al.* (2012) SSCM is "[…] the management of supply chain operations, resources, information, and funds in order to maximize the supply chain profitability while at the same time minimizing the environmental impacts and maximizing the social well-being". The central ethos of Elkington's (1997) "TBL" approach to sustainability is clearly evident in these definitions.

Agreeing with these definitions, from hereinafter, we will use the term SSCM to mean integrating environmental, economic and social concerns into the inter-organisational practices of SCM, assuming the following managerial practices:

- reduction of negative environmental and social impacts as an imperative;
- consideration of all the stages across the entire value chain for each product; and
- a multi-disciplinary perspective, encompassing the entire product life cycle.

SSC is now identified as a primary factor in promoting industrial sustainability (Tonelli *et al.*, 2013), where it is evident that the closed-loop nature of sustainability creates opportunities to modify operations or changes in tactics that can have substantial effects on policy (even if it involves complex high-level policy making to stimulate the strategic actions towards more sustainable production-consumption paradigms – Bianchi *et al.*, 2009).

Surprisingly, exerting such a major influence of sustainability on national economies and industrial systems, aside from research studies dominated by theory development, case or survey-based research; little attention has been given to measuring performance in the context of SSC. In fact, while several reviews provide different perspectives on sustainability in supply chain management, few of them provide a performance measurement (PM) inter-organisational perspective involving the key supply chain stakeholders.

As a consequence of this, goal of this paper is to explore the nature of existing literature and its spread among publications so as to identify the potential development of the subject in academia.

In order to achieve this, the authors reviewed the existing literature assessing the SSC and PM developments, aiming to define guidelines for a possible research agenda.

In Sections 2 and 3, the authors introduce research on SSC and PM; in Section 4 existing literature is assessed with the use of bibliometric analysis ; in Section 5 some evidence from the literature is presented and, finally, in Section 6 findings and implications are discussed in order to drawing conclusions.

2. Introducing SSC

Some of the earliest work concerning the today's greening of supply chain can be traced to Ayres and Kneese (1969). From the 1990s, the research efforts were mainly devoted to understanding the technical and operational considerations linked to the following areas: collecting, testing, sorting and remanufacturing of returned products, so including production planning, scheduling and control, inventory management and reverse logistics issues. To this concern, Fleischmann *et al.* (1997) focus on quantitative models of reverse logistics, and subdivide the literature in three areas: distribution planning, inventory control and production planning. Later in 1999, Gungor and Gupta focus on environmentally conscious manufacturing and product recovery through a review of more than 300 papers. Recycling and remanufacturing were also addressed by Guide *et al.* (1999), and Guide and Van Wassenhove (2002). Researchers concentrated their activities on the environmental aspects of supply chains, looking at the internal dimension (or intra-organisation) of companies – typically manufacturing firms – arising from previous research on supply chain management and green initiatives or practices. As soon as the interaction between sustainability and supply chain became critical (Corbett and Kleindorfer, 2003) a new course of research began trying to catch the systemic nature of sustainability. In 2005, in fact, Kleindorfer *et al.*, departed the previous narrow focus extending to various sustainability themes related to the operational aspects, including concepts such as environmental management, closed-loop supply chains and the TBL thinking. Consequently, researchers and practitioners in operations management started integrating sustainability issues within the traditional areas of expertise. This can be explained because while important contributions have been made in relation to a wide range of topics including environmental operations and policy, strategy, finance, product design, supplier relationships and post-consumer product management, it became critical to move forward to the systemic issues that exist at the intersection of sustainability, environmental management and supply chains (Linton *et al.*, 2007). Past trends in integration aiming to incorporate sustainability in changes to legislation modified the competitive environment in which firms operate (Webster and Mitra, 2007; Kocabasoglu *et al.*, 2007; Ackali *et al.*, 2007; Mazhar *et al.*, 2007).

At the same time, several studies focused on analytical models to implement sustainability: scheduling (Lejeune, 2006) with energy aware considerations (Bruzzone *et al.*, 2012), facility location (Srivastava, 2008; Dou and Sarkis, 2010), supplier selection, policy assessment, optimisation (Cannon *et al.*, 2005), analytical hierarchy process (Che, 2010), fuzzy decision making (Tsai and Hung, 2009), heuristics such as genetic algorithm (Wang and Hsu, 2010), simulation (Van Der Vorst *et al.*, 2009; Vlachos *et al.*, 2007), "exergoeconomics" (Ji, 2008), life cycle costing and life cycle assessment (Matos and Hall, 2007; Frota Neto *et al.*, 2010; Hu and Bidanda, 2009; Singh *et al.*, 2008). Soon it was clear the matter was not only about models or tools aiming to analyse and optimise one single sustainability dimension (or even more than one) but to extend them according to a new holistic view.

Thanks to these steps, sustainability studies about supply chains extended beyond the core of traditional supply chain management improving and refining concepts like manufacturing by-products, by-products generated during product use, product life extension, product service systems and product end-of-life related issues. At the same time, proposals and innovation in legislation such as the WEEE directive 2002/96/EC on waste electrical and electronic equipment together with the RoHS Directive 2002/95/EC in Europe (European Union, 2003), applied the waste hierarchy, employing the 3Rs: reduce, reuse, recycle, forcing both manufacturers and researchers to explore options on how to improve the sustainability of operations across the entire supply chain. Even if application was not satisfactory, in January 2012, proposals were debated by the European Parliament to recast the WEEE Directive; the proposals included increasing recycling rates.

Unfortunately, extending the supply chain to include issues such as remanufacturing, recycling and refurbishing added complexity to supply chain design together with a set of potential strategic and operational issues (Sivadasan *et al.*, 2004), and consequently PM as one of the pillars to support achievement of strategy implementation.

3. Introducing PM of SSC

Research on PM (the process of quantifying efficiency and effectiveness of action – Neely *et al.*, 1995) and PM and management (the process of using measurement information for supporting managers in decision-making processes aiming to link strategy to operations – Taticchi and Balachandran, 2008) has remarkably increased in the last 30 years (Taticchi *et al.*, 2010). Particularly, it is critical to note the progress of focusing performance from merely a financial perspective to a non-financial perspective as announced by Eccles (1991) in its popular paper "The performance measurement manifesto". Firms have understood that for competing in complex and continuously changing environments, it is compulsory to measure, monitor and manage organisational performance in its multiple dimensions. Measurement has been acknowledged as a crucial element to underpin improvement and the reporting of business performance (Sharma *et al.*, 2005). Research within this context largely focuses on the development of new metrics and frameworks, both qualitative and quantitative (Taticchi *et al.*, 2009).

A PM and management system (or framework) is a balanced and dynamic system that facilitates support of decision-making processes by gathering, elaborating and analysing information (Neely *et al.*, 2002). The notion of "balance" refers to the necessity of using different metrics and perspectives that tied together provide a holistic view of the organisation (Kaplan and Norton, 1996; Burgess *et al.*, 2007). The notion of "dynamicity" indicates the need of developing a system that constantly monitors the internal and external context and reviews objectives and priorities (Bititci *et al.*, 2000).

The balanced scorecard (Kaplan and Norton, 1992) and the performance prism (Neely *et al.*, 2002) have emerged as the most popular PM and management frameworks.

PM in application to supply chains is not a new topic (Cagnazzo *et al.*, 2009). In fact, supply chain PM has seen increased attention due to the changing competitive nature from individual organisational competition to supply chains competing against each other (Bai *et al.*, 2012; Taticchi *et al.*, 2012b). Substantial research has been carried out for developing and classifying metrics based on (adapted from Shepherd and Gunter, 2005):

- whether they are qualitative or quantitative;
- what they measure, including cost and non-cost; quality, cost, delivery and flexibility, resource utilization, visibility, trust and innovativeness;
- their operational, tactical or strategic focus; and
- the process in the supply chain they relate to.

Less research has focused on the development of integrated frameworks for measuring the performance of supply chains. The most popular framework, not specifically designed for the measurement of performance but for the general description of supply chain processes, is the SCOR model proposed by the Supply-Chain Council (2013) that suggests to measure performance based on five key supply chain processes that are plan, source, make, deliver and return. In fact, performance metrics can be developed over these five processes for the individual companies in the supply chain as well as for the entire network (see e.g. the work of Gunasekaran and Kobu, 2007). Though widely used in practice, the SCOR model never gained real attention from academia. Other frameworks were also proposed by academics (Chan and Qi, 2003; Chan *et al.*, 2003; Gunasekaran *et al*, 2004; Beamon, 1999, Berrah and Clivillé, 2007) but found little implementation in practice.

Unsurprisingly, a consistent number of criticisms highlight the limits of available PM systems for supply chains (Shepherd and Gunter, 2005):

- lack of connection with strategy;
- focus on cost to the detriment of non-cost indicators;
- lack of a balanced approach (e.g. insufficient focus on customers and competitors); and
- lack of system thinking (that encourages local optimisation).

Recently, some authors argued that there are incompatibilities between the known principles of performance measures and supply chain dynamics (Lehtinen and Ahola, 2010).

The call for sustainability measurement and reporting is certainly not new neither (Milne, 1996), but surely received a boost in the recent times. The popular book by Eccles and Krzus (2010) was definitely one of the boosts. Many organisations are starting to measure the sustainability of their business with mainly three goals: transparency and communication to stakeholders, improvement of their operations and strategy alignment. Within this context, metrics and frameworks have been proposed by industry such as the Global Reporting Initiative (2013), the Carbon Disclosure Project (CDP, 2013) or the International Federation of Accountants (IFAC, 2013), while academia has produced both revised versions of traditional frameworks such as the

responsive business scorecards (Van der Woerd and Van den Brink, 2004) or more innovative models such as the corporate sustainability model (Epstein, 2008), the sustainability evaluation and reporting system (Perrini and Tencati, 2006), the sustainability DartBoards (Bonacchi and Rinaldi, 2007) and the sustainability assessment model (Bebbington *et al.*, 2007). Majority of the frameworks mentioned above relies on the TBL concept and recognises the need of approaching sustainability with both generic and industry-specific measures of performance.

Following this path of evolution, the authors perceive that a new and growing interesting area of research is PM in application to SSC, from hereinafter SSCPM.

4. Bibliometric analysis of the literature

There are a number of techniques that can be used to examine a body of literature. Citation/co-citation analysis and classic bibliometric techniques have been used several times for this purpose in different management fields (Taticchi *et al*, 2010; Hassini *et al*, 2012; Pilkington and Liston-Heyes, 1999; Neely, 2005). The rationale at the base of the use of these techniques relies on the assumption that authors cite papers they consider relevant for the research topic investigated (Culnan, 1986; Sharplin and Mabry, 1985). As a consequence of this, the analysis of publication and citations allows to study a certain body of knowledge under different perspectives that include: extent of publications available, leading authors and leading work among others.

The authors adopted this research methodology with the goal of providing a clear picture of the research field in terms of quantity and quality of papers published, gaps in the literature and drivers at the base of the research evolution.

The dataset selected for this study was the "ISI Web of Science" that is one of the most consistent repositories of business and management papers (Shepherd and Gunter, 2005). The authors interrogated the database searching for ("Sustainable" OR "Sustainability") AND ("Supply Chain Performance") AND ("Measurement" OR "Management" OR "Metrics" OR "Indicators"), in the titles, abstracts and keywords of papers published between 1970 and 2012.

The interrogation resulted in 205 papers published in 35 different journals that constitute the base of further analysis. The earliest paper included in the dataset was published in 2002 and the most recent in 2012.

Once downloaded with the Sitkis software (Schildt *et al.*, 2006), the authors performed the reviewing process. In particular, every record in the dataset was verified independently by two authors so as to enhance the accuracy of the process, and errors identified consequently corrected coherently with the current best practices for bibliometric analysis (Schildt, 2002).

Analysis of publications

Table I presents the list of the first ten journals where SSCPM research has been published. *Journal of Cleaner Production*, *International Journal of Production Economics*, *International Journal of Production Research and Supply Chain Management: An International Journal* lead the ranking with 29, 27 and 18 publications, respectively. Table II presents the ranking of most prolific SSCPM scholars. Sarkis J., Klassen, R.D., Seuring S., Vachon S. lead the table with 11, 7, 6 publications, respectively. The most prolific authors identified have similar disciplinary backgrounds in operations or supply chain management. Table III presents the geographic diversity of scholars. In this case it is relevant to note the leadership of North American and European academic institutions that contribute substantially equally to the research field development. Moreover, the

Journal title	Publications
Journal of Cleaner Production	29
International Journal of Production Economics	27
International Journal of Production Research	18
Supply Chain Management An International Journal	18
International Journal of Operations Production Management	12
Business Strategy and the Environment	11
Journal of Supply Chain Management	7
Ecological Economics	6
International Journal of Physical Distribution Logistics Management	6
Journal of Purchasing and Supply Management	6

Table I.
Ranking of journals by number of publications

Author	Publications
Sarkis, J.	11
Klassen, R.D.	7
Seuring, S.	6
Vachon, S.	6
Pagell, M.	5
Carter, C.R.	4
Foerstl, K.	4
Gunasekaran, A.	4
Reuter, C.	4
Simpson, D.	4

Table II.
Ranking of most prolific authors

Country	Publications
USA	66
Germany	26
Canada	24
England	23
France	15
Australia	14
Spain	14
China	13
Taiwan	10
Italy	8

Table III.
Geography of scholars

table highlights the emerging contribution of scholars from China and Taiwan. This suggests the relevance of this topic also for emerging countries.

Further, Figure 1 presents the frequency of publications over time highlighting a research field that is growing very fast, while Figure 2 highlights the ranking of keywords used by authors.

Analysis of citation data

In more detail, the frequency of citations was explored for individual publications. The 205 papers included in the dataset provide 2,213 citations. The most frequently cited authors (see Figure 3) are: P. Rao (132 citations), P.R. Kleindorfer (106 citations),

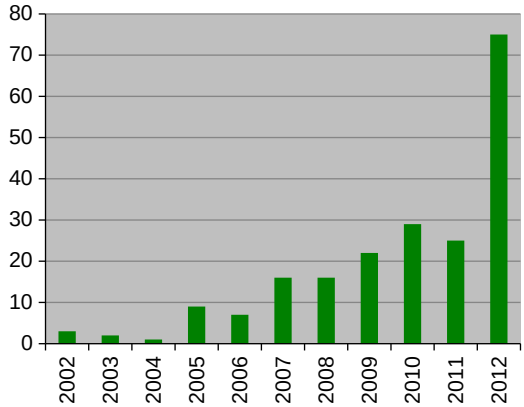

Figure 1.
Publications per year on sustainable supply chains performance management

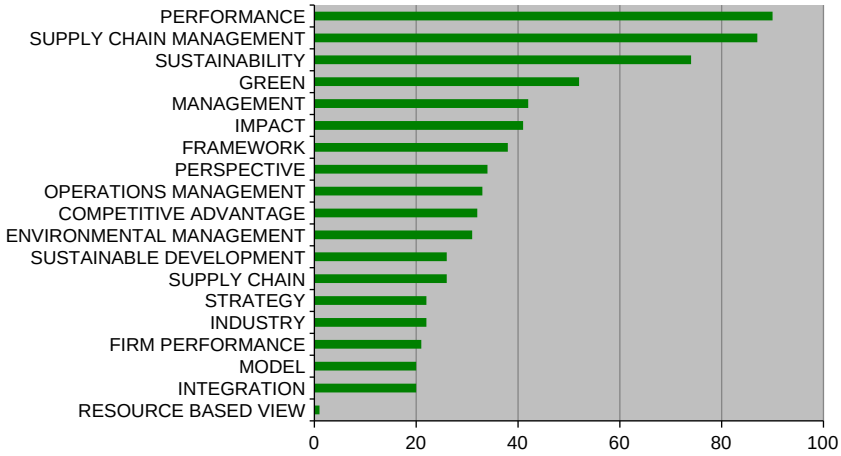

Figure 2.
Frequency of the keywords used by authors

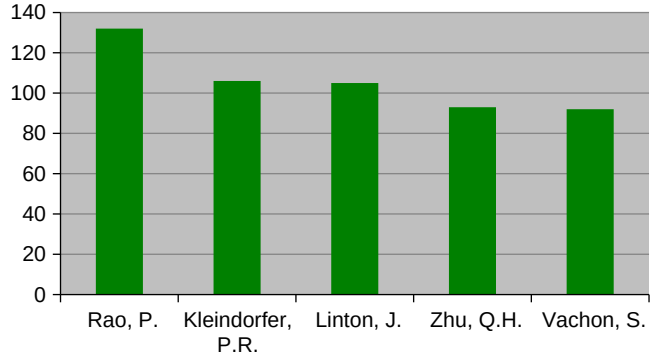

Figure 3.
Most cited authors

J. Linton (105 citations), Q.H. Zhu (93 citations) and S. Vachon (92 citations). The most cited authors identified have a diverse disciplinary background: Rao – environmental science, Kleindorfer – technology and operations management, Linton – supply chain management, Zhu – sustainable development and Vachon – supply chain management.

The most frequently cited journals, presented in Table IV, are: *International Journal of Operations & Production Management* (410 citations), *Journal of Cleaner Production* (283 citations), *International Journal of Production Economics* (213 citations) and the *International Journal of Production Research* (184 citations). It is interesting to note that the most cited journal is in the field of operations and production management, not supply chain management, demonstrating the strong link among the two disciplines.

A predictable observation was that, the trend of citations over time is consistent with the trend of publications (Figure 4). Moreover, it is noteworthy to observe that citations of most cited authors (Figure 3) are stable and grow over time (Figure 5). This confirms the academic acceptability of citing relevant works and authors while writing research papers. For this purpose, Table V identifies the most cited papers.

A different analysis can be developed by studying the social network (Wasserman and Faust, 1994) of keywords for the most frequently cited works on literature. The authors performed the analysis by downloading the keywords from the dataset with the help of the Sitkis software (only works with over 20 citations were included) and used the UCINET software (Borgatti *et al.*, 2002) for performing the social network analysis.

Journal title	Citations
International Journal of Operations & Production Management	410
Journal of Cleaner Production	283
International Journal of Production Economics	213
International Journal of Production Research	184
Journal of Operations Management	146
Supply Chain Management: an International Journal	134
International Journal of Physical Distribution & Logistics Management	124
Production and Operations Management	114
Journal of Supply Chain Management	105
Ecological Economics	79
Environmental Science & Technology	72
Journal of Environmental Management	49
Business Strategy and the Environment	46
International Journal of Life Cycle Assessment	38
Journal of Industrial Ecology	34

Table IV.
Top 15 most cited journals

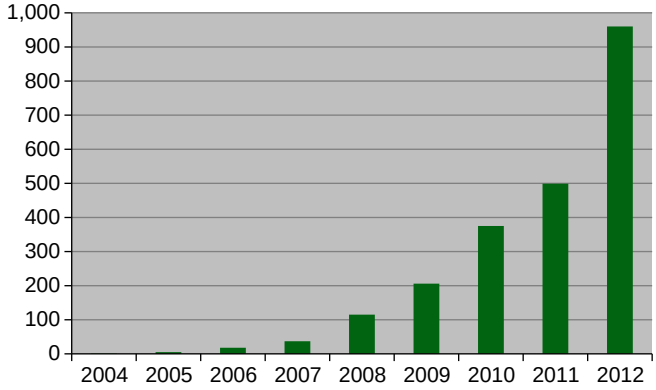

Figure 4.
Number of citations per year

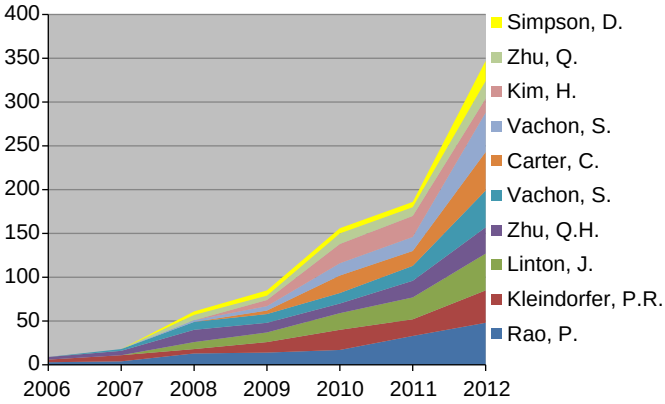

Figure 5.
Trends of citation frequency over time of the ten most cited works

Authors	Article	Year	Citations
Rao, P., Holt, D.	Do green supply chains lead to competitiveness and economic performance?	2005	132
Kleindorfer, P.R., Singhal, K., Van Wassenhove, L.N.	Sustainable operations management	2005	106
Linton, J.D., Klassen, R., Jayaraman, V.	Sustainable supply chains: an introduction	2007	105
Zhu, Q.H., Sarkis, J. Geng, Y.	Green supply chain management in China: pressures, practices and performance	2005	93
Vachon, S., Klassen, R.D.	Extending green practices across the supply chain – the impact of upstream and downstream integration	2006	92
Carter, C.R., Rogers, D.S.	A framework of sustainable supply chain management: moving toward new theory	2008	85
Vachon, S., Klassen, R.D.	Environmental management and manufacturing performance: the role of collaboration in the supply chain	2008	82
Kim, H., Kim, S., Dale, B.E.	Biofuels, land use change, and greenhouse gas emissions: some unexplored variables	2009	69
Zhu, Q., Sarkis, J., Lai, K.-h.	Green supply chain management: pressures, practices and performance within the Chinese automobile industry	2007	53
Simpson, D., Power, D., Samson, D.	Greening the automotive supply chain: a relationship perspective	2007	45

Table V.
Top 10 most cited articles

Figure 6 presents the visual network obtained and highlights the centrality of five keywords: "performance", "firm performance", "green", "impact" and "competitive advantage".

5. Some evidence from literature

The previous paragraph has depicted the literature evolution about SSC and PM with the use of bibliometric techniques. In contrast, in this section we review the characteristics of the most relevant frameworks identified.

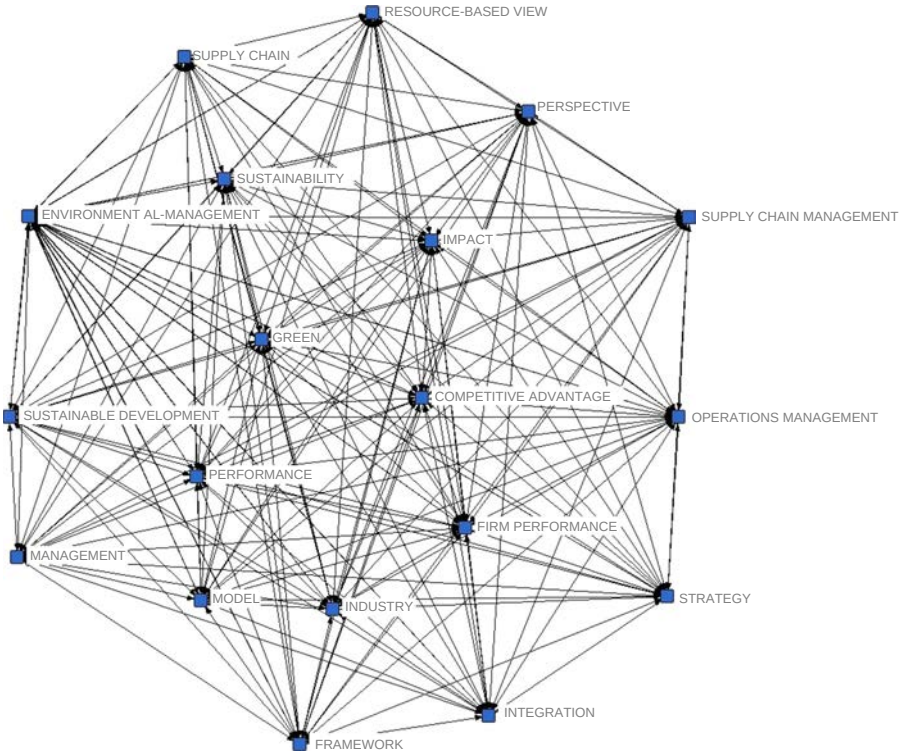

Figure 6.
Keyword's social network analysis of most influential works (over 20 citations)

This is carried out by identifying three main categories of papers as follows:

(1) papers approaching SSCPM taking into account all the three dimensions of the TBL (30 papers);

(2) papers approaching SSCPM taking into account only one or two dimensions of the TBL (130 papers); and

(3) papers providing relevant guidelines for specific issues related to SSCPM (45 papers).

Papers approaching SSCPM taking into account all the three dimensions of the TBL
Kempener *et al.* (2009) propose a quantitative framework for measuring and analysing SSC based on economic, social and environmental performance by integrating agent-based modelling and global dynamic optimisation modelling. Wiedmann *et al.* (2009) present a measurement and reporting scheme based on economic input-output analysis extended with data from TBL and life cycle principles. Erol *et al.* (2011) offer multi-criteria framework based on fuzzy entropy and fuzzy multi-attribute utility for SSCPM with reference to the three dimensions of the TBL.

Papers approaching SSCPM taking into account only one or two dimensions of the TBL
Bai *et al.* (2012) propose a novel methodology for measuring environmental performance of supply chains based on Grey system theory and the SCOR model. Bjorklund *et al.* (2012) suggest a methodology for assessing the same dimension

considering the influence of stakeholders and the role of strategic management. Carbone *et al.* (2012) present a framework for mapping environmental and social performance of SSC by using data available in existing databases.

Papers providing relevant guidelines for specific issues related to SSCPM

Carter and Rogers (2008) use conceptual theory building for setting the foundation of SSC theory, and provide valuable guidelines for further theory development including in the area of PM. Sarkis *et al.* (2010) provide guidelines and an extensive list of metrics for measuring the social sustainability of reverse logistics practices. Hassini *et al.* (2012) provide a list of frameworks for SSC management and evaluation and provide a list of more than one hundred indicators that can be used. Olugu *et al.* (2011) develops an integrated PM system for measuring the environmental sustainability of supply chains in the automobile industry, while Singh *et al.* (2007) propose a different framework for the steel industry. Petrini and Pozzebon (2009) discuss how business intelligence systems can support the measurement of SSC.

Since global supply chains span across a number of countries with different environmental, economic, social and legal standards, when setting requirements to their suppliers, companies need to consider the reality of these differences and to understand the challenges in each sourcing market. In this context, new emerging countries are playing a crucial role (i.e. China and Taiwan), since their participation to the global supply chain is at the top level. Increasingly stakeholders demand to use their leverage to improve conditions along the supply chains and apply the same standard of responsible sourcing across the globe, even in emerging countries. Regulation in developed countries guarantees that; not the same in emerging ones. This last important aspect raises a strong issue: how to implement regulation in emerging countries and "protecting" those already regulated so that operating accordingly to sustainable precepts could not result in a competitive disadvantage?

6. Discussion and implications

With an increasing pressure to act and report on sustainability strategies, an overwhelming number of principles, tools and reporting formats have emerged. Corporations began to adopt some of these to demonstrate their commitment to sustainable development (Beloff *et al.*, 2004).

In this paper, the authors argue that literature on SSCPM is flourishing in terms of quantity (Figure 1). Despite of this, quality of research is still far from being relevant and only a few papers provide significant theory for the further development of the field. As presented in the previous paragraph, the literature is characterised by three clusters of research that include work relating to SSCPM taking into account all the three dimensions of TBL, work focusing only on one or two dimensions and work providing relevant guidelines for specific issues. Section 5 has presented a characterisation of available research based on three clusters and the following evidence emerges:

- since managing decisions in the SSC context properly implies involving various participants and perspectives, it is argued that it is impossible to reduce all dimensions to a single unit of measure;
- the large majority of research has focused on specific issues related to SSCPM, while little research has approached the topic taking into account all the three dimensions of the TBL; and

- much research has focused on measuring environmental performance of supply chains, while little research has investigated the social dimension of performance.

Section 3 presented the research evolution of the PM towards SSCPM. This research found that little academic work addressed the topic of SSCPM in its entirety, and the authors have found no evidence of industrial use of these frameworks. In addition to this, there is no evidence of relevant frameworks emerging from industry or practitioners (excluding frameworks developed by individual organisations). We are far from a situation such as the successful adoption of the balanced scorecard for the PM of individual companies, but this finding is not unexpected since the emergence of models or frameworks for supply chain PM tends to inform the body of literature on which the related sustainability discussion is based. Moreover there is evidence that in practice businesses are leading the sustainability measurement and reporting discussion with frameworks such as the Global Reporting Initiative that is becoming popular in a variety of industries. Academia is called to play a major role in this discussion.

Another relevant finding of this research is that SSCPM research is spread over a large variety of journals belonging to the academic fields of operations, supply chain, strategy, economics and marketing (Table I). The authors attribute this dispersion due to fact that the topic of sustainability does not fall into a discrete subject area because it is relevant to so many disciplines and therefore research in this field competes for space within publications in traditional business and management journals. Certainly this evidence is resonated by sustainability scholars that experience difficulties in properly locating and publishing their research. Moreover, the large majority of existing journals focus on environmental issues creating a barrier for the further development of research including the social and economic dimensions of performance.

A further interesting and unsurprisingly finding is that SSCPM research is predominantly developing in North America and Europe (Table III). In this paper the authors explored these by analysing publication patterns, but it will be of great interest to investigate this in more detail so as to understand if the research agenda of North American scholars differ from that of their European counterparts.

However, despite the contributions, it is needed to consider possible limitations of this research. The most considerable risk is that the literature review is not comprehensive since only the ISI Web of Science database was interrogated. Whilst this is largely regarded as an excellent data source that has been used in other similar research (Pilkington and Liston-Heyes, 1999; Shepherd and Gunter, 2005; Neely, 2005; Taticchi *et al.*, 2010, 2012a), other databases could have been reviewed for completeness. Moreover, our theoretical discussion of SSC and evolution of SSCPM research relies mainly on operations management literature not covering therefore other pertinent theories or works in other areas such as strategy or accounting.

In respect of the limitations, based on the findings of this work, a number of recommendations are raised which constitute the base of a research agenda.

Forward a new generation of scholars and journals

The analysis of the literature has highlighted an increasing attention of academia to SSCPM. The majority of today's body of knowledge has been developed by a "first generation" of leading academics that contributed to build the bodies of knowledge relating to supply chain, PM and sustainability. Given the importance of the topic, and the need of a dedicated and integrated approach, the authors envisage

an emerging "new/second generation" of scholars that will drive the evolution of research in the discipline. In parallel, the authors envisage a growing number of journals dedicated to the topics of sustainability and SSC.

The call for a structured approach to SC PM

The review of literature has evidenced the need of the developing basic theory and frameworks for SSCPM in respect of the TBL concept. In order to achieve this, significant research is needed in order to develop, first, the body of knowledge related to SSC, and second, attention should be given to SSC PM in terms of measures and frameworks. Metrics and models to be developed should rely on previous research and overcame the issues of previous SC measurement frameworks that have not evidenced attention in academy and industry. Moreover, they should interface with measurement systems developed for single organisations yet maintaining the cross-view required to address SSC context. Being at the beginning of this journey, all research methodologies could be used to contribute to build the body of knowledge including conceptual modelling, surveys, action research and case studies.

The call for a balanced TBL approach

Traditional research has predominantly focused on measuring SC performance in terms of competitiveness (particularly cost, quality, speed, flexibility and reliability performance objectives) referring therefore to the economic dimension of the TBL. Further, in the last decade, considerable research has focused on "green" supply chains, referring therefore to the environmental dimension of the TBL (Foran *et al.*, 2005; Kleindorfer *et al.*, 2005). In contrast, little research has focused on analysing the social dimension performance of supply chains. Therefore, further studies are encouraged in this area as well as more generally on measurement approaches relying on a balanced consideration of the TBL dimensions. It would also be useful to evaluate potential improvement driven by technology investments.

The call for country and industry-specific studies

Previous research on sustainability measurement has highlighted the importance of analysing sustainability issues in reference to the context of business operations. As a consequence of this, it is always more relevant to develop research models and frameworks that take into consideration specific country and industry characteristics. This characteristic is of essential importance at the supply chain level where TBL impacts are often context dependent and technology related.

All valuations reducible to a single one-dimension standard

Multi-criteria evaluation introduced a framework that develops a standardised measure that addresses the difficulty imposed by the multi-disciplinary nature of sustainability by offering an approach that is inter-disciplinary, participatory and transparent. Interesting approaches have been developed to face the multiple criteria nature of the SSC measurement problem, proposing the multi-criteria decision method. Nevertheless, the sole use of multi-criteria-based SSC measurement is not sufficient to satisfy all the needs of decision makers although it is used to evaluate sustainability performance of SSC because: it only measures overall sustainability performance, it is not capable of analysing sustainability indicators independently and it does not consider the specific targets in terms of different sustainability aspects.

The call for establishing the scope of current knowledge

This work analysed the nature and spread of available publications. However, we recognise the need of further analysing the literature in terms of content in order to establish a detailed research agenda aiming to define a platform for the development of theory.

The above recommendations open up some crucial research areas accordingly to the following perspectives (CSR Europe web site):

- Stakeholder expectations dynamic: how are stakeholder expectations changing? How will this impact the nature of SSC? How do expectations of stakeholders in emerging countries differ?
- Business implications in developed and emerging markets: what are the strategic drivers pushing towards innovation of the business model? What are the business implications for companies, especially when sourcing from emerging markets? What are possible drawbacks of being a pioneer in implementing sustainability across the supply chain? How should the strategic implications of (un)sustainability risks for the supply chain be modelled and understood?
- Company practice reporting: what are examples of emerging innovative company practice in SSC? Why are these examples considered to be strategically competitive? What are key success factors enabling competitiveness and how are they related?
- Strategic planning: how should strategic planning efforts towards sustainability be fully integrated?
- Reporting initiatives: how can involvement in external reporting and disclosure efforts on sustainability be justified?

7. Conclusions

This paper carried out a literature review examining publications reporting the state of the art of SSC – PM. After an initial theoretical introduction to the topic of SSC, citation and co-citation techniques were used to analyse the evolution and nature of the literature. Findings highlighted the growing number of publications, leading authors, leading journals, geographical distribution of scholars, the most cited papers, trends of citations and the most cited journals. Moreover, a description of the evolution of PM research was provided in order to highlight issues related to PM, sustainability measurement, supply chain measurement and SSC measurement. The analysis of the state of the art that emerges presents interesting discoveries, including:

- there is no popular academic framework for SCPM and only few integrate the TBL approach;
- the business community is leading the development of frameworks for sustainability measurement, while the academic community is following a step behind;
- little research has focused on measuring the social performance of supply chains;
- there is no evidence of sustainability improvements and technology investments;
- research is spread over a variety of different disciplines;

- North American and Europe are leading the research field;
- country and industry-specific studies are relevant for the development of SSCPM frameworks; and
- distributed decision making processes increase complexity of different measures across different stakeholders.

The analysis performed also shows that companies are going to:

- adapt their supply chains to support rapid expansion and capitalize on the growing number of middle-class buyers in emerging markets (EMs);
- develop their existing supply chains to drive cost efficiencies and boost margins in their mature market operations; and
- manage environmental and sustainability expectations with profound effect on supply chain network configuration.

In our opinion companies still failed especially in turning this latter point to their advantage both in terms of margin enhancement in developed countries and as a catalyst for growth in emerging markets. Sustainability, in fact, is included in corporate agenda (i.e. regulatory pressure to develop robust policies on issues from the ethical sourcing of raw materials to carbon reduction measures, human rights and waste management) since failing to engage with sustainability can leave companies exposed to financial loss, serious reputational damage and tarnished brand equity. These companies are usually large, so sustainability is still out of reach for SMEs. On the other hand clients, shareholders and investors are pushing organisations for public commitment to sustainable operations. Unfortunately, the success of sustainability initiatives requires a holistic approach crossing the product and service life cycle as well as all business functions including R&D, product development and procurement. Hence, traditional life cycle analysis and business functions need to be revised in the light of the entire sustainability agenda.

Since the success of any sustainability programme lies in visibility (and hence measurement) of sustainability risks throughout the supply chain and standards to mitigate them, developing effective ways to assess, compare, benchmark, correlate practices to sustainability indicators is mandatory.

The supply chain perspective is so important because the sustainability risk begins not with a company's products, but with its suppliers. Organisations may miss unethical working practices or unsustainable processing, packaging or transportation activities that could damage their reputation by inappropriate association. The environmental impact of both inbound and outbound logistics is also under evaluation, with companies seeking to streamline factors like distance, transportation, number of shipments and batch size when sourcing and developing relationships.

Rigorous policies are the first step towards incorporating sustainability into the supply chain, but transparent and efficient monitoring/measurement are fundamentals not only to effectively communicate performance both to internal stakeholders and to the market, but also to have trajectories towards improvement.

Though the findings above represent substantial barriers to be overcome, the research field is still very young and this work has highlighted that attention and research is expanding very fast. As a consequence of this, the authors envisage consistent development in research in the years to come, the emerging of a second/new generation of scholars and the appearance of new dedicated journals.

SSC PM and management opens a new challenge for researchers and practitioners in sustainability, supply chain and PM areas. This journey is just at the beginning.

References

Ackali, E., Karakayali, I. and Emir-Farinas, H. (2007), "An analysis of decentralized collection and processing of end-of-life products", *Journal of Operations Management*, Vol. 25 No. 6, pp. 1161-1183.

Ayres, R.U. and Kneese, A.V. (1969), "Production, consumption, and externalities", *The American Economic Review*, Vol. 59 No. 3, pp. 282-297.

Bai, C. and Sarkis, J. (2010), "Integrating sustainability into supplier selection with grey system and rough set methodologies", *International Journal of Production Economics*, Vol. 124 No. 1, pp. 252-264.

Bai, C., Sarkis, J., Wei, X. and Koh, L. (2012), "Evaluating ecological sustainable performance measures for supply chain management", *Supply Chain Management: An International Journal*, Vol. 17 No. 1, pp. 78-92.

Beamon, B.M. (1999), "Designing the green supply chain", *Logistics Information Management*, Vol. 12 No. 4, pp. 332-342.

Bebbington, J., Brown, J. and Frame, B. (2007), "Accounting technologies and sustainability assessment models", *Ecological Economics*, Vol. 61 Nos 2-3, pp. 224-236.

Beloff, B., Tanzil, D. and Lines, M. (2004), "Sustainable development performance assessment", *Environmental Progress*, Vol. 23 No. 4, pp. 271-276.

Berrah, L. and Clivillé, V. (2007), "Towards an aggregation performance measurement system model in a supply chain context", *Computers in Industry*, Vol. 58 No. 7, pp. 709-719.

Bianchi, N.P., Evans, S., Revetria, R. and Tonelli, F. (2009), "Influencing factors of successful transitions towards product-service systems: a simulation approach", *International Journal of Mathematics and Computers in Simulation*, Vol. 3 No. 1, pp. 30-43.

Bititci, U.S., Turner, T. and Begemann, C. (2000), "Dynamics of performance measurement systems", *International Journal of Operations & Production Management*, Vol. 20 No. 6, pp. 692-704.

Bjorklund, M., Martinsen, U. and Abrahamsson, M. (2012), "Performance measurements in the greening of supply chains", *Supply Chain Management: An International Journal*, Vol. 17 No. 1, pp. 29-39.

Bonacchi, M. and Rinaldi, L. (2007), "DartBoards and clovers as new tools in sustainability planning and control", *Business Strategy and the Environment*, Vol. 16 No. 7, pp. 461-473.

Borgatti, S.P., Everett, M.G. and Freeman, L.C. (2002), *Ucinet for Windows: Software for Social Network Analysis*, Analytic Technologies, Harvard, MA.

Bruzzone, A.A.G., Anghinolfi, D., Paolucci, M. and Tonelli, F. (2012), "Energy-aware scheduling for improving manufacturing process sustainability: a mathematical model for flexible flow shops", *CIRP Annals – Manufacturing Technology*, Vol. 61 No. 1, pp. 459-462.

Burgess, T., Ong, T.S. and Shaw, N. (2007), "Traditional or contemporary? The prevalence of performance measurement system types", *International Journal of Productivity and Performance Management*, Vol. 56 No. 7, pp 583-602.

Cagnazzo, L., Taticchi, P. and Brun, A. (2009), "The role of performance measurement systems to support quality improvement initiatives at supply chain level", *The International Journal of Productivity and Performance Management*, Vol. 59 No. 2, pp. 163-185.

Cannon, M., Kouvaritakis, B. and Huang, G. (2005), "Modelling and optimisation for sustainable development policy assessment", *European Journal of Operational Research*, Vol. 164 No. 2, pp. 475-490.

Carbone, V., Moatti, V. and Esposito Vinzi, V. (2012), "Mapping corporate responsibility and sustainable supply chains: an exploratory perspective", *Business Strategy and the Environment*, Vol. 21 No. 7, pp. 475-494.

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. 360-387.

Carter, C.R., Kale, R. and Grimm, C.M. (2000), "Environmental purchasing and firm performance: an empirical investigation", *Transportation Research Part E: Logistics and Transportation Review*, Vol. 36 No. 3, pp. 219-228.

CDP (2013), *CDP Climate Change Reporting Guidance*, available at: www.cdproject.net/en-US/Pages/guidance.aspx (accessed 23 February 2013).

Chan, F.T.S. and Qi, H.J. (2003), "An innovative performance measurement method for supply chain management", *Supply Chain Management: An International Journal*, Vol. 8 No. 3, pp. 209-223.

Chan, F.T.S., Qi, H.J., Chan, H.K., Lau, H.C.W. and Ip, R.W.L. (2003), "A conceptual model of performance measurement for supply chains", *Management Decision*, Vol. 41 No. 7, pp. 635-642.

Che, Z.H. (2010), "Using fuzzy analytic hierarchy process and particle swarm optimisation for balanced and defective supply chain problems considering WEEE/RoHS directives", *International Journal of Production Research*, Vol. 48 No. 11, pp. 3355-3381.

Chopra, S and Meindl, P. (2007), *Supply Chain Management: Strategy, Planning, and Operation*", Prentice-Hall, NJ.

Corbett, C.J. and Kleindorfer, P.R. (2003), "Environmental management and operations management: introduction to the third special issue", *Production and Operations Management*, Vol. 12 No. 3, pp. 287-289.

Cruz, J.M. and Matsypura, D. (2009), "Supply chain networks with corporate social responsibility through integrated environmental decision-making", *International Journal of Production Research*, Vol. 47 No. 3, pp. 621-648.

Culnan, M. (1986), "The intellectual development of management information systems", *Management Science*, Vol. 32 No. 2, pp. 156-172.

Dou, Y. and Sarkis, J. (2010), "A joint location and outsourcing sustainability analysis for a strategic offshoring decision", *International Journal of Production Research*, Vol. 48 No. 2, pp. 567-592.

Eccles, R.G. (1991), "The performance measurement manifesto", *Harvard Business Review*, Vol. 69 No. 1, pp. 131-137.

Eccles, R.G. and Krzus, M.P. (2010), *One Report: Integrated Reporting for a Sustainable Strategy*, John Wiley & Sons Inc, Hoboken, NJ.

Elkington, J. (1997), "Cannibals with forks: the triple bottom line of 21st century business', Capstone, Oxford.

Epstein, M.J. (2008), *Making Sustainability Work*, Green leaf Publishing Limited, Sheffield.

Erol, I., Sencer, S. and Sari, R. (2011), "A new fuzzy multi-criteria framework for measuring sustainability performance of a supply chain", *Ecological Economics*, Vol. 70 No. 6, pp. 1088-1100.

European Union (2003), "Directive 2002/96/EC of the European Parliament and of the Council of 27 January 2003 on waste electrical and electronic equipment (WEEE)", *Official Journal L 037*, European Union, Brussels, 13 February, pp. 24-39.

Fleischmann, M., Runwaard, J.B.M., Dekker, R., Laan, E., Nnunen, J.A.E.E. and Van Wassenhove, L. (1997), "Quantitative models for reverse logistics: a review", *European Journal of Operational Research*, Vol. 103 No. 1, pp. 1-17.

Foran, B., Lenzen, M., Dey, C. and Bilek, M. (2005), "Integrating supply chain management with triple bottom line accounting", *Ecological economics*, Vol. 52 No. 2, pp. 143-157.

Frota Neto, J.Q., Walther, G., Bloemhof, J., Van Nunen, J. and Spengler, T. (2010), "From closed-loop to sustainable supply chains: the WEEE case", *International Journal of Production Research*, Vol. 48 No. 15, pp. 4463-4481.

Gonzalez-Benito, J. and Gonzalez-Benito, Ó (2006), "The role of stakeholder pressure and managerial values in the implementation of environmental logistics practices", *International Journal of Production Research*, Vol. 44 No. 7, pp. 1353-1373.

Global Reporting Initiative (2013), *Reporting Framework Overview*, available at: www.globalreporting.org/reporting/reporting-framework-overview/Pages/default.aspx (accessed 23 February 2013).

Guide, V.D.R. Jr and Van Wassenhove, L.N. (2002), "The reverse supply chain", *Harvard Business Review*, Vol. 80 No. 2, pp. 25-26.

Guide, V.D.R. Jr, Jayaraman, V. and Srivastava, R. (1999), "Production planning and control for remanufacturing: a state-of-the-art-survey", *Robotics and Computer-Integrated Manufacturing*, Vol. 15 No. 3, pp. 221-230.

Gunasekaran, A. and Kobu, B. (2007), "Performance measures and metrics in logistics and supply chain management: a review of recent literature (1995-2004) for research and applications", *International Journal of Production Research*, Vol. 45 No. 12, pp. 2819-2840.

Gunasekaran, A., Parel, C. and Mc Gaughey, R.E. (2004), "A framework for supply chain performance measurement", *International Journal of Production Economics*, Vol. 87 No. 3, pp. 333-347.

Hassini, E., Surti, C. and Searcy, C. (2012), "A literature review and a case study of sustainable supply chains with a focus on metrics", *International Journal of Production Economics*, Vol. 140 No. 1, pp. 69-82.

Hu, G. and Bidanda, B. (2009), "Modeling sustainable product lifecycle decision support systems", *International Journal of Production Economics*, Vol. 122 No. 1, pp. 366-375.

IFAC (2013), *IFAC Sustainability Framework 2.0*, available at: www.ifac.org/publications-resources/ifac-sustainability-framework-20 (accessed 23 February 2013).

Ji, G. (2008), "Performance evaluation of complaint management and virtual enterprise in closed-loop supply chains by using exergoeconomics and extenics", *International Journal of Services and Operations Management*, Vol. 4 No. 3, pp. 368-397.

Kaplan, R. and Norton, D. (1992), "The balanced scorecard: measures that drive performance", *Harvard Business Review*, Vol. 70 No., No. 1, pp. 71-79.

Kaplan, R. and Norton, D. (1996), "Using the balanced scorecard as a strategic management system", *Harvard Business Review*, January-February, pp. 75-85.

Kempener, R., Beck, J. and Petrie, J. (2009), "Design and analysis of bioenergy networks. A complex adaptive systems approach", *Journal of Industrial Ecology*, Vol. 13 No. 2, pp. 284-305.

Kleindorfer, P.R., Singhal, K. and Van Wassenhove, L.N. (2005), "Sustainable operations management", *Production and Operations Management*, Vol. 14 No. 4, pp. 482-492.

Kocabasoglu, C., Prahinski, C. and Klassen, R. (2007), "Linking forward and reverse supply chain investments: the role of business uncertainty", *Journal of Operations Management*, Vol. 25 No. 6, pp. 1141-1160.

Kovacs, G. (2004), "Framing a demand network for sustainability", *Progress in Industrial Ecology: an International Journal*, Vol. 1 No. 4, pp. 397-410.

Lehtinen, J. and Ahola, T. (2010), "Is performance measurement suitable for an extended enterprise?", *International Journal of Operations & Production Management*, Vol. 30 No. 2, pp. 181-204.

Lejeune, M.A. (2006), "A variable neighborhood decomposition search method for supply chain management planning problems", *European Journal of Operational Research*, Vol. 175 No. 2, pp. 959-976.

Linton, J.D., Klassen, R. and Jayaraman, V. (2007), "Sustainable supply chains: an introduction", *Journal of Operations Management*, Vol. 25 No. 6, pp. 1075-1082.

Matos, S. and Hall, J. (2007), "Integrating sustainable development in the supply chain: the case of life cycle assessment in oil & gas and agricultural biotechnology", *Journal of Operations Management*, Vol. 25 No. 6, pp. 1083-1102.

Mazhar, M.I., Kara, S. and Kaebernick, H. (2007), "Remaining life estimation of used components in consumer products: life cycle data analysis by Weibull and artificial neural networks", *Journal of Operations Management*, Vol. 25 No. 6, pp. 1184-1193.

Milne, M.J. (1996), "On sustainability; the environment and management accounting", *Management Accounting Research*, Vol. 7 No. 1, pp. 135-161.

Min, H. and Galle, W.P. (1997), "Green purchasing strategies: trends and implications", *The Journal of Supply Chain Management*, Vol. 33 No. 3, pp. 10-17.

Murphy, P.R. and Poist, R.F. (2000), "Green logistics strategies: an analysis of usage patterns", *Transportation Journal*, Vol. 40 No. 2, pp. 5-16.

Neely, A. (2005), "The evolution of performance measurement research: development in the last decade and a research agenda for the next", *International Journal of Operations & Production Management*, Vol. 25 No. 2, pp. 1264-1277.

Neely, A., Adams, C. and Kennerley, M. (2002), *The Performance Prism: the Scorecard for Measuring and Managing Stakeholder Relationship*, Prentice-Hall, London.

Neely, A., Gregory, M. and Platts, K. (1995), "Performance measurement system design: a literature review and research agenda", *International Journal of Operations & Production Management*, Vol. 15 No. 4, pp. 80-116.

Olugu, E.U., Wong, K.Y. and Shaharoun, A.M. (2011), "Development of key performance measures for the automobile green supply chain", *Resources, Conservation and Recycling*, Vol. 55 No. 6, pp. 567-579.

Perrini, F. and Tencati, A. (2006), "Sustainability and stakeholder management: the need for new corporate performance evaluation and reporting systems", *Business Strategy and the Environment*, Vol. 15 No. 5, pp. 296-308.

Petrini, M. and Pozzebon, M. (2009), "Managing sustainability with the support of business intelligence: integrating socio-environmental indicators and organisational context", *Journal of Strategic Information Systems*, Vol. 18 No. 4, pp. 78-191.

Pilkington, A. and Liston-Heyes, C. (1999), "Is production and operations management a discipline? A citation/co-citation study", *International Journal of Operations & Production Management*, Vol. 19 No. 1, pp. 7-20.

Sarkis, J., Helms, M.M. and Hervani, A.A. (2010), "Reverse logistics and social sustainability", *Corporate Social Responsibility and Environmental Management*, Vol. 17 No. 6, pp. 337-354.

Schildt, H.A. (2002), *SITKIS: Software for Bibliometric Data Management and Analysis*, Helsinki Institute of Strategy and International Business, available at: http:/users.tkk.fi/~hschildt/sitkis/

Schildt, H.A., Zahra, S.A. and Sillanpää, A. (2006), "Scholarly communities in entrepreneurship research: a co-citation analysis", *Entrepreneurship Theory and Practice*, Vol. 30 No. 3, pp. 399-416.

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. 1699-1710.

Sharma, M.K., Bhagwat, R. and Dangayach, G.S. (2005), "Practice of performance measurement: experience from Indian SMEs", *International Journal of Globalisation and Small Business*, Vol. 1 No. 2, pp. 183-213.

Sharplin, A. and Mabry, R. (1985), "The relative importance of journals used in management research: an alternative ranking", *Human Relations*, Vol. 38 No. 2, pp. 139-149.

Shepherd, C. and Gunter, H. (2005), "Measuring supply chain performance: current research and future directions", *International Journal of Productivity and Performance Management*, Vol. 55 Nos 3-4, pp. 242-258.

Singh, R.K., Murty, H.R., Gupta, S.K. and Dikshit, A.K. (2007), "Development of composite sustainability performance index for steel industry", *Ecological Indicators*, Vol. 7 No. 3, pp. 565-588.

Singh, R.K., Murty, H.R., Gupta, S.K. and Dikshit, A.K. (2008), "Integrated environment management in steel industries", *International Journal of Management and Decision Making*, Vol. 9 No. 1, pp. 103-128.

Sivadasan, S., Efstathiou, J., Calinescu, A. and Huaccho Huatuco, L. (2004), "Supply chain complexity", in New, S., and Westbrook, R. (Eds.), *Understanding Supply Chains*, Oxford University Press, Oxford, pp. 133-163.

Srivastava, S.K. (2008), "Network design for reverse logistics", *Omega*, Vol. 36 No. 4, pp. 535-548.

Supply-Chain Council (2013), "Supply-chain operations reference model", Version 10.0, available at: www.supply-chain.org (accessed 23 February 2013).

Svensson, G. (2007), "Aspects of sustainable supply chain management (SSCM): conceptual framework and empirical example", *Supply Chain Management*, Vol. 28 No. 3, pp. 262-266.

Taticchi, P. and Balachandran, K.R. (2008), "Forward performance measurement and management integrated frameworks", *International Journal of Accounting and Information Management*, Vol. 16 No. 2, pp. 140-154.

Taticchi, P., Tonelli, F. and Cagnazzo, L. (2009), "A decomposition and hierarchical approach for business performance measurement and management", *Measuring Business Excellence*, Vol. 13 No. 4, pp. 47-57.

Taticchi, P., Cagnazzo, L. and Tonelli, F. (2010), "Performance measurement and management: a literature review and a research agenda", *Measuring Business Excellence*, Vol. 14 No. 1, pp. 4-18.

Taticchi, P., Balachandran, K. and Tonelli, F. (2012a), "Performance measurement and management systems: state of the art, guidelines for design and challenges", *Measuring Business Excellence*, Vol. 16 No. 2, pp. 41-54.

Taticchi, P., Cagnazzo, L., Barber, K. and Beach, R. (2012b), "A management framework for organisational networks: a case study", *Journal of Manufacturing Technology Management*, Vol. 23 No. 5, pp. 593-614.

Tonelli, F., Evans, S. and Taticchi, P. (2013), "Industrial sustainability: challenges, perspectives, actions", *International Journal of Business Innovation Research*, Vol. 7 No. 2, pp. 143-163.

Tsai, W.-H. and Hung, S.-J. (2009), "A fuzzy goal programming approach for green supply chain optimisation under activity-based costing and performance evaluation with a value-chain structure", *International Journal of Production Research*, Vol. 47 No. 18, pp. 4991-5017.

Van Der Vorst, J.G.A.J., Tromp, S.O. and Van Der Zee, D.J. (2009), "Simulation modelling for food supply chain redesign; integrated decision making on product quality, sustainability and logistics", *International Journal of Production Research*, Vol. 47 No. 23, pp. 6611-6631.

Van der Woerd, F. and Van den Brink, T. (2004), "Feasibility of a responsive business scorecard – a pilot study", *Journal of Business Ethics*, Vol. 55 No. 2, pp. 173-186.

Vlachos, D., Georgiadis, P. and Iakovou, E. (2007), "A system dynamics model for dynamic capacity planning of remanufacturing in closed-loop supply chains", *Computers and Operations Research*, Vol. 34 No. 2, pp. 367-394.

Wang, H.F. and Hsu, H.W. (2010), "A closed-loop logistic model with a spanning-tree based genetic algorithm", *Computers and Operations Research*, Vol. 37 No. 2, pp. 376-389.

Wasserman, S. and Faust, K. (1994), *Social Network Analysis*, Cambridge University Press, Cambridge.

Webster, S. and Mitra, S. (2007), "Competitive strategy and the impact of take-back laws", *Journal of Operations Management*, Vol. 25 No. 6, pp. 1123-1140.

Wiedmann, T.O., Lenzen, M. and Barrett, J.R. (2009), "Companies on the scale: comparing and benchmarking the sustainability performance of businesses", *Journal of Industrial Ecology*, Vol. 13 No. 3, pp. 361-383.

Young, A. and Kielkiewicz-Young, A. (2001), "Sustainable supply network management", *Corporate Environmental Strategy*, Vol. 8 No. 3, pp. 260-268.

Zsidisin, G.A. and Siferd, S.P. (2001), "Environmental purchasing: a framework for theory development", *European Journal of Purchasing & Supply Management*, Vol. 7 No. 1, pp. 61-73.

Further reading

Gungor, A. and Gupta, S. (1999), "Issues in environmentally conscious manufacturing and product recovery: a survey", *Computers and Industrial Engineering*, Vol. 36 No. 4, pp. 811-853.

Gunther, E. and Scheibe, L. (2006), "The hurdle analysis. A self-evaluation tool for municipalities to identify, analyse and overcome hurdles to green procurement", *Corporate Social Responsibility and Environmental Management*, Vol. 13 No. 2, pp. 61-77.

Kim, H., Kim, S. and Dale, B.E. (2009), "Biofuels, land use change, and greenhouse gas emissions: some unexplored variables", *Environmental Science and Technology*, Vol. 43 No. 3, pp. 961-967.

Piplani, R., Pujawan, N. and Ray, S. (2008), "Foreword: sustainable supply chain management", *International Journal of Production Economics*, Vol. 111 No. 2, pp. 193-194.

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.

Simpson, D., Power, D. and Samson, D. (2007), "Greening the automotive supply chain: a relationship perspective", *International Journal of Operations & Production Management*, Vol. 27 No. 1, pp. 28-48.

Vachon, S. and Klassen, R.D. (2006), "Extending green practices across the supply chain: the impact of upstream and downstream integration", *International Journal of Operations & Production Management*, Vol. 26 No. 7, pp. 795-821.

Vachon, S. and Klassen, R.D. (2008), "Environmental management and manufacturing performance: the role of collaboration in the supply chain", *International Journal of Production Economics*, Vol. 111 No. 2, pp. 299-315.

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. 449-468.

Zhu, Q., Sarkis, J. and Lai, K. (2007), "Green supply chain management: pressures, practices and performance within the Chinese automobile industry", *Journal of Cleaner Production*, Vol. 15 Nos 11-12, pp. 1041-1052.

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This article has been cited by:

1. Payman Ahi, Cory Searcy, Mohamad Y. Jaber. 2018. A Quantitative Approach for Assessing Sustainability Performance of Corporations. *Ecological Economics* **152**, 336-346. [Crossref]
2. Tsai-Chi Kuo, Shana Smith. 2018. A systematic review of technologies involving eco-innovation for enterprises moving towards sustainability. *Journal of Cleaner Production* **192**, 207-220. [Crossref]
3. SinglaAnuj, Anuj Singla, SethiAPS, APS Sethi, AhujaInderpreet Singh, Inderpreet Singh Ahuja. 2018. An empirical examination of critical barriers in transitions between technology push and demand pull strategies in manufacturing organizations. *World Journal of Science, Technology and Sustainable Development* **15**:3, 257-277. [Abstract] [Full Text] [PDF]
4. Ardian Qorri, Zlatan Mujkić, Andrzej Kraslawski. 2018. A conceptual framework for measuring sustainability performance of supply chains. *Journal of Cleaner Production* **189**, 570-584. [Crossref]
5. PanigrahiSwayam Sampurna, Swayam Sampurna Panigrahi, BahinipatiBikram, Bikram Bahinipati, JainVipul, Vipul Jain. Sustainable supply chain management. *Management of Environmental Quality: An International Journal*, ahead of print. [Abstract] [Full Text] [PDF]
6. Rafi-Ul-ShanPiyya Muhammad, Piyya Muhammad Rafi-Ul-Shan, GrantDavid B., David B. Grant, PerryPatsy, Patsy Perry, AhmedShehzad, Shehzad Ahmed. 2018. Relationship between sustainability and risk management in fashion supply chains. *International Journal of Retail & Distribution Management* **46**:5, 466-486. [Abstract] [Full Text] [PDF]
7. Hacer Güner Gören. 2018. A decision framework for sustainable supplier selection and order allocation with lost sales. *Journal of Cleaner Production* **183**, 1156-1169. [Crossref]
8. TuniAndrea, Andrea Tuni, RentizelasAthanasios, Athanasios Rentizelas, DuffyAlex, Alex Duffy. Environmental performance measurement for green supply chains. *International Journal of Physical Distribution & Logistics Management*, ahead of print. [Abstract] [Full Text] [PDF]
9. Michael Kühnen, Rüdiger Hahn. 2018. From SLCA to Positive Sustainability Performance Measurement: A Two-Tier Delphi Study. *Journal of Industrial Ecology* **13**. . [Crossref]
10. MishraDeepa, Deepa Mishra, GunasekaranAngappa, Angappa Gunasekaran, PapadopoulosThanos, Thanos Papadopoulos, DubeyRameshwar, Rameshwar Dubey. 2018. Supply chain performance measures and metrics: a bibliometric study. *Benchmarking: An International Journal* **25**:3, 932-967. [Abstract] [Full Text] [PDF]
11. Masha Menhat, Y Yusuf. 2018. Factors influencing the choice of performance measures for the oil and gas supply chain – exploratory study. *IOP Conference Series: Materials Science and Engineering* **342**, 012091. [Crossref]
12. Pradipta Patra. 2018. Distribution of profit in a smart phone supply chain under Green sensitive consumer demand. *Journal of Cleaner Production* . [Crossref]
13. Yuhuan Zhao, Ye Cao, Hao Li, Song Wang, Ya Liu, Yue Li, Yongfeng Zhang. 2018. Bullwhip effect mitigation of green supply chain optimization in electronics industry. *Journal of Cleaner Production* **180**, 888-912. [Crossref]
14. Tamara Popovic, Ana Barbosa-Póvoa, Andrzej Kraslawski, Ana Carvalho. 2018. Quantitative indicators for social sustainability assessment of supply chains. *Journal of Cleaner Production* **180**, 748-768. [Crossref]
15. SinglaAnuj, Anuj Singla, AhujaInderpreet Singh, Inderpreet Singh Ahuja, SethiAmanpreet Singh, Amanpreet Singh Sethi. An examination of effectiveness of technology push strategies for achieving

sustainable development in manufacturing industries. *Journal of Science and Technology Policy Management*, ahead of print. [Abstract] [Full Text] [PDF]

16. Wei Yan, Hengyu Li, Junwu Chai, Zhifeng Qian, Hong Chen. 2018. Owning or Outsourcing? Strategic Choice on Take-Back Operations for Third-Party Remanufacturing. *Sustainability* **10**:2, 151. [Crossref]
17. Deepak Mathivathanan, Devika Kannan, A. Noorul Haq. 2018. Sustainable supply chain management practices in Indian automotive industry: A multi-stakeholder view. *Resources, Conservation and Recycling* **128**, 284-305. [Crossref]
18. Claudia Pinna, Melissa Demartini, Flavio Tonelli, Sergio Terzi. 2018. How Soft Drink Supply Chains drive sustainability: Key Performance Indicators (KPIs) identification. *Procedia CIRP* **72**, 862-867. [Crossref]
19. Matloub Hussain, Raid Al-Aomar. 2017. A model for assessing the impact of sustainable supplier selection on the performance of service supply chains. *International Journal of Sustainable Engineering* **13**, 1-16. [Crossref]
20. Rakhi Das, Krishnendu Shaw. 2017. Uncertain supply chain network design considering carbon footprint and social factors using two-stage approach. *Clean Technologies and Environmental Policy* **19**:10, 2491-2519. [Crossref]
21. Elisabete Correia, Helena Carvalho, Susana Azevedo, Kannan Govindan. 2017. Maturity Models in Supply Chain Sustainability: A Systematic Literature Review. *Sustainability* **9**:12, 64. [Crossref]
22. Susana Garrido Azevedo, Helena Carvalho, Luís M. Ferreira, João C. O. Matias. 2017. A proposed framework to assess upstream supply chain sustainability. *Environment, Development and Sustainability* **19**:6, 2253-2273. [Crossref]
23. Morteza Yazdani, Pascale Zarate, Adama Coulibaly, Edmundas Kazimieras Zavadskas. 2017. A group decision making support system in logistics and supply chain management. *Expert Systems with Applications* **88**, 376-392. [Crossref]
24. D'AgostiniMarina, Marina D'Agostini, TondoloVilmar Antonio Gonçalves, Vilmar Antonio Gonçalves Tondolo, CamargoMaria Emília, Maria Emília Camargo, DulliusAngela Isabel dos Santos, Angela Isabel dos Santos Dullius, TondoloRosana da Rosa Portella, Rosana da Rosa Portella Tondolo, RussoSuzana Leitão, Suzana Leitão Russo. 2017. Relationship between sustainable operations practices and performance: a meta-analysis. *International Journal of Productivity and Performance Management* **66**:8, 1020-1042. [Abstract] [Full Text] [PDF]
25. Adriana Giret, Damien Trentesaux, Miguel A. Salido, Emilia Garcia, Emmanuel Adam. 2017. A holonic multi-agent methodology to design sustainable intelligent manufacturing control systems. *Journal of Cleaner Production* **167**, 1370-1386. [Crossref]
26. Zulfiquar N. Ansari, Ravi Kant. 2017. Exploring the Framework Development Status for Sustainability in Supply Chain Management: A Systematic Literature Synthesis and Future Research Directions. *Business Strategy and the Environment* **26**:7, 873-892. [Crossref]
27. K.T. Shibin, Angappa Gunasekaran, Rameshwar Dubey. 2017. Explaining sustainable supply chain performance using a total interpretive structural modeling approach. *Sustainable Production and Consumption* **12**, 104-118. [Crossref]
28. A. Rajeev, Rupesh K. Pati, Sidhartha S. Padhi, Kannan Govindan. 2017. Evolution of sustainability in supply chain management: A literature review. *Journal of Cleaner Production* **162**, 299-314. [Crossref]
29. Andreas Thöni, A Min Tjoa. 2017. Information technology for sustainable supply chain management: a literature survey. *Enterprise Information Systems* **11**:6, 828-858. [Crossref]

30. Huixiang Zeng, Xiaohong Chen, Xu Xiao, Zhifang Zhou. 2017. Institutional pressures, sustainable supply chain management, and circular economy capability: Empirical evidence from Chinese eco-industrial park firms. *Journal of Cleaner Production* **155**, 54-65. [Crossref]
31. Massimo Paolucci, Davide Anghinolfi, Flavio Tonelli. 2017. Facing energy-aware scheduling: a multi-objective extension of a scheduling support system for improving energy efficiency in a moulding industry. *Soft Computing* **21**:13, 3687-3698. [Crossref]
32. Ozden Tozanli, Gazi Duman, Elif Kongar, Surendra Gupta. 2017. Environmentally Concerned Logistics Operations in Fuzzy Environment: A Literature Survey. *Logistics* **1**:1, 4. [Crossref]
33. DubeyRameshwar, Rameshwar Dubey, GunasekaranAngappa, Angappa Gunasekaran, ChildeStephen J., Stephen J. Childe, PapadopoulosThanos, Thanos Papadopoulos, Fosso WambaSamuel, Samuel Fosso Wamba. 2017. World class sustainable supply chain management: critical review and further research directions. *The International Journal of Logistics Management* **28**:2, 332-362. [Abstract] [Full Text] [PDF]
34. Ali Pedram, Payam Pedram, Nukman Bin Yusoff, Shahryar Sorooshian. 2017. Development of closed–loop supply chain network in terms of corporate social responsibility. *PLOS ONE* **12**:4, e0174951. [Crossref]
35. Deepa Mishra, Angappa Gunasekaran, Thanos Papadopoulos, Benjamin Hazen. 2017. Green supply chain performance measures: A review and bibliometric analysis. *Sustainable Production and Consumption* **10**, 85-99. [Crossref]
36. Adolf Acquaye, Kuishuang Feng, Eunice Oppon, Said Salhi, Taofeeq Ibn-Mohammed, Andrea Genovese, Klaus Hubacek. 2017. Measuring the environmental sustainability performance of global supply chains: A multi-regional input-output analysis for carbon, sulphur oxide and water footprints. *Journal of Environmental Management* **187**, 571-585. [Crossref]
37. Melissa Demartini, Ilenia Orlandi, Flavio Tonelli, Davide Anguitta. A Manufacturing Value Modeling Methodology (MVMM): A Value Mapping and Assessment Framework for Sustainable Manufacturing 98-108. [Crossref]
38. Solange Garcia, Yara Cintra, Rita de Cássia S.R. Torres, Fabiano Guasti Lima. 2016. Corporate sustainability management: a proposed multi-criteria model to support balanced decision-making. *Journal of Cleaner Production* **136**, 181-196. [Crossref]
39. GERALDO CARDOSO OLIVEIRA NETO, FÁBIO YTOSHI SHIBAO, MOACIR GODINHO FILHO. 2016. THE STATE OF RESEARCH ON CLEANER PRODUCTION IN BRAZIL. *Revista de Administração de Empresas* **56**:5, 547-577. [Crossref]
40. Matloub Hussain, Mohsin Malik. 2016. Prioritizing lean management practices in public and private hospitals. *Journal of Health Organization and Management* **30**:3, 457-474. [Abstract] [Full Text] [PDF]
41. Eleftherios Iakovou, Dionysis Bochtis, Dimitrios Vlachos, Dimitrios Aidonis. Sustainable Agrifood Supply Chain Management 1-39. [Crossref]
42. Konrad Zimmer, Magnus Fröhling, Frank Schultmann. 2016. Sustainable supplier management – a review of models supporting sustainable supplier selection, monitoring and development. *International Journal of Production Research* **54**:5, 1412-1442. [Crossref]
43. Shradha Gawankar, Sachin Kamble, Rakesh Raut. 2016. Development, measurement and validation of supply chain performance measurement (SCPM) scale in Indian retail sector. *Benchmarking: An International Journal* **23**:1, 25-60. [Abstract] [Full Text] [PDF]
44. Ana M. Mejías, Enrique Paz, Juan E. Pardo. 2016. Efficiency and sustainability through the best practices in the Logistics Social Responsibility framework. *International Journal of Operations & Production Management* **36**:2, 164-199. [Abstract] [Full Text] [PDF]

45. Aino Halinen, Päivi Jokela. Exploring Ethics in Business Networks: Propositions for Future Research 333-356. [Crossref]
46. Marco Formentini, Paolo Taticchi. 2016. Corporate sustainability approaches and governance mechanisms in sustainable supply chain management. *Journal of Cleaner Production* **112**, 1920-1933. [Crossref]
47. Andrew C. Trapp, Joseph Sarkis. 2016. Identifying Robust portfolios of suppliers: a sustainability selection and development perspective. *Journal of Cleaner Production* **112**, 2088-2100. [Crossref]
48. Luis Miguel D. F. Ferreira, Cristóvao Silva. Integrating Sustainability Metrics in the Supply Chain Performance Measurement System 113-132. [Crossref]
49. Paolo Taticchi, Patrizia Garengo, Sai S. Nudurupati, Flavio Tonelli, Roberto Pasqualino. 2015. A review of decision-support tools and performance measurement and sustainable supply chain management. *International Journal of Production Research* **53**:21, 6473-6494. [Crossref]
50. Philip Beske-Janssen, Matthew Phillip Johnson, Stefan Schaltegger. 2015. 20 years of performance measurement in sustainable supply chain management – what has been achieved?. *Supply Chain Management: An International Journal* **20**:6, 664-680. [Abstract] [Full Text] [PDF]
51. Giacomo Liotta, Giuseppe Stecca, Toshiya Kaihara. 2015. Optimisation of freight flows and sourcing in sustainable production and transportation networks. *International Journal of Production Economics* **164**, 351-365. [Crossref]
52. Behnam Fahimnia, Joseph Sarkis, Hoda Davarzani. 2015. Green supply chain management: A review and bibliometric analysis. *International Journal of Production Economics* **162**, 101-114. [Crossref]
53. M. Gaggero, F. Tonelli. 2015. Optimal Control of Distribution Chains for Perishable Goods. *IFAC-PapersOnLine* **48**:3, 1049-1054. [Crossref]
54. Payman Ahi, Cory Searcy. 2015. An analysis of metrics used to measure performance in green and sustainable supply chains. *Journal of Cleaner Production* **86**, 360-377. [Crossref]
55. Roger Burritt, Stefan Schaltegger. 2014. Accounting towards sustainability in production and supply chains. *The British Accounting Review* **46**:4, 327-343. [Crossref]
56. Jisoo Oh, Bongju Jeong. 2014. Profit Analysis and Supply Chain Planning Model for Closed-Loop Supply Chain in Fashion Industry. *Sustainability* **6**:12, 9027-9056. [Crossref]
57. C.Z. Tessecino, A.T. Simon, P.F. Santos, R. Alexandre. 2014. Uma Análise Bibliométrica sobre a Gestão do Conhecimento na Área de Engenharia de Produção. *Revista de Ciência & Tecnologia* **17**:34, 93-111. [Crossref]
58. Philip Beske, Stefan Seuring. 2014. Putting sustainability into supply chain management. *Supply Chain Management: An International Journal* **19**:3, 322-331. [Abstract] [Full Text] [PDF]
59. Manasvi Kumar, Manoj Kumar Tiwari, Kuan Yew Wong, Kannan Govindan, Chuen Tse Kuah. 2014. Evaluating Reverse Supply Chain Efficiency: Manufacturer's Perspective. *Mathematical Problems in Engineering* **2014**, 1-9. [Crossref]
60. Kijpokin Kasemsap. The Role of Sustainable Performance Measurement System in Global Supply Chain 658-676. [Crossref]
61. Amulya Gurtu, Cory Searcy, Mohamad Y. Jaber. Sustainable Supply Chains 1-26. [Crossref]
62. Kijpokin Kasemsap. The Role of Sustainable Performance Measurement System in Global Supply Chain 331-348. [Crossref]