



## Full length article

## Sustainable supply chain modeling and analysis: Past debate, present problems and future challenges

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## ABSTRACT

For the last two decades, the topic of sustainable supply chains has evoked considerable interest from academics and practitioners. Within this context, Resources, Conservation and Recycling (RCR) and its two predecessors (Resources and Conservation, and Conservation and Recycling) have provided a platform for the exchange of technological, economic, institutional and policy aspects to help societies transition toward sustainability. The current article analyses the published research works in the RCR literature within the context of sustainable supply chain modeling by employing a content analysis literature review technique. Using the body of available literature in RCR, the articles on sustainable supply chain are analyzed in terms of the following: (1) publication per year, (2) top-cited papers across time, (3) most productive and influential authors, institutions and countries (4) supply chain related topical themes, (5) research methodologies applied, (6) illustration types and (7) industries addressed. The analysis revealed that the call for incorporating sustainability (i.e., economic, social, and environmental pillars) into supply chain operations has increased in recent years in RCR publications. Finally, the comprehensive findings and interpretations are presented, as well as the primary current trends, future challenges, directions and opportunities.

## 1. Introduction

Sustainability, which is the integration of environmental and social aspects with economic consideration, has become a popular buzzword among academic researchers and industrial practitioners (Brandenburg et al., 2014; Seuring and Müller, 2008). It has received increasing attention since the release of *Our Common Future* by Brundtland (1987) over two decades ago. Researchers and corporate managers have devoted many efforts toward sustainability integration, i.e., creating a culture of sustainability mindset (Galpin et al., 2015) and revisiting business models (Bocken et al., 2014; França et al., 2017). It has become apparent that it is vital for organizations to move forward and address not only sustainability issues internally (within the organization), but externally as well (Berning and Venter, 2015). Therefore, managing supply chains in a sustainable manner plays a vital role in addressing sustainability concerns in firms of all sizes and across a

broad spectrum of industries.

Consequently, many researchers have studied sustainable supply chain (SSC) in recent decades (Beske et al., 2014; Brandenburg et al., 2014; Craig and Easton, 2011; Ghadimi et al., 2016; Seuring, 2013; Seuring and Müller, 2008). Before discussing these issues in more detail, it is necessary to present the various definitions related to SSC that are included in the current literature (see Table 1). SSC is a concept that has evolved from the convergence of the perspectives of sustainability and supply chain (Seuring and Müller, 2008). Pagell and Shevchenko (2014) stated that a truly SSC had “no harm on social or environmental systems while maintaining economic viability.” An SSC requires awareness about sustainable practices such as ethical sourcing, green purchasing, environmental purchasing, and logistics social responsibility (Agrawal et al., 2015; Ghadimi et al., 2017a; Sarkis and Zhu, 2017).

This paper conducts a systematic literature review of SSCs with the

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**Table 1**  
Definitions related to sustainable supply chains.

Term	Definition	References
Sustainable supply chain (SSC)	A supply chain that not only simultaneously makes profit and achieves its potential, but also is one that is responsible to its consumers, suppliers, societies, and environments by innovative strategic, tactics and management technologies.	Kim et al. (2014)
Supply chain sustainability (SCS)	Management of environmental, social and economic impacts, and the encouragement of good governance practices, throughout the lifecycles of goods and services.	United Nations Global Compact (2011)
Sustainable supply chain management (SSCM)	The management of material, information and capital flows as well as cooperation among companies along the supply chain while taking goals from all three dimensions of sustainable development, i.e., economic, environmental and social, into account which are derived from customer and stakeholder requirements.	Seuring and Müller (2008)

goal of identifying related works on sustainable supply chain modeling and analysis in the Resources, Conservation and Recycling (RCR) publications. Thereafter, the related identified articles are analyzed to identify gaps, issues and opportunities for further research and development. Several theoretical analyses and reviews have been published over the years that examine various aspect of the SSC-related research, such as the conceptual framework of SSCM (Ahi and Searcy, 2013; Carter and Rogers, 2008; Pagell and Wu, 2009; Seuring and Müller, 2008; Svensson, 2007) and SSC practices/empirical examples (Beske et al., 2014). Among these identified papers in the related research, only two articles are modeling based reviews. Seuring (2013) performed a review of SSCM covering quantitative models on forward supply chains by reviewing 36 publications. Brandenburg et al. (2014) provided a review on quantitative, formal models that address sustainability aspects in the forward supply chain, which was based on 134 publications.

Our research study distinguishes itself from the previous two modeling-based literature reviews by (a) including reverse logistics (RL) and supply chain management articles, as RCR is one of the main venues to publish papers on societal, economic and technological change for improved recovery and reuse of materials and (b) reviewing articles solely from RCR dedicated to the legacy of RCR to celebrate its 30<sup>th</sup> anniversary. Although the published RCR research on this topic contains a relatively small proportion compared with the SSC studies published in other journals, RCR's published articles provide a small-scale version of how academic researchers within this domain have contributed. In addition, we will use this opportunity to share our own perspectives with regard to the addressed SSC-related themes in RCR and will provide suggestions regarding future enhancements that are needed in this research field.

The rest of this paper is structured as follows. Section 2 presents the motivation for conducting this study. Section 3 describes an overview of the research methodology in preparing this review article. Section 4 provides the details of various analyzed and discussed taxonomies together with the results of the analysis. The current trends, challenges and future directions gained after analyzing various articles with respect to various categories are discussed in Section 5. Finally, Section 6 presents the study's conclusions and outlines several limitations.

## 2. Motivation

In parallel to the increasing publications on SSC in logistics and supply chain management journals, this topic has shown a strong and continuous growth in RCR as well. In 2018, RCR will reach its 30th anniversary (or 43 years tracing back to the inception of Resource Recovery and Conservation), making it one the oldest journals in the sustainable management and conservation of resources field. The impact factor of RCR has shown a steady increase in recent years, which may coincide with increased global attention to environmental problems. In the literature, a series of special activities may be organized when the journal reaches an important milestone in the journal's development, such as a call for papers of an editorial (Dolgui, 2012), review articles (Sarkis and Zhu, 2017; Zou et al., 2017) or a bibliometric

(Cancino et al., 2017). To celebrate its 30th anniversary, RCR has organized a special issue calling for review papers specially regarding the four following topics.

- Resource efficiency and environmental impact analysis
- Resource recovery and waste utilization technologies and policies
- Environmental behavior studies
- Sustainable supply chain modeling and analysis

This paper seeks to contribute to the SSC modeling and analysis topic by reviewing and analyzing the related articles published in RCR over the past 43 years (1975–2017). Historically, the notion of a supply chain first appeared in RCR in 1993, when Pearce and Turner (1993) introduced the “dual system,” which involved mandatory waste collection and recovery systems across the SC that were established by the industrial sector and the normal municipal system. Phillips et al. (1999) studied the barriers to carrying out waste minimization initiatives in the East Midlands of England, and it was predicated that the current lowly ranked barrier was likely to become a more prominent issue in the years ahead. However, these two works focus on waste management, not directly on the management of the supply chain. In 2002, RCR published the first paper related to sustainable/green supply chains. Tsoufas et al. (2002) investigated the used starting, lighting and ignition (SLI) batteries sector and analyzed the different stages of the reverse supply chain of used SLI batteries, presenting the environment impact using a life cycle analysis methodology. Following those studies, the excellent work of authors, reviewers, and editors over the past 16 years have resulted in 61 research papers on the topic of SSC modeling and analysis in RCR.

## 3. Methodology

To identify the relevant publications for this review, the titles and abstracts of all published studies in RCR and its three predecessors, i.e., Conservation and Recycling, Resource Recovery and Conservation, and Resources and Conservation, have been reviewed. More specifically, the actual contents of the papers and their primary focus has been considered rather than using a keyword search approach. To prevent the exclusion of any publications, all the published papers from Volume 1, Issue 1 in Resource Recovery and Conservation (May 1975) to Volume 125 and articles in press in Resources, Conservation and Recycling (October 2017) have been reviewed carefully based on a pre-determined coding process (see Sub-section 3.2) and the SSC related articles have been included in the articles database.

### 3.1. Article database

The SSC modeling and analysis research started somewhat slowly in RCR and its predecessors. However, this trend also occurred in many other supply chain and industrial engineering journals. Relatively few articles with a focus on sustainable/green supply chain, production and operations were found between 1975–2002. A general overview of these papers is provided in Section 2. From 2002–2017, 61 published

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