MSCRA
1,1

Received 4 March 2019
Revised 18 April 2019
1 May 2019
Accepted 1 May 2019

Exploring the relationship between reverse logistics and sustainability performance

A literature review

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Abstract

Purpose – The implementation of reverse logistics (RL) as a strategic decision has gained significant attention amongst organisations due to its benefits to sustainable development. The purpose of this paper is to provide a comprehensive review of the literature to evaluate the performance of the RL process based on the three dimensions of sustainability including environmental, economic and social aspects.

Design/methodology/approach – Content analysis was adopted to collect and analyse the information.

Findings – The findings of this research show that most of the studies have focused on the performance evaluation of RL by considering the factors associated with economic and environmental performance. The social aspect of RL has been overlooked and requires investigation due to its contribution to positive social outcomes. In addition, no research has been conducted to assess the impact of each of the disposition options on the triple-bottom-line sustainability performance in one study.

Originality/value – Although RL can make a significant contribution to improving the sustainability performance of firms, little research has been undertaken on exploring the relationship between RL and sustainability performance. This paper provides practitioners, academics and researchers a broad and complete view of the relationship between RL and sustainability performance with suggestion for future research.

Keywords Reverse logistics, Sustainability, Sustainability performance, Economic, Environmental and social impact, Triple-bottom-line sustainability

Paper type Literature review

1. Introduction

Sustainability has become a strategic intent for almost all businesses in the twenty-first century because of its contribution to profitability and growth and even the survival of a business (Corbett and Klassen, 2006; Kolk and Pinkse, 2008). Sustainability in the supply chain has gained attention in recent years due to community concerns about the environment and organisations' adoption of "green" strategies and recognition of their social responsibility; the need to respond to legislation aimed to reduce environmental impacts; and the realities of challenging market and economic competition (Agrawal *et al.*, 2016b). Organisations can gain more profit and sustain their businesses over long term by adopting sustainability principles (Székely and Knirsch, 2005). Thus, developing practices that increase sustainability are considered to be a critical goal for organisations due to their contribution to competitive advantage (Hart, 2005; Pfeffer, 2010). Organisations need to

Modern Supply Chain Research and Applications
Vol. 1 No. 1, 2019
pp. 2-27
Emerald Publishing Limited
2631-3871
DOI 10.1108/MSCRA-03-2019-0009

evaluate and analyse the environmental and social performance of their business in addition to their economic performance (Agrawal *et al.*, 2016b).

Reverse logistics (RL) is a logistics function focusing on the backward flow of products from customers to suppliers (Hazen, 2011). RL is a crucial component of green supply chain management (GSCM) as it can help to reduce the waste generated by handling and disposition of returned and used products through employing a range of disposition options (Hervani *et al.*, 2005; Pokharel and Mutha, 2009). Product returns can occur for a number of reasons and at different places in the supply chain including manufacturing, distribution and customer-related returns (Rogers and Tibben-Lembke, 1999; Flapper, 2003). Product disposition involves activities associated with making a decision about what to do with used or returned products and this process is a key part of RL (Prahinski and Kocabasoglu, 2006). Reuse, repair, remanufacturing, recycling and disposal have been defined as the common disposition options of RL (Thierry *et al.*, 1995; De Brito and Dekker, 2002; Pokharel and Mutha, 2009).

Well-managed RL programs can lead to sustainable development and create a competitive advantage through increased profits, cost reduction and improvement in customer satisfaction (Rogers and Tibben-Lembke, 1999; Stock *et al.*, 2002). RL can produce both tangible and intangible benefits by recapturing value from used or returned products and extending the life of products, rather than purchasing more raw materials and wasting manpower and time. In addition, RL can play a key role in customer satisfaction and thus maintaining their loyalty by paying attention to fixing or replacing faulty products. Furthermore, RL can result in improvements in future products or new product designs by incorporating feedback from customers and understanding the reasons for product returns (Aitken and Harrison, 2013).

Much of the research so far has focused on the economic and environmental benefits of RL. There is a lack of research investigating the relationship between RL and sustainability and evaluating how RL can improve sustainability performance by integrating the three pillars of sustainability performance. This study reviews literature related to RL and sustainability performance and evaluates the performance of the RL process through three dimensions of sustainability, that is, the environmental, economic and social aspects. The remainder of this paper is organised as follow: the following section reviews different definitions of RL and its processes, and examines the difference between RL and forward logistics. Next, the three aspects of sustainability performance and their indicators are examined. The research methodology is presented in the next section, followed by a discussion of the relationship between RL and sustainable development. Finally, the paper summarises the discussion and concludes by suggesting future research.

2. RL processes

Over recent years, research on RL has increased significantly and its definition has changed over time. Murphy and Poist (1988) provided the earliest definition of RL by referring to the reverse flow of goods. Later the term "environment" appeared in the definition of RL by Carter and Ellram (1998) and they considered RL to be an environmentally friendly approach. RL has been defined as "The term most often used to refer to the role of logistics in product returns, source reduction, recycling, materials substitution, reuse of materials, waste disposal, and refurbishing, repair and remanufacturing" (Stock, 1998, p. 20). This definition refers to different disposition options in the RL process. RL is also defined as "the process of planning, implementing, and controlling the efficient, cost-effective flow of raw materials, in-process inventory, finished goods and related information from the point of consumption to the point of origin for the purpose of recapturing value or proper disposal" (Rogers and Tibben-Lembke, 1999, p. 2). They created the most widely accepted definition of RL by introducing the purpose of RL.

Significant difference exists between RL and forward logistics in terms of process and purpose (Tibben-Lembke and Rogers, 2002). RL deals with the activities associated with taking back products from customers for recapturing value through reprocessing or proper disposal, while forward logistics contains the activities that are necessary to get products to the customers. Most of the research on supply chain and logistics management has focused on forward logistics, while RL has been neglected (Stock *et al.*, 2002; Bernon and Cullen, 2007).

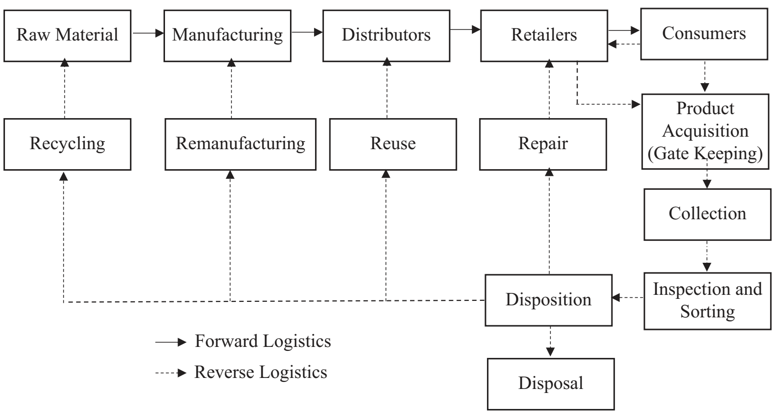
RL and forward logistic processes are illustrated in Figure 1. RL starts with the end users (consumers in Figure 1) from whom the used or returned products are collected, moved through product acquisition at which stage the products are inspected and sorted into various groups. The next step is to make an appropriate disposition decision including reuse, repair, remanufacturing or recycling for recapturing value or disposal. The key RL processes include product acquisition, collection, inspection/sorting and disposition (Rogers and Tibben-Lembke, 1999; Fleischmann *et al.*, 2000; Guide and Wassenhove, 2003).

2.1 Product acquisition/gate keeping

The process of acquiring used products from the end users for further processing is known as product acquisition. This is an important consideration with respect to the success of RL because of uncertainty regarding time, quantity and quality of used products (Agrawal *et al.*, 2015). Gate keeping is a set of decisions about whether products must be sent for further processing or given back to the consumer, and is usually implemented by retailers (Agrawal *et al.*, 2015).

2.2 Collection

Collection is the process of collecting products after the acquisition and sending them to other facilities for inspection, sorting and disposition. Kumar and Putnam (2008) categorised collection methods into three groups: manufacturers directly collecting from customers, manufacturers collecting returned products via retailers and manufactures collecting products through third-party logistics. The selection of collection methods is dependent on cost structure and quantities (Atasu *et al.*, 2013). The selection of collection centres and recovery facilities must be involved in designing RL if it is to operate efficiently (Pochampally and Gupta, 2004).



Source: Adapted from Agrawal *et al.* (2015, p. 78)

Figure 1.
Fundamental flow of RL and forward logistics processes

2.3 Inspection and sorting

Products are inspected and sorted after collection. Product returns may be manufacturing, distribution or customer related (Rogers and Tibben-Lembke, 1999; Guide and Wassenhove, 2003) and they may differ greatly in terms of quality and condition. Thus, it is necessary to inspect the products separately for sorting into different groups for disposition (Agrawal *et al.*, 2015).

2.4 Disposition

Once the products are inspected and sorted, the next phase is to make decisions for their disposition. Product disposition is a key component in the RL process (Prahinski and Kocabasoglu, 2006). The set of available disposition options commonly includes reuse, repair, remanufacturing, recycling and disposal (Thierry *et al.*, 1995; Fleischmann *et al.*, 1997; De Brito and Dekker, 2002; Mutha and Pokharel, 2009). These are described below:

> Reuse requires only minor inspection, cleaning and maintenance (Fleischmann *et al.*, 2000) without disassembly, reprocessing and reassembly activities (Matsumoto, 2010). This process requires less work in comparison with other options (Fleischmann *et al.*, 2000).
>
> Repair denotes the process of repairing and servicing products and returning them to customers (Fleischmann *et al.*, 2000).
>
> Remanufacturing is related to material recovery from products with high value (Blackburn *et al.*, 2004). The process of replacing obsolete or faulty parts with new or refurbished ones is incorporated under this term. In this process, the identity and functionality of the original product materials are maintained (Eltayeb *et al.*, 2011). Remanufactured products are redistributed and sold into the potential market. Companies need to identify the proper markets for these products, choosing between selling them alongside new products, via discount stores, in secondary markets or donating them to charity (Rogers and Tibben-Lembke, 1999).
>
> Recycling is related to material recovery from products with low value (Blackburn *et al.*, 2004) and involves processes to extract reusable materials from used products. The identity and functionality of the original product materials are lost (Khor *et al.*, 2016). Recycling is chosen when the original product or component can be used for another product or subassembly (Skinner *et al.*, 2008).
>
> Disposal is the process of incinerating products or components or using them for landfill. Disposal is chosen when the products cannot be sold or reused and the other options of disposition are not effective (Khor *et al.*, 2016).

3. Sustainability performance

Sustainability has become a strategic issue for firms (Álvarez-Gil *et al.*, 2007; Lee and Lam, 2012). From a triple-bottom-line perspective, sustainability is considered to be the integration of environmental, economic and social objectives that provides a balance between the three aspects (Elkington, 2001; Carter and Rogers, 2008; Gunasekaran and Spalanzani, 2012). Nowadays firms are understood to have responsibilities for the environment and society. As Hubbard (2009) stated, almost 75 per cent of large international organisations are under pressure to consider sustainability issues and to develop non-financial measures of performance in addition to traditional ones. Generally, sustainable development is considered as a critical goal for organisations due to its impact on achieving long-term competitiveness (Hart, 2005; Pfeffer, 2010) and sustainability has made firms rethink their strategies and situation in the market (Lubin and Esty, 2010; Lee and Lam, 2012). The sections below elaborate each of the sustainability dimensions. In addition, Tables III and VI are provided in Sections 5.1 and 5.3 to summarise the key sustainability performance indicators in the context of RL.

3.1 Environmental performance and measurement

Judge and Douglas (1998) described the environmental performance of an organisation as its commitment to environmental excellence in order to meet expectations of society regarding environmental concerns. Environmental performance of an organisation is regarded as its capability to contribute to reductions in air and water pollution and solid waste, and its ability to reduce consumption of harmful, hazardous, and toxic materials and the frequency of environmental accidents (Zhu *et al.*, 2008). Maxwell and Van der Vorst (2003) mentioned that environmental performance of an organisation can be measured by several indicators such as reduction in energy and material consumption, decrease in air and water pollution and minimisation or elimination of waste generation and use of toxic and harmful materials.

3.2 Economic performance and measurement

The economic performance of an organisation mainly focuses on its profitability and growth (Judge and Douglas, 1998). Daugherty *et al.* (2005) indicated that the economic performance of RL can be evaluated by using indicators such as recapturing value from products, cost containment, reduction in inventory investment, and improved profitability and labour productivity.

Diabat *et al.* (2013) categorised economic practices into those that contribute to positive or negative economic performance. They defined benefits obtained through GSCM practices such as cost reduction in purchasing materials, energy consumption, and waste treatment, and reduction of discharge and environmental accidents as positive economic contributors. On the other hand, they defined costs related to the adoption of GSCM practices including costs of investment and purchasing environmentally friendly materials, operational and training cost as negative economic outcomes. While it may seem that adopting GSCM practices is costly and has a negative impact on economic performance in the short time, it can contribute to improvement in other performance in the long term (Diabat *et al.*, 2013).

3.3 Social performance and measurement

Social performance is defined as "a business organisation's configuration of principles of social responsibility, processes of social responsiveness, and policies, programs and observable outcomes as they relate to the firm's societal relationships" (Wood, 1991, p. 693). Social performance refers to a company's apparent engagement with issues related to social responsibility (Wood, 1991) such as quality of management, health and safety issues, wages and benefits, equal opportunities policy, training/education, child labour, forced labour, freedom of association, and human rights and services (Dixon *et al.*, 2005; DETR, 1999). Safety and health issues, disturbance, access and equity were defined as social indicators by DETR (1999). Sarkis *et al.* (2010) examined some social indicators such as internal human resources, external population, stakeholder participation and macro social issues. Researchers have suggested that the social aspect of sustainability is underexplored and worthy of further study (Seuring and Müller, 2008; Gold *et al.*, 2010; Seuring, 2013).

4. Research methodology

The content analysis method was adopted for conducting the literature review in this paper due to its suitability for observational research and the ability to systematically evaluate the symbolic content of all forms of recorded documents (Kolbe and Burnett, 1991). The content analysis method also helps researchers to identify and analyse the literature to form different categories (Li and Cavusgil, 1995) which can contribute to developing a realm of research opportunities (Berelson, 1952; Kolbe and Burnett, 1991).

This review only includes the papers published in scholarly journals and conferences in English between 1990 and 2019. This excludes the articles published in other languages.

Databases were used to search for related articles, including Google Scholar (scholar.google.com.au), Science Direct (www.sciencedirect.com), Scopus (www.scopus.com), Emerald (www.emeraldinsight.com), Taylor & Francis (taylorandfrancis.com), Springer (www.springer.com/gp), Web of Science (www.webofknowledge.com) and ProQuest (www.proquest.com). The keywords used for the search were "Reverse Logistics", "Sustainability", "Sustainability performance", "Sustainable development" and "Performance evaluation". The keywords were applied to the title and abstract in the search and sorted by relevance. Articles that have focused on RL network design and modelling were not included if they do not consider the implementation of RL. In total, 416 papers were collected and after checking the content and relevance of papers, 43 papers were selected and reviewed.

The annual distribution of selected papers is shown in Figure 2. From 1990 to 2004, no articles have been published on exploring the relationship between RL and sustainability performance. There was a peak in 2013 with seven papers published in the year. Since then, the annual publication number has maintained at a relatively high level due to the increasing interest of researchers in this subject.

The number of articles published by different journals is shown in Table I. Among them, the *International Journal of Production Economics* is the leading journal with seven papers, followed by the *Journal of Cleaner Production* with three papers and *International Journal of Physical Distribution & Logistics* with two papers. The rest of the papers are distributed in other journals. The selected papers were classified into three categories: papers investigating RL from the perspective of GSCM and sustainability performance; papers evaluating RL performance in general without considering the RL processes and disposition options; and papers focusing on different RL disposition options and sustainability performance.

5. Discussion and findings

5.1 RL and sustainable development in the context of GSCM

The natural environment has become a challenging issue for business organisations due to global environmental problems and climate change. In response, organisations have been trying to minimise their impact on the environment (Beamon, 1999). The concept of a green supply chain reflects the responsibility that a firm has towards the environment from purchasing raw materials up to final use and disposal of its products (Hart, 1997). The aim of the green supply chain is to eliminate or minimise waste of materials and energy and negative environmental impacts through all steps of a product's life cycle

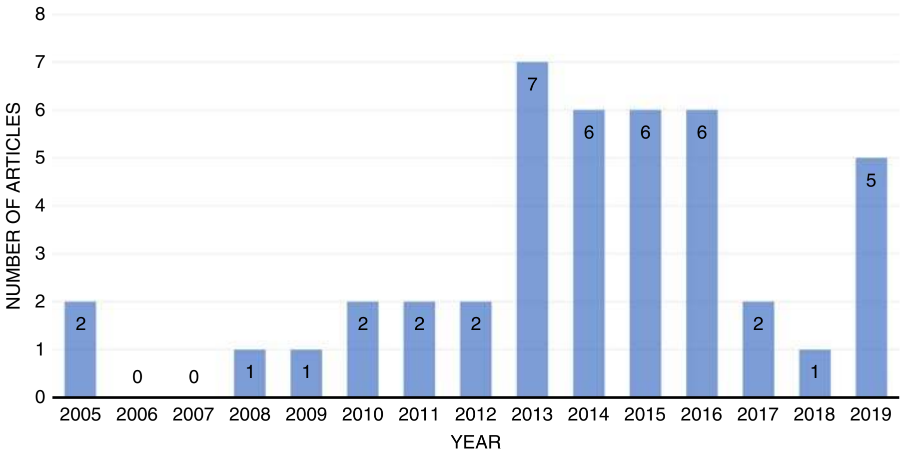


Figure 2.
Annual distribution of papers across the period of the study

Source: journals/conference	Number of articles
International Journal of Operations & Production Management	1
International Journal of Production Economics	7
International Journal of Physical Distribution & Logistics	2
International Journal of Services and Operations Management	1
International Journal of Fuzzy Systems	1
International Journal of Environmental Science and Technology	1
International Journal of Supply Chain and Logistics	1
Journal of Cleaner Production	3
Journal of Statistics and Management Systems	1
Journal of Modelling in Management	1
Expert Systems with Applications	1
Transportation Research Part E	1
Resources, Conservation and Recycling	1
International Journal of Advanced Manufacturing Technology	1
Industrial Management & Data Systems	1
Competitiveness Review	2
International Journal of Environmental Technology and Management	1
Computers in Industry	1
Management Research Review	1
European Business Review	1
Corporate Social Responsibility and Environmental Management	1
Supply Chain Forum: An International Journal	1
Research-Technology Management	1
Sustainability (Switzerland)	1
Sustainability science	1
Waste Management & Research	1
American Journal of Mechanical and Industrial Engineering	1
Conferences	6

Table I.
Number of articles published by main journals

(Hervani *et al.*, 2005). RL is considered as one of the green supply chain practices and some scholars investigated the effect of RL from the perspective of the GSCM along with other practices on different aspects of sustainability and performance outcomes.

Some studies claim a positive relationship between adopting RL and economic performance (Rao and Holt, 2005; Tippayawong *et al.*, 2015). For example, the first empirical study carried out by Rao and Holt (2005) evaluated potential links between RL and improving competitiveness and economic performance amongst a sample of leading-edge ISO14001 certified companies in South East Asia. This research illustrated that greening the inbound function as well as the production phase resulted in greening the outbound phase, which led to significant improvements in competitiveness and economic performance. In another study, the positive influence of RL as one of the green logistics practices on Thai Electronic firms' financial performance was investigated (Tippayawong *et al.*, 2015). Other studies found that, in addition to economic performance outcomes, adopting RL along with other GSCM practices results in positive performance outcomes in social and operational areas (e.g. Eltayeb *et al.* (2010).

While there are several studies investigating the relationship between RL and other GSCM practices and performance outcomes, the findings are not conclusive as they differ across several industries. While Younis *et al.* (2016) found a significant positive relationship between RL and social performance, Geng *et al.* (2017) found no relationship between the two. Contrastingly, Geng *et al.* (2017) and Diabat *et al.* (2013) found a positive connection between RL and environmental performance, while Younis *et al.* (2016) found no such relationship. Wu *et al.* (2015) claimed that the recovery and recycling system had the most significant effect on economic performance, while Schoenherr (2012) found that recycling does not have any significant effect on economic performance. Table II presents the papers that investigated the effect of RL in the context of GSCM on each dimension of the triple-bottom-line sustainability performance, and Table III shows the relevant sustainability indicators. Table IV is a combination of Tables II and III to provide a holistic picture of RL and its respective impact on each dimension of the sustainability performance in the perspective of GSCM through relevant indicators.

5.2 RL and sustainable development

RL can make a significant contribution to improving the sustainability performance of firms through, for example, its impact on cost savings (Jack *et al.*, 2010); increased revenue from sales of recovered and remanufactured products (Mollenkopf and Closs, 2005); improved customer satisfaction by acting in a socially and environmentally responsible manner (Glenn Richey *et al.*, 2005; Li and Olorunniwo, 2008); improved customer loyalty by paying more attention to faulty products (Aitken and Harrison, 2013); and its positive effect on climate change and global warming by taking back products and reducing their carbon footprint (Carter and Rogers, 2008).

Efficient and sustainable RL can create competitive advantage through cost savings in procurement, inventory carrying, distribution and transportation (Li and Olorunniwo, 2008; Srivastava and Srivastava, 2006; Kannan *et al.*, 2009), positive impact on environmental performance (Huang *et al.*, 2010) and improving corporate image (Carter and Ellram, 1998). In order to ensure sustainable RL, firms have to continuously monitor and evaluate their RL performance. However, only a small number of studies consider sustainability issues from the RL point of view and examine their possible interrelations. It would be beneficial to investigate the relationship between RL and sustainable development (Govindan, Soleimani and Kannan, 2015; Govindan and Soleimani, 2017). In addition, the social aspects of sustainability, especially their application to RL, are less explored and there is a need for research (Vahabzadeh and Yusuff, 2015; Sarkis *et al.*, 2010; Geng *et al.*, 2017; Wang *et al.*, 2017).

Implementing RL has been shown to have significant impacts on organisations' environmental and economic performance (Ye *et al.*, 2013; Huang and Yang, 2014; Huang *et al.*, 2015). Wanjiku and Mwangangi (2019) investigated the influence of RL on the performance of the food and beverage industry in Kenya. de Oliveira Neto and de Sousa (2014) investigated the implementation of RL in a supermarket business using observations and semi-structured interviews and found that the supermarket gained both environmental and economic advantages. Ye *et al.* (2013) also reported RL advantages in environmental and economic outcomes in their study of Chinese

Author	RL Economic	Environmental	Social
Wu *et al.* (2015)	✓	✓	✓
Govindan, Khodaverdi and Vafadarnikjoo (2015)	✓	✓	
Azevedo *et al.* (2011)	✓	✓	✓
Eltayeb *et al.* (2011)	✓	✓	✓
Diabat *et al.* (2013)	✓	✓	✓
Laosirihongthong *et al.* (2013)	✓	✓	✓
Govindan *et al.* (2014)	✓	✓	✓
Geng *et al.* (2017)	✓	✓	✓
Younis *et al.* (2016)	✓	✓	✓
Eltayeb *et al.* (2010)	✓	✓	✓
Abdel-Baset *et al.* (2019)	✓	✓	

Table II.
RL and sustainability performance in the perspective of GSCM

Table III. Sustainability indicators (RL and sustainability performance in the perspective of GSCM)

Authors	Sustainability indicators Economic: Reduced cost	Profitability	Delivery improvement	Sales growth	Return on investment	Productivity improvement	Market share growth	Efficiency	Quality improvement	Inventory reduction
Wu *et al.* (2015)	✓		✓						✓	
Govindan, Khodaverdi and Vafadarnikjoo (2015)		✓				✓	✓			
Azevedo *et al.* (2011)	✓							✓	✓	
Eltayeb *et al.* (2011)	✓	✓		✓		✓				
Diabat *et al.* (2013)	✓		✓						✓	✓
Laosirihongthong *et al.* (2013)	✓	✓								
Geng *et al.* (2017)		✓	✓	✓			✓		✓	✓
Younis *et al.* (2016)	✓		✓		✓		✓		✓	
Eltayeb *et al.* (2010)	✓	✓	✓	✓		✓	✓	✓	✓	

Authors	Sustainability indicators Environmental: Reduced energy and resource consumption	Waste reduction	Reduction in pollution	Reduction of hazardous and toxic materials	Compline with environmental regulations	Decrease of frequency for environmental accidents	Firm's Environmental image
Wu *et al.* (2015)	✓	✓	✓				
Govindan, Khodaverdi and Vafadarnikjoo (2015)	✓	✓	✓	✓			
Azevedo *et al.* (2011)		✓					

(*continued*)

Eltayeb *et al.* (2011)	✓		✓	✓	✓					
Diabat *et al.* (2013)		✓	✓	✓		✓	✓			
Laosirihongthong *et al.* (2013)	✓		✓	✓	✓					
Geng *et al.* (2017)	✓	✓	✓							
Younis *et al.* (2016)	✓	✓	✓	✓		✓	✓			
Eltayeb *et al.* (2010)			✓		✓					
	Sustainability indicators Social									
Authors	Customer satisfaction	Firm's corporate image	Stakeholders' satisfaction	Customer loyalty	Customer satisfaction	Product image	Health and safety of employees	Social commitment	Employee job satisfaction	Preserve environment
Wu *et al.* (2015)	✓									
Govindan, Khodaverdi and Vafadarnikjoo (2015)										
Azevedo *et al.* (2011)	✓									
Eltayeb *et al.* (2011)		✓								
Diabat *et al.* (2013)		✓	✓							
Laosirihongthong *et al.* (2013)		✓		✓	✓	✓				
Geng *et al.* (2017)		✓		✓	✓	✓	✓			
Younis *et al.* (2016)		✓					✓	✓	✓	✓
Eltayeb *et al.* (2010)		✓								

Table III.

Table IV.
A holistic picture of RL and its respective impact on each dimension of the sustainability performance in the perspective of GSCM through relevant indicators

	Sustainability indicators Economic									
GSCM practice	Reduced cost	Profitability	Delivery improvement	Sales growth	Return on investment	Productivity improvement	Market share growth	Efficiency	Quality improvement	Inventory reduction
RL	7	5	5	3	1	3	4	2	6	2
	Sustainability indicators Environmental									
GSCM practice	Reduced energy and resource consumption	Waste reduction	Reduction in pollution	Reduction of hazardous and toxic materials	Compline with environmental regulations	Decrease of frequency for environmental accidents	Firm's environmental image			
RL	6	6	8	5	3	2	2			
	Sustainability indicators Social									
GSCM practice	Customer satisfaction	Firm's corporate image	Stakeholders' satisfaction	Customer loyalty	Customer satisfaction	Product image	Health and safety of employees	Social commitment	Employee job satisfaction	Preserve environment
RL	2	6	1	2	2	2	2	1	1	1

Note: The number in each cell refers to the number of articles researched manufacturing firms with a further study in Taiwan, demonstrating RL's positive effect on environmental and economic performance (Huang *et al.*, 2015).

In order to stimulate research related to social sustainability and RL in the literature, Sarkis *et al.* (2010) developed a profile of RL for social sustainability by referring to practical examples from industries to identify the potential social benefits of RL. They developed four categories: internal human resources (practices associated with employment stability, health and safety); external population (human, productive and community capital); stakeholder participation (information provision and stakeholder influence issues); and macro social issues (socio-economic and socio-environmental performance).

In another study, Nikolaou *et al.* (2013) proposed an integrated model according to the triple-bottom-line performance indicators to measure the corporate social responsibility of RL. There are a few studies that consider social criteria to evaluate RL performance (Jindal and Sangwan, 2013; Agrawal *et al.*, 2016b; Ahmed *et al.*, 2016). Jindal and Sangwan (2013) developed a model to evaluate RL network models based on the triple bottom line of sustainability. They utilised fuzzy AHP approach to compute the weight of economic, environmental and social criteria and then used fuzzy TOPSIS to rank the RL network alternatives. After analysing the results from a case in the automobile industry, they found that economic criteria had the highest weight amongst other criteria. Agrawal *et al.* (2016b) also found that economic performance had the highest importance in evaluating RL performance, followed by environmental and social performance. Most previous studies have focused on evaluating RL performance in general without considering the processes associated with RL. In particular, little attention has been given to the disposition decisions in RL (Agrawal *et al.*, 2016a; Khor *et al.*, 2016).

5.3 RL disposition options and sustainable development

Since there are different disposition options of RL with different impact on a company's sustainable development, some scholars explored the impact of RL disposition options on different aspects of sustainability performance in order to present an approach for selecting the appropriate one (Skinner *et al.*, 2008; Agrawal *et al.*, 2016a; Ahmed *et al.*, 2016; Khor *et al.*, 2016; Jindal and Sangwan, 2016). For example, Haji Vahabzadeh *et al.* (2015) examined the impact of RL disposition options on only one of the sustainability dimensions, i.e. environmental dimension. They considered six disposition options and five environmental indicators to analyse and rank the influences of each RL disposition options on each environmental indicator by using the FUZZY_VIKOR method. They found that disposal and reselling the returned products were the best and worst disposition options, respectively. However, the final conclusion could have been more compelling if the economic and social dimensions of RL had also been considered and analysed.

Some scholars investigated the economic performance of RL implementation and disposition options as well as environmental performance (Ye *et al.*, 2013; Huang and Yang, 2014; Khor *et al.*, 2016). For instance, Khor *et al.* (2016) studied the effect of RL disposition options (repair, recondition, remanufacture, recycle and disposal) on profitability and sales growth as well as environmental performance in Malaysian electrical and electronic equipment manufacturing firms. They considered the institutional theory and identified the effect of regulatory and ownership pressure on the relationship between disposition options and business performance. The study revealed that in the absence of regulatory pressure, only repair and recycling were profitable for these organisations while remanufacturing had a significant impact on sales growth. Also, it should be noted that ownership pressure can create improvements in all aspects of performance, especially for product recondition and remanufacturing activities. Overall, they concluded that RL implementation could contribute to improvements in business performance, especially in the presence of institutional pressures.

The effect of different disposition strategies of RL on economic and operational performance was investigated in another study by Skinner *et al.* (2008). They developed a conceptual model to investigate the effect of different disposition strategies on strategic performance (economic and operational performance). They also explored the role of returns policy in the customer's shopping decisions and the influence of resource commitment (technological, managerial and financial resources) as a moderator. The results of this research illustrated that only destroying and recycling strategies impact on RL performance outcomes directly from the operational responsiveness aspect. While destroying returned goods had a positive effect on operational responsiveness, recycling had a negative influence. This study was limited to economic and operational factors.

Some scholars have utilised multi-criteria decision-making (MCDM) methods for evaluating RL networks and dispositions options (Jindal and Sangwan, 2013; Jindal and Sangwan, 2016; Agrawal *et al.*, 2016a). A fuzzy MCDM framework was developed by Jindal and Sangwan (2016) in order to select the product disposition process. In this study, the evaluation of different types of disposition options (repair, refurbishing, remanufacturing, cannibalising and recycling) was conducted according to operating cost, value-added recovery, environmental impact, market demand, technical/operational feasibility and corporate responsibility. Fuzzy AHP and fuzzy TOPSIS were utilised to calculate the weight of evaluation criteria and ranking the disposition options, respectively. After conducting a case example, they found that operating cost had the highest importance, followed by value-added recovery, market demand, technical/operational feasibility, environmental impact and corporate social responsibility. By considering these results, repair was the best option due to the low operating cost (repair needs low initial investment and degree of disassembly), high value-added recovery, high technical/operational feasibility and low environmental impact (repair consumes less resource and produces less waste).

Also, in another study, Agrawal *et al.* (2016a) presented a fuzzy MCDM framework for selecting the best disposition options in RL among recycling, reuse, remanufacturing, repairing and disposal. According to the literature review and discussion with experts, economic benefits, environmental benefits, corporate social responsibility, stakeholder's needs and RL resources were determined as main criteria for selecting disposition options.

There are few studies focusing on disposition decisions in RL process but no comprehensive study was found that explored the various disposition options and offered a method for selecting the most appropriate one (Agrawal *et al.*, 2016a). There is a research gap that investigates the impact of different RL disposition options on sustainable development by considering economic, environmental and social measures. For instance, Ahmed *et al.* (2016) developed a model to evaluate and select the best end-of-life vehicles (ELVs) management alternatives considering sustainable criteria (economic, environmental, social and technology). The results show that recycling was the best option in this particular industry. Financial benefits as sub-criteria in the economic dimension were the most important criteria in selecting the best ELVs management alternatives. They mentioned that it would be better if they collected data from multiple industries.

As mentioned before, reuse, repair, remanufacturing, recycling and disposal are the common disposition options in RL and some scholars have investigated the effect of each of them on different sustainability aspects separately. According to the critical discussion in Sections 5.2 and 5.3, Tables V and VI are derived. The two tables show papers that investigated the RL system in general or disposition options and their effects on each dimension of the triple-bottom-line sustainability performance and their relevant sustainability indicators, respectively. Further, Table VII combines Tables V and VI to show a holistic picture of the RL system and disposition options and their respective impact on each dimension of the sustainability performance through relevant indicators.

Authors	Reuse	Repair	Remanufacturing	Recycling	Disposal	RL system
	The RL system and disposition options and sustainability performance					
	Economic					
	RL disposition options					
Authors	Reuse	Repair	Remanufacturing	Recycling	Disposal	RL system
Keh *et al.* (2012)						✓
de Oliveira Neto and de Sousa (2014)						✓
Ye *et al.* (2013)						✓
Huang *et al.* (2015)						✓
Agrawal *et al.* (2016b)						✓
Yu *et al.* (2018)						✓
Vahabzadeh *et al.* (2015)						
Khor *et al.* (2016)		✓	✓	✓	✓	
Skinner *et al.* (2008)			✓	✓	✓	
Jindal and Sangwan (2016)		✓	✓	✓		
Agrawal *et al.* (2016a)	✓	✓	✓	✓	✓	
Ahmed *et al.* (2016)	✓	✓	✓	✓		
Hart *et al.* (2005)						
Kang (2015)						
Oliveira and Magrini (2017)						
Chen *et al.* (2009)				✓		
Wibowo *et al.* (2014)				✓		
Sabharwal and Garg (2013)			✓			
Yalabik *et al.* (2014)			✓			
Zanghelini *et al.* (2014)						
O'Connell *et al.* (2013)	✓					
Bahrami and Jafari (2019)						
Wanjiku and Mwangangi (2019)	✓			✓		
Nußholz and Whalen (2019)	✓					
Oliveira Neto and Correia (2019)				✓		
	The RL system and disposition options and sustainability performance					
	Environmental					
	RL disposition options					
Authors	Reuse	Repair	Remanufacturing	Recycling	Disposal	RL system
Keh *et al.* (2012)						✓
de Oliveira Neto and de Sousa (2014)						✓
Ye *et al.* (2013)						✓
Huang *et al.* (2015)						✓
Agrawal *et al.* (2016b)						✓
Yu *et al.* (2018)						✓
Vahabzadeh *et al.* (2015)		✓	✓	✓	✓	
Khor *et al.* (2016)		✓	✓	✓	✓	
Skinner *et al.* (2008)						
Jindal and Sangwan (2016)		✓	✓	✓		
Agrawal *et al.* (2016a)	✓	✓	✓	✓	✓	
Ahmed *et al.* (2016)	✓	✓	✓	✓		
Hart *et al.* (2005)				✓		
Kang (2015)				✓		
Oliveira and Magrini (2017)				✓	✓	
Chen *et al.* (2009)				✓		
Wibowo *et al.* (2014)				✓		
Sabharwal and Garg (2013)						
Yalabik *et al.* (2014)			✓			
Zanghelini *et al.* (2014)			✓	✓	✓	
O'Connell *et al.* (2013)	✓					
Bahrami and Jafari (2019)				✓		
Wanjiku and Mwangangi (2019)						
Nußholz and Whalen (2019)						
Oliveira Neto and Correia (2019)				✓		

(*continued*)

Table V. Investigating the RL system or disposition options and their effect on each dimension of the triple-bottom-line sustainability performance

Authors	The RL system and disposition options and sustainability performance Social RL disposition options Reuse	Repair	Remanufacturing	Recycling	Disposal	RL system
Keh *et al.* (2012)						✓
de Oliveira Neto and de Sousa (2014)						
Ye *et al.* (2013)						
Huang *et al.* (2015)						
Agrawal *et al.* (2016b)						✓
Yu *et al.* (2018)						
Vahabzadeh *et al.* (2015)						
Khor *et al.* (2016)						
Skinner *et al.* (2008)						
Jindal and Sangwan (2016)		✓	✓	✓		
Agrawal *et al.* (2016a)	✓	✓	✓	✓	✓	
Ahmed *et al.* (2016)	✓	✓	✓	✓		
Hart *et al.* (2005)						
Kang (2015)						
Oliveira and Magrini (2017)						
Chen *et al.* (2009)				✓		
Wibowo *et al.* (2014)				✓		
Sabharwal and Garg (2013)						
Yalabik *et al.* (2014)						
Zanghelini *et al.* (2014)						
O'Connell *et al.* (2013)	✓					
Bahrami and Jafari (2019)						
Wanjiku and Mwangangi (2019)	✓			✓		
Nußholz and Whalen (2019)						
Oliveira Neto and Correia (2019)						

Table V.

6. Conclusions

This paper presented a comprehensive review of the literature to evaluate the performance of the RL process based on the three dimensions of sustainability including environmental, economic and social aspects. The content analysis approach was adopted to systematically collect the relevant information from the papers published in academic journals and conferences from the period of 1990–2019. The findings of the review show that when RL is investigated in the context of GSCM, it is studied as a single factor without considering the relationship between the various RL processes and ignoring the different disposition options and their possible performance outcomes. Also, it is compared to other GSCM practices with more attention being paid to its environmental performance and contributions to economic and social benefits being overlooked. Furthermore, only a small number of studies have investigated RL in the context of sustainability and their interrelationship. There is a need to examine the relationship between RL and sustainable development. In addition, the social aspect of sustainability of RL has been largely overlooked.

Moreover, most of the previous studies have focused on evaluating RL performance in general without considering the RL process. While product disposition is a key component of RL, little attention is given to the disposition decisions in RL and their potential impact on sustainability performance. Since there are different disposition options during the RL process, an evaluation of how each disposition option would impact on sustainability performance would enable firms to make informed decisions on choosing the appropriate disposition options. Making an appropriate disposition decision leads to extending the product's life and can achieve many goals of sustainable development. Future research

Table VI. Sustainability indicators (the RL system and disposition options and sustainability performance)

Authors	Sustainability indicators Economic Reduced cost	Profitability	Recovery of assets	Return on investment	Market share growth	Reduction in inventory investment	Recapturing value	Recycle Efficiency	Sales growth	Enhanced company's market competitiveness	Quality
Keh *et al.* (2012)	✓	✓									
Ye *et al.* (2013)	✓	✓	✓		✓	✓				✓	
Huang *et al.* (2015)	✓	✓	✓			✓					
Agrawal *et al.* (2016b)	✓			✓			✓	✓	✓		
Vahabzadeh *et al.* (2015)											
Khor *et al.* (2016)	✓	✓	✓		✓	✓			✓		
Skinner *et al.* (2008)	✓	✓	✓			✓					
Jindal and Sangwan (2016)	✓						✓				✓
Ahmed *et al.* (2016)	✓										
Wibowo *et al.* (2014)		✓			✓						
Wanjiku and Mwangangi (2019)		✓			✓						

(continued)

Table VI.

Authors	Sustainability indicators Reduced energy and resource	Stretching environmental impact beyond compliance	Reduction in pollution	Waste reduction	Compline with environmental regulations	Environmental Environmental commitment	Firm's environmental image	Land use and biodiversity	Decrease of frequency for environmental accidents	Recognition or reward for superior environmental performance	Green technology innovation
Keh *et al.* (2012)	✓				✓	✓					
Ye *et al.* (2013)			✓		✓	✓	✓				
Huang *et al.* (2015)		✓			✓		✓				
Agrawal *et al.* (2016b)	✓		✓	✓							
Vahabzadeh *et al.* (2015)			✓	✓				✓			
Khor *et al.* (2016)			✓	✓		✓	✓		✓	✓	
Skinner *et al.* (2008)											
Jindal and Sangwan (2016)	✓			✓							
Ahmed *et al.* (2016)	✓		✓		✓	✓					
Wibowo *et al.* (2014)					✓			✓			✓
Wanjiku and Mwangangi (2019)											

(*continued*)

Authors	Sustainability indicators Social								
	Community complaints	Customer health and safety	Stakeholders participation	Employment stability and employee benefits	Donations to community	Job creation or preservation	Health and safety of employees	Customer satisfaction and loyalty	Firm's corporate image
Keh *et al.* (2012)						✓			
Ye *et al.* (2013)									
Huang *et al.* (2015)									
Agrawal *et al.* (2016b)	✓	✓	✓	✓	✓				
Vahabzadeh *et al.* (2015)									
Khor *et al.* (2016)									
Skinner *et al.* (2008)									
Jindal and Sangwan (2016)						✓			
Ahmed *et al.* (2016)				✓		✓	✓	✓	
Wibowo *et al.* (2014)							✓		✓
Wanjiku and Mwangangi (2019)								✓	

Table VI.

Table VII. A holistic picture of the RL system and disposition options and their respective impact on each dimension of the sustainability performance through relevant indicators

The RL system and disposition options	Sustainability indicators Economic: Reduced cost	Profitability	Recovery of assets	Return on investment	Market share growth	Reduction in inventory investment	Recapturing value	Recycle Efficiency	Sales growth	Enhanced company's market competitiveness	Quality
RL disposition options											
Reuse	1	1	0	0	1	0	0	0	0	0	0
Repair	4	2	2	0	1	2	1	0	1	0	1
Remanufacturing	4	2	2	0	1	2	1	0	1	0	1
Recycling	4	4	2	0	3	2	1	0	1	0	1
Disposal	2	2	2	0	1	2	0	0	1	0	0
RL system	4	3	2	1	1	2	1	1	1	1	0

The RL system and disposition options	Sustainability indicators Environmental: Reduced energy and resource	Stretching environmental impact beyond compliance	Reduction in pollution	Waste reduction	Compline with environmental regulations	Environmental commitment	Firm's environmental image	Land use and biodiversity	Decrease of frequency for environmental accidents	Recognition or reward for superior environmental performance	Green technology innovation
RL disposition options											
Reuse	1	0	1	0	1	1	0	0	0	0	0
Repair	2	0	3	3	1	2	1	1	1	1	0
Remanufacturing	2	0	3	3	1	2	1	1	1	1	0
Recycling	2	0	3	3	2	2	1	2	1	1	1
Disposal	0	0	2	2	0	1	1	1	1	1	0
RL system	2	1	2	1	3	2	2	0	0	0	0

(*continued*)

Table VII.

The RL system and disposition options	Sustainability indicators Social								
	Community complaints	Customer health and safety	Stakeholders participation	Employment stability and employee benefits	Donations to community	Job creation or preservation	Health and safety of employees	Customer satisfaction and loyalty	Firm's corporate image
RL disposition options									
Reuse	0	0	0	1	0	1	1	2	0
Repair	0	0	0	1	0	2	1	1	0
Remanufacturing	0	0	0	1	0	2	1	1	0
Recycling	0	0	0	1	0	2	2	2	1
Disposal	0	0	0	0	0	0	0	0	0
RL system	1	1	1	1	1	1	0	0	0

Note: The number in each cell refers to the number of articles researched should focus on finding empirical evidence on how each of the disposition options may impact on the sustainability performance, examining all disposition options in the same context, comparing the differences between different industries and using the triple-bottom-line approach for measuring sustainability performance.

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