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Resource commitment and sustainability: a reverse logistics performance process model

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Abstract

Purpose – The purpose of this paper is to extend existing and motivate future sustainable supply chain management (SCM) and logistics research by examining a structure-conduct-performance framework linking resource commitment to sustainable SCM, reverse logistics, and operational performance. A sustainable reverse logistics capability is investigated as mediating the performance benefits associated with resource commitments to sustainable SCM.

Design/methodology/approach – Survey methods and structural equation modeling were used to collect and analyze data from 180 supply chain professionals.

Findings – The results of a mediated model suggest that resource commitments may be used to develop a sustainable reverse logistics capability, reducing the environmental impact of reverse logistics activities. A strong sustainable reverse logistics capability results from resources committed specifically to sustainable reverse logistics and a commitment to the sustainability of the supply chain.

Research limitations/implications – This study applied a purposefully general sampling procedure. Specific industries may have additional constraints (e.g. risk, transparency, governance factors) that directly impact reverse logistics. These constraints are limitations of the study as well as opportunities for future research. Resource commitment is critical to the success of an overall firm strategy to build a sustainable supply chain, especially when considering reverse logistics.

Practical implications – As managers examine the benefits of sustainable SCM, they must consider the resources required. For firms engaging in sustainable SCM, developing a sustainable reverse logistics capability is a key success factor for improved performance.

Originality/value – Given the growing acceptance and importance of sustainable SCM, this research provides insights to managers and academics regarding the key mediating role of a sustainable reverse logistics capability when integrated into existing and future supply chain research frameworks and processes.

Keywords Sustainability, Mediation, Capability, Operational performance, Reverse logistics, Resource-based view, Resource commitment, Structure conduct performance

Paper type Research paper

Introduction

As firms search for revenue, profits, and cost savings in an increasingly competitive environment, reverse logistics has shown to be an area of complexity and promise. According to the National Retail Federation, returns cost US retailers more than $260 billion in 2016 (Hufford, 2017). Given the considerable impact to company bottom lines, supply chains have become increasingly interested in addressing the economic impact of reverse logistics. This monetary consideration includes both the aspect of reclaimed value from returned products and the cost of sustainable logistics program operations (e.g. cost to the environment due to shipping, wasted production, processing of trash) for the returned products

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(Douglas, 2016). Therefore, it is important for both researchers and supply chain managers to better understand the strategic link between sustainable reverse logistics and higher levels of operational performance.

The importance of sustainability as a growing research focus in supply chain management (SCM) is evident given the burgeoning number of research studies on the topic of sustainable SCM (Alexander *et al.*, 2014). Within this body of research, it is common for sustainability to be considered as an opportunity for supply chains to enhance social, environmental, and economic performance (Carter and Easton, 2011; Carter and Rogers, 2008). Our manuscript focuses on sustainability as an environmental factor and considers the role that sustainable supply chain structures play in achieving an ecological balance through reverse logistics. Specific to reverse logistics, researchers have long been interested in evaluating the effectiveness of processes and programs (Daugherty *et al.*, 2001; Wang *et al.*, 2017). In a seminal study, Rogers and Tibben-Lembke (2001) define reverse logistics as the reverse flow of goods from the point of consumption to the point of origin. By design, reverse logistics may offer environmental sustainability benefits through "returns to resell, refurbish, recondition, remanufacture, cannibalize for parts, or recycle products to minimize landfill waste"[1] (Bilodeau, 2013). Examining the overlap of reverse logistics with sustainable supply chain practices, sustainable reverse logistics is defined as those operational activities that minimize the use of natural resources during the reverse flow of goods through recycling, remanufacturing, and reusable packaging (e.g. Rogers and Tibben-Lembke, 2001). Embracing this definition, studies of reverse logistics with an environmental focus have been referenced as "green logistics" or "green reverse logistics" (e.g. Hazen *et al.*, 2011; Rogers and Tibben-Lembke, 2001). Similar to our study, Hazen *et al.* (2011) focused on the recycling, remanufacturing, and reuse of products to address the environmental impact of reverse logistics. We look to make a contribution to the literature by making the direct connection between the study and metrics used to evaluate reverse logistics practices (e.g. Stock and Mulki, 2009) and sustainable reverse logistics practices.

Reverse logistics was established as an important part of the consensus definition of SCM (see Stock and Boyer, 2009). Too often research focusing on sustainable SCM has failed to explicitly include reverse logistics (Seuring and Müller, 2008). Ignoring reverse logistics is inconsistent with previously developed supply chain frameworks (Lambert *et al.*, 2005). Early in the development of theory supporting the benefits associated with reverse logistics, the environmental goals of reverse logistics were noted as complementary to economic outcomes (Dowlatshahi, 2000). Moreover, a review of the existing sustainable supply chain literature determined that reverse logistics is part of sustainability due to the aspects of recycling and green supply chain issues (Winter and Knemeyer, 2013).

Sustainable reverse logistics has also been investigated through a modeling approach where environmental concerns are balanced against other supply chain objectives (Ramos *et al.*, 2014). Researchers have made calls for research to address "how reverse logistics can contribute to the sustainability efforts of the firm" (Morgan *et al.*, 2016, p. 308). We look to fill this gap in the literature by adding further clarity to the key role a sustainable reverse logistics capability plays. As such, this research provides empirical evidence to address the importance of sustainable reverse logistics as a key component of a successful supply chain strategy. The related operational performance benefits are assessed through data collected from 180 supply chain professionals.

Since the late 1990s, a variety of research approaches (e.g. case studies, modeling, literature reviews) have been used to understand sustainable supply chains (Winter and Knemeyer, 2013). Yet, the implementation of reverse logistics practices, particularly as related to sustainability, remains unclear for many firms today. It is expected that incorporating reverse logistics practices can act as part of a broader sustainable SCM strategy (Ansari and Qureshi, 2015). Over the last several years, important research calls have been published searching for extensive investigation of sustainability issues in existing paradigms of SCM and logistics (Sarkis *et al.*, 2010; Stock *et al.*, 2010; Wang *et al.*, 2017). According to Genchev *et al.* (2011), the strategic underpinnings of sustainable reverse logistics programs deserve "considerable attention by future scholars." Likewise, Carter and Easton (2011) point to the need for continued theory building around sustainable SCM.

Research questions

In this study, we extend existing sustainable supply chain and (reverse) logistics research through the lens of a structure-conduct-performance (SCP) framework. Based on the SCP framework, this study examines the link between structuring a strategy that supports both sustainable reverse logistics and higher levels of operational performance. In doing so, this study incorporates the resource-based view (RBV) of the firm embedded within the SCP framework, suggesting that firms can structure their sustainable reverse logistics strategies through appropriate resource commitment. Inherently, a sustainable reverse logistics capability is comprised of two aspects: sustainability (strategic) and reverse logistics (operational). While often the case, it is not a requirement that reverse logistics always be environmentally sustainable. Therefore, it is important to examine the resource commitments to those reverse logistics environmental practices that focus on recycling, remanufacturing, and reuse. Indicators of the firm's structure that support a sustainable reverse logistics capability include the commitment of resources (e.g. financial, managerial, technological, and physical) to sustainability policy. These commitments then facilitate the conduct of the firm's sustainable reverse logistics practices that may be associated with higher levels of operational performance. Thus, in combination with SCP and RBV, the specific research questions are as follows:

RQ1. To what extent does committing resources to sustainable SCM impact the development of sustainable reverse logistics?

RQ2. Do sustainable reverse logistics and related resource commitments impact supply chain operational performance?

We will greatly expand this discussion in the sections that follow as we introduce the SCP paradigm and RBV perspective as theoretical frameworks grounding process-based hypotheses that elaborate upon each research question. A review of previous literature and support for these hypotheses are presented. Afterward, the methodology is described with details provided regarding our sample. Finally, implications for managers and theory are discussed, with multiple opportunities for future research suggested.

Theoretical background and hypothesis development

SCP paradigm

The principal thesis of the SCP paradigm (Bain, 1956) suggests that external structural traits of an industry have a significant impact on firms' strategic decisions – called conduct – toward achieving superior performance. According to Caves and Porter (1977), the structure is developed collectively by incumbent firms in an industry with the goal of building effective processes and setting entry barriers for newcomers. Furthermore, structure is a dynamic set of characteristics that can be disrupted by new entrants. Therefore, SCP paradigm theorists (Porter, 1980; Caves and Porter, 1977) suggest that individual firms may make investments within and across the supply chain for the collective good of the industry while establishing entry barriers against new entrants. The extent to which these entry barriers are set for new entrants is the main determinant of the firm's strategic conduct. Conduct may include installation and utilization of capacity, distribution of supplies and finished goods, promotional and pricing policies, and research and development (McWilliams and Smart, 1993). In a case where an industry's structure starts shifting toward a contemporary concept like sustainable logistics, an individual firm would have to take action to build a strength in that area to gain a competitive advantage and maintain superior performance.

Structure in a supply chain context may take many forms. Information technology use, outsourcing (Chow *et al.*, 1995), automation (Ellinger *et al.*, 1998), rule formalization, centralization of authority, vertical integration (Stank *et al.*, 2005), and the development of a logistics capability can each be considered an element of structure in supply chains (Stock *et al.*, 1998). More specifically, Defee and Stank (2005) undertook a broad review of the topic and concluded that supply chain structure can be found in widely accepted capabilities of technology integration, communications, and decision making.

A firm's infrastructure is intrinsically linked to supply chain structure. Infrastructure is considered the underlying map of interdependencies an organization confronts over a given time period as it engages in business activities (Fombrun, 1986). The culture, systems, and processes of the supply chain are inherent in its firm-linking infrastructure. Importantly, core competencies (Prahalad and Hamel, 1990) and capabilities (Day, 1994) are the most valuable parts of infrastructure and will be described in more detail shortly.

Recent SCM applications of the SCP paradigm focus on various factors in which individual firms make investments to develop a collective structure that helps to determine their strategic conduct for higher performance. Ralston *et al.* (2015) report that integration is an important structural trait for supply chains that leads to conduct involving quick response strategies and results in higher operational and financial performance. Similarly, Nakano (2015) reveals that investments in formal supply chain departments are considered an internal structural element that leads to conduct of combined efficient and responsive supply chain strategies. In both cases, the researchers take the view that individual firms make investments in specific structural factors to develop collective capital for their supply chain.

This study follows the SCP approach suggesting that firm resources committed to sustainable SCM through reverse logistics create structures within and across the supply chain that result in improved performance. In accordance with the sustainable SCM framework developed by Carter and Rogers (2008), we define commitment to sustainable SCM as the allocation of organizational resources to achieve the sustainability goals of the individual company within a supply chain. These organizational resource commitments may include dedicated workforce time, defined responsibilities and objectives, and employee training to support sustainable SCM strategies. Creating an internal collective structure for the firm to conduct its strategy requires obtaining logistics employees' buy-in concerning the strategy, training employees to achieve sustainability goals, and presenting employees with clear objectives and responsibilities.

From the reverse logistics perspective, additional resources are dedicated to operate the reverse flow of goods from the consumer back to manufacturers. Firm resources may be classified under the four previously mentioned categories: financial, managerial, technological, and physical (Das and Teng, 1998). Managing the reverse flow of goods requires transportation vehicles (physical resources), software to track the flow of goods (technological resources), a workforce to oversee the operation (managerial resources), and financial resources to cover the cost of the operation. Menon and Menon (1997) suggest that firms will dedicate substantial resources to sustainable strategies if it is determined that doing so provides them with a potential competitive advantage. Therefore, firms may structure their resources toward achieving a competitive advantage by committing higher levels of these types of resources toward sustainable reverse logistics. Consequently, we define commitment to sustainable reverse logistics as the allocation of individual firm financial, managerial, technological, and physical resources to achieve the sustainable objectives of recycling, remanufacturing, and reuse. Grounded in SCP theory, the organizational structure variables discussed above (commitment to sustainable SCM and commitment to reverse logistics) support the potentially effective conduct of a sustainable reverse logistics capability, which in turn is argued to lead to higher levels of operational performance.

We propose that the conduct step in SCP can be described using the RBV concept of capabilities. A capability is formed through the combination of firm resources that are judged to be valuable, rare, inimitable, and non-substitutable (Barney, 1991). These complex resource bundles are comprised of unique combinations of skills, knowledge, and assets that may be aligned in unique ways in order to produce a competitive advantage (Miller, 2003; Olavarrieta and Ellinger, 1997). Firms that are able to leverage resources toward specific programs are likely to create superior performance.

We specifically examine a reverse logistics capability that is sustainable. A reverse logistics capability "represents the organization's ability to develop ways to respond to changing customer requirements" through the management of reverse logistics processes (Genchev *et al.*, 2010; p. 12). This capability arises from organizational processes within a supply chain's reverse logistics program(s) (Daugherty *et al.*, 2005). Extant research has addressed these processes as information technology management, innovation, and responsiveness (Richey *et al.*, 2005). Adapting this concept to recent sustainability literature (e.g. Busse and Mollenkopf, 2017; Timmer and Kaufmann, 2017; Canzaniello *et al.*, 2017; Normann *et al.*, 2017), we define a sustainable reverse logistics capability as the organization's ability to develop ways of responding to changing partner, customer, and environmental sustainability requirements by way of reverse logistics process management.

In combination, SCP and the capabilities perspective augmented by RBV create a process model for understanding performance resulting from the creation of a sustainable supply chain returns strategy. Here, the focus is on a key mediating variable we call a sustainable reverse logistics capability. We expect that commitments of resources to sustainability programs and reverse logistics will offer firms the opportunity to cultivate a sustainable reverse logistics capability. We also expect that a sustainable reverse logistics capability is key to changing reverse logistics processes from a cost center to a profit center.

Our analysis tests a mediated model as depicted in Figure 1. Following the SCP framework, commitment to sustainable SCM and commitment to sustainable reverse logistics comprise the structural variables that influence the conduct of sustainable reverse logistics, which in turn leads to higher levels of operational performance. In the broadest sense, making the

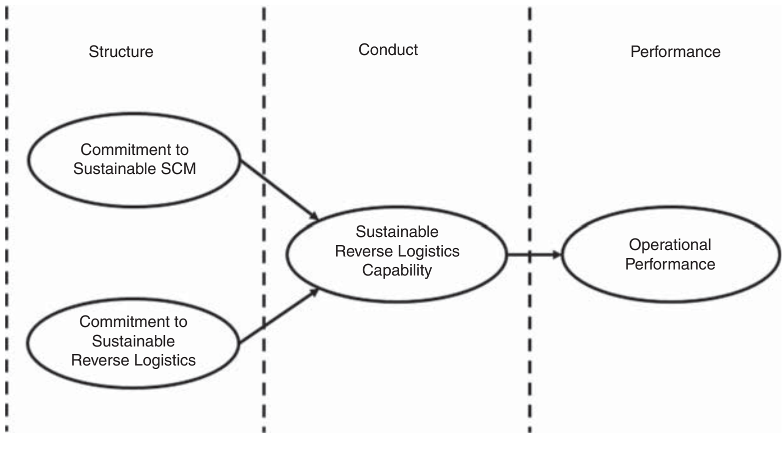


Figure 1.
Theoretical model

necessary resource commitments to develop supply chain processes (structure) requires a capability (conduct) to elicit a superior outcome (performance). Therefore, a mediated model is proposed to test the links between the variables.

Relationship between organizational structure and sustainable reverse logistics

Sustainable practices have become an essential element of SCM as firms look to use sustainability to generate a collaborative advantage (Gold *et al.*, 2010). When introducing and/or adapting strategic elements into the supply chain, management must consider setting well-defined expectations and allocating adequate support. Firms committed to sustainable SCM must have clearly stated sustainability goals and provide employees with adequate training and education to work toward achieving sustainability (Closs *et al.*, 2011).

Reverse logistics has been closely linked to many sustainable supply chain elements. Reduce, reuse, remanufacture, and recycle have played an extensive role in many traditional sustainability efforts providing a gateway for firms engaging in sustainable reverse logistics (Kumar *et al.*, 2017). While reverse logistics is not always required for a supply chain to be sustainable or environmentally friendly, the result of bringing products back and thus reducing the consumption of raw materials is commonly associated with environmental consciousness (Defee *et al.*, 2009). In fact, the president of Reverse Logistics Association suggests, "Reverse logistics is inherently green […] Repairing, refurbishing, or recycling a product instead of throwing it in a landfill automatically does good for Mother Earth" (Partridge, 2010). Moreover, recent academic studies addressing sustainability through reverse logistics have found positive associations with the environmental impact of the firm (Hsu *et al.*, 2016).

In industry, IKEA's commitment to sustainable SCM and reverse logistics has recently received best-in-class accolades. According to an article by Lee (2016), IKEA commits considerable managerial and organizational resources to sustainable supply chain practices and as a result explores reverse logistics programs like "taking old bookshelves, old furniture, or an old door that's finished its first life and sending it into new products. You'll have a kitchen that used to be a bookshelf, without seeing any visible difference in them. It's not a revolution, but you have to actually fundamentally change your supply chain to do that[2]." At IKEA, these types of sustainable reverse logistics practices are the result of providing resources to a chief sustainability officer who defines sustainability objectives, responsibilities, and expectations for the company and promotes a culture of sustainability within the company. Therefore, the following relationship is hypothesized:

H1. Commitment to sustainable SCM is positively related to a sustainable reverse logistics capability.

The commitment of resources for reverse logistics has also been found to positively influence the achievement of operational goals (Daugherty *et al.*, 2001). The deployment of resources allows the firm to setup the structure to support the conduct it wishes to undertake. Firms often find that incorporating sustainable reverse logistics practices into their supply chain is difficult and may become a barrier to achieving sustainable SCM (Ansari and Qureshi, 2015). Thus, firms focusing on sustainable supply chain strategies may benefit from also having the necessary resources allocated to engaging in sustainable activities. According to Sarkis *et al.* (2010), "implementation of internal [reverse logistics] programs often incorporates significant allocations of capital and resources for the construction of reclamation and redistribution facilities and the purchase of recycling equipment" (p. 348).

Previous research supports the formalization of reverse logistics processes to ensure that benefits are realized (e.g. reduced costs, increased revenues, improved customer satisfaction) (Genchev *et al.*, 2011; Rogers *et al.*, 2002). As part of the findings from their qualitative research, Genchev *et al.* (2010) argue "[…] that resources must be allocated to developing reverse logistics programs to avoid the potential negative impact on the bottom line. Conversely, if adequate resources (tangible/intangible or property-based/knowledge-based) are targeted to reverse logistics programs, it can have tremendous positive financial impact as well as important relational implications" (p. 20).

For instance, the mobile electronics producer, Palm Inc., activated a reverse logistics program to refurbish returned inventory and resell through secondary channels such as Overstock.com (Partridge, 2011). This sustainable reverse logistics program allowed Palm to decrease processing costs by 50 percent and recover up to 80 percent of the retail sales price for the returned goods. This story of success at Palm, where a sustainable reverse logistics capability resulted in higher levels of operational performance, was a consequence of resource commitments to reverse logistics. Palm's initiative required physical resources where the refurbishing of returned inventory took place; technological resources to refurbish the retuned inventory; managerial resources to oversee the activities; and financial resources to cover the cost of the program. Therefore, the following relationship is hypothesized:

H2. Commitment to sustainable reverse logistics is positively related to a sustainable reverse logistics capability.

Relationship between sustainable reverse logistics and operational performance

The SCP paradigm depicts performance as resulting from the strategic conduct of the firm. Conduct is equated with implementing plans to achieve strategic goals while performance is the evaluation of how well the goals are met (Chandler, 1962). Thus, performance is the measurable outcome of strategic conduct and supported by structural implementation. Therefore, the organizational objectives identified for the implementation of an individual firm's supply chain structure lead to effective conduct that in turn leads to potential achievement of operational and financial goals (Defee and Stank, 2005). Applying the SCP paradigm to sustainable SCM, successful reverse logistics programs have been associated with positive performance measures (e.g. logistics performance (Morgan *et al.*, 2016), economic performance and environmental performance (Huang and Yang, 2014)).

We follow Zhu *et al.*'s (2008) approach to measure operational performance by assessing the amount of improvement an individual firm achieves on such logistics outcomes as delivery time, inventory levels, and capacity utilization as a result of implementing a sustainable supply chain strategy. Remanufacturing and recycling often provide cost-effective alternatives when compared to the sourcing of new raw materials for use in the supply chain. For instance, electronics retailer, Best Buy, developed a program for its repair parts reverse logistics. The technology developed for these types of programs helped technicians to determine immediately if a product's condition is eligible for remanufacturing or is unusable (Partridge, 2010). The program resulted in a reduced carbon footprint and allowed Best Buy to cut millions of dollars each year in transportation costs for un-reusable defective parts. Therefore, the following relationship is hypothesized:

H3. A sustainable reverse logistics capability is positively related to operational performance.

Methods

Sample and data collection

A preliminary survey instrument was created using the approach recommended by Dillman (2000) and Fanning (2005). This instrument was then pretested by four academics experienced in the field of SCM. A final draft of the measurement instrument was hosted online with participants recruited by a survey research firm. A profile was developed to target potential respondents with extensive knowledge of their firm's supply chain operations.

Survey administration followed recommendations of Schoenherr *et al.* (2015). We note that despite some past concerns, recent research has recognized that the use of survey research firms to recruit participants in SCM studies is growing and similar type of recruitment has an established history of publication in other academic disciplines such as marketing and accounting (Schoenherr *et al.*, 2015).

The survey research firm targeted participants working in job roles that unambiguously engaged in supply chain practices. In total, 1,719 respondents viewed the survey and 1,542 agreed to participate. Before beginning the survey, the respondents were provided a definition of sustainable SCM and asked to affirm "yes" or "no" to the question: "Does your firm engage in some form of sustainable SCM?" Those individuals who answered "no" were redirected and not allowed to complete the survey, resulting in 467 remaining qualified respondents. Additional steps were included to ensure that participants were carefully taking the survey. Attention filter questions were embedded among survey items and asked participants the following: "to verify your spot in the survey, please mark 'strongly disagree' for this question." Respondents who did not mark "strongly disagree" were considered to not be conscientiously taking the survey. These two attention filters assisted with identifying participants for removal from the analysis due to their threat to data quality (Smith *et al.*, 2016). The elimination of responses that failed the attention filler question resulted in a further reduction of the sample size of 214.

Prior to analysis, the researchers also considered the length of time the participant utilized to complete the survey. Participants who completed the survey in less than three minutes were removed for not thoughtfully reviewing the survey, resulting in the removal of an additional 19 participants. Another four individuals were removed for taking over 12 hours to take the survey. Three individuals were removed because they did not finish the survey. Following Van Vaerenbergh and Thomas (2013), response style bias was evaluated in the sample with four participants being removed for response style issues (e.g. yea-saying) concerned with repeating the same response over large blocks of questions without discrimination. In addition to an initial screening of job titles prior to participation in the survey, four respondents were removed in our post-survey review of job titles. As a result, the final sample of 180 responses represents a 39 percent participation rate for those who were qualified for admission to the survey. The job titles of the participants include a range of positions that interact with supply chain functions in the firm (e.g. operations analyst, VP production, Sr. quality engineer). In the sample, 107 participants indicated that they work in the manufacturing industry. The other 73 participants were spread among several other supply chain positions (e.g. 3PL, aftermarket retail, wholesale/distribution, retail).

Measures

The development of the survey instrument followed the guidelines from Malhotra and Grover (1998) for conducting survey research. All variables originate from extant research and were adapted to the SCM context of the study. The variables utilized in this research project are described here and listed in Table AI. Commitment to sustainable SCM is adapted from the Rizzo *et al.* (1970). Respondents were asked to rate their level of agreement (1 = strongly disagree; 7 = strongly agree) regarding how the firm has addressed commitment to sustainable SCM strategy using six items. Commitment to sustainable reverse logistics is adapted from Daugherty *et al.* (2001) and measures the allocation of financial, technological, physical, and managerial resources for sustainable reverse logistics. A sustainable reverse logistics capability was measured using eight items adapted from Banerjee (2002). Respondents were asked to rate their level of agreement (1 = strongly disagree; 7 = strongly agree) regarding how the firm has incorporated sustainable reverse logistics in their strategic conduct. Operational performance is measured using a six-item scale adapted from Zhu *et al.* (2008) and evaluates operational performance improvement since implementing sustainable supply chain activities. Regarding the constructs of interest, the survey also included the following definitions: "Sustainable supply chain management is defined as integrating environmental thinking into supply chain management. This may include product design, material sourcing and selection, manufacturing processes, delivery of the final product to the consumers, as well as end-of-life management of the product after its useful life." "Sustainable reverse logistics is defined as recycling, remanufacturing, and reuse." Please see Table I for the construct descriptive statistics.

In addition to the measures mentioned above, two control variables were added to the model: firm size and industry (i.e. manufacturing vs nonmanufacturing). Previous research suggests that larger firm size and specific industries may indicate higher levels of resource commitments and may lead to higher performance levels (Tokman *et al.*, 2007; Dai *et al.*, 2015; Zaremba *et al.*, 2016). Therefore, these two variables were added to control for potential confounding effects.

In order to assess discriminant validity, correlations between variables were compared to the square root of the AVEs (Fornell and Larcker, 1981). In all cases, the square root of the AVEs were larger than the correlations, supporting discriminant validity (see Table I). In order to assess convergent validity, standardized factor loadings for each item were observed. The item factor loadings were all above 0.50 threshold (Hair *et al.*, 2006) and significant ($p < 0.001$), suggesting convergent validity (see Table AI). In addition, the AVEs for the latent variables ranged between 0.647 and 0.849, also suggesting convergent validity (<50 percent variance explained; Hatcher, 1994). Cronbach's α was used to examine reliability of the measures and the results ranged from 0.923 to 0.957, suggesting adequate construct reliability (Cronbach, 1951). Finally, the fit statistics for the measurement model all exceeded thresholds for acceptable fit ($\chi^2 = 396.114$; df = 238; CFI = 0.963; TLI = 0.958; RMSEA = 0.061). In some instances, error terms within constructs were allowed to correlate.

Analyses and results

In order to test the proposed SCP model, AMOS 23.0 structural equation path analysis tool was used to examine mediation between structure variables and operational performance through conduct of sustainable reverse logistics. In assessing the mediated relationships between variables, it is essential to examine both direct and indirect effects. While the direct effects are those that exist between two specific variables, the indirect effects are the links between two variables that are facilitated by other variables. For instance, in a fully mediated relationship, the direct effects between structure and performance variables are expected not to be significant but the indirect effects mediated by the conduct of sustainable reverse logistics should be significant. The Baron and Kenny (1986) approach to assessing mediation requires a comparison of direct effects from structural variables to a performance variable with and without the conduct variable (mediator); the Zhao *et al.* (2010) approach takes the aforementioned approach one step further to assess indirect effects through bootstrapped model paths. The mediation assessment results are summarized in Table II.

	Mean	SD	CSSCM	CSRL	SRLC	OP
CSSCM	5.277	1.123	0.838			
CSRL	4.518	1.385	0.636**	0.921		
SRL	4.977	1.173	0.654**	0.719**	0.826	
OP	3.438	0.972	0.610**	0.557**	0.589**	0.804

Notes: CSSCM, commitment to sustainable supply chain management; CSRL, commitment to sustainable reverse logistics; SRLC, sustainable reverse logistics capability; OP, operational performance. Sq. root of AVE is listed on the diagonal. **Correlation is significant at the 0.01 level (two-tailed)

Table I.
Descriptive statistics

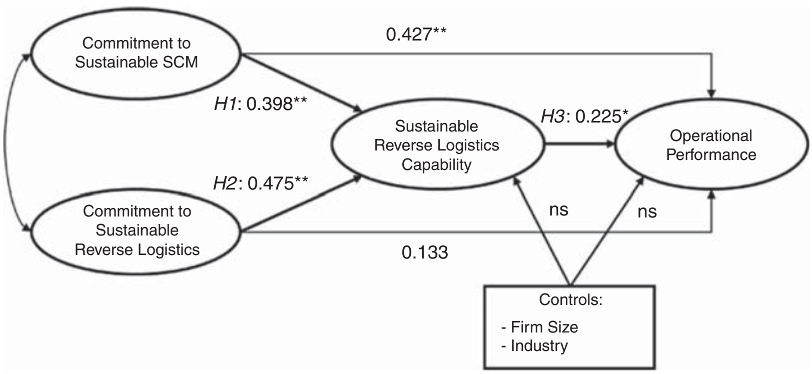
Our mediated process model approach suggests a partial mediation from commitment to sustainable SCM to operational performance. The effect was partial because both the direct (direct effect = 0.427; 95 percent bootstrap CI = 0.231 to 0.641; $p < 0.01$) and indirect (indirect effect = 0.090; 95 percent bootstrap CI = 0.008 to 0.228; $p < 0.05$) effects are significant between the two variables. The Zhao *et al.* (2010) approach does not support a mediated relationship between commitment to sustainable reverse logistics and operational performance. The direct (direct effect = 0.133; 95 percent bootstrap CI = −0.060 to 0.315; $p = 0.173$) and indirect (indirect effect = 0.107; 95 percent bootstrap CI = −0.003 to 0.258; $p = 0.057$) effects are not significant and the confidence intervals include zero. This indicates that resource commitments to sustainable reverse logistics do not have a mediated association with enhanced performance. Indirect and direct effects for the bootstrapped model using 5,000 bootstrap samples are included in Table II. Consistent with theory, this supports that conduct is a mediator between structure and performance for commitment to sustainable SCM.

In order to confirm the hypotheses, structural equation modeling was adopted as the appropriate statistical method. The fit statistics suggest that the model fit was adequate ($\chi^2 = 479.060$; df = 283; CFI = 0.955; TLI = 0.948; RMSEA = 0.062) based on thresholds proposed in Iacobucci (2010). Moreover, all three hypotheses were confirmed by the hypothesized model (see Figure 2). Commitment to sustainable SCM has a positive relationship with a sustainable reverse logistics capability ($\beta = 0.398$; $p < 0.01$), providing support for *H1*. Commitment to sustainable reverse logistics has a positive relationship with a sustainable reverse logistics capability ($\beta = 0.475$; $p < 0.01$), providing support for *H2*. Finally, a sustainable reverse logistics capability has a positive relationship with operational performance ($\beta = 0.225$; $p < 0.05$), providing support for *H3*.

Table II. Assessment of mediation

	Direct effect without mediator	Direct effect with mediator	Indirect effect
CSSCM to OP	0.517 ($p < 0.01$)	0.427 ($p < 0.01$)	0.090 ($p < 0.05$)
CSRL to OP	0.240 ($p < 0.01$)	0.133 ($p = 0.173$)	0.107 ($p = 0.057$)

Notes: CSSCM, commitment to sustainable supply chain management; CSRL, commitment to sustainable reverse logistics; OP, operational performance



Notes: Model fit: χ^2=479.060; df=283; CFI=0.955; TLI=0.948; RMSEA=0.062. ns, not significant. *p<0.05; **p<0.01

Figure 2. Structural equation model

Additional analysis also supports that the combination of commitment to sustainable SCM and commitment to sustainable reverse logistics explain a sustainable reverse logistics capability ($R^2 = 0.641$).

Discussion and conclusions

Theoretical implications

This study addresses three important objectives using the SCP paradigm. First, the impact of organizational structure variables on strategic conduct is established. The results suggest that resource commitments to both sustainable SCM and reverse logistics are associated with more effective sustainable reverse logistics as conduct. When firms allocate resources to gain employee buy-in for sustainable supply chain activities and provide the needed financial, technological, managerial, and physical resources to effectively perform reverse logistics activities, a sustainable reverse logistics capability becomes probable. These findings support previous research suggesting that building a strategic structure by investing in interconnected resources supports the behavior desired in related strategic planning (Madhavaram and Hunt, 2008).

Second, the results of the study suggest that an effective sustainable reverse logistics capability is associated with higher operational performance as indicated by better delivery timeliness, higher production quality, and greater capacity utilization. Previous studies have called for research to evaluate how firms implement sustainability in their organizations, particularly important is the need to understand how employee education/training impact operational performance (Closs *et al.*, 2011). Our study evaluates firm commitment to sustainable SCM as providing a structure through which human resources provide support to achieving sustainability goals. Looking to the future, it is important to remind the academy that human resources continue to be understudied in SCM research.

Finally, the results of the model suggest that resources committed to sustainable SCM are directly and indirectly (i.e. through their association with a sustainable reverse logistics capability) associated with improved operational performance. Resources committed to reverse logistics may benefit the firm if the commitments are used to develop a sustainable reverse logistics capability (e.g. reducing the negative environmental impact of reverse logistics processes). A strong sustainable reverse logistics capability may result from resources committed specifically to reverse logistics and a commitment to the sustainability of the supply chain. This implies that effective strategic conduct is a critical requirement to transform resource investments into success in sustainable supply chain operations.

Resource commitments are generally believed to be a key driver toward achieving supply chain objectives (Ellinger *et al.*, 1998), although the existence of mixed results has been reported concerning previous literature (Daugherty *et al.*, 2001). This study finds that as part of an overall firm strategy to build a sustainable supply chain, the resources committed to sustainable reverse logistics programs are critical to success. Through our partially mediated model, the study findings support that allocating resources for sustainable reverse logistics alone is not adequate to grow performance. Resources contribute to a structure that supports firm conduct through a sustainable reverse logistics capability and provides improved performance. Given these findings, our study contributes to theory through the incorporation of an SCP framework that expands on previous sustainable supply chain research.

Practical implications

Companies sometimes consider their industry positions to be safe and their growth to be linear. As a result, supply chain managers may perceive that their competitive position is protected and focus on cost cutting and day-to-day operations rather than on strategic elements for doing business. Knowing this reality in SCM, it is important for managers to step back and realize that sustainability is being discussed and measured outside of the firm's daily operations. Supply chain managers need to appreciate that a sustainable reverse logistics capability is the link to effective reverse logistics management and general supply chain performance outcomes. As industries change, often rapidly and in dramatic ways, managers need to pay attention to the needed change in conduct. Ignoring changes in the competitive environment has significantly damaged companies like Scott Paper and Fleming Company Inc. A change currently underway across supply chains is the conduct of creating a sustainable SCM capability. Managers need to examine the benefits of sustainable SCM and structure their reverse logistics processes to build capabilities and gain ground on their competitors.

To remain effective, companies will need to commit resources to both the development of sustainable SCM and reverse logistics. In doing so, they may develop a sustainable reverse logistics capability that can defend their position and even lead to improved performance. Our study similarly shows that for a reverse logistics program to be successful in the twenty-first century, it may need to be based on sustainability. It is expected that improvements in both cost and responsiveness can be facilitated by developing and employing a sustainable SCM capability. Strategically, questions remain about the development of a sustainable reverse logistics capability under a continuous improvement perspective. It is expected that these types of capabilities must extend across multiple firms demonstrating their enterprise wide value and applicability to the supply chain environment (Defee and Fugate, 2010). That level of complexity needs profound examination.

It should be noted that few sustainability initiatives survive as a cost center. Over time supply chain managers will be required to show cost reductions and improvements in responsiveness. This study details that both environmental and market-based improvements are possible. Striving for both outcomes is a legitimate goal. In the long run, the performance aspect of reverse logistics and sustainable reverse logistics may be the key to maintaining a sustainability program.

Research implications

Taken to the 20,000-foot level, this study adds an SCP and RBV theoretical perspective to our field in researching the intersection of reverse logistics and sustainability. This area of study has been given only limited attention to date and, we believe, represents an area of great opportunity for discovery going forward. Ultimately, this study presents a foundational theoretical and empirical relationship where reverse logistics and sustainability come together as an inseparable relationship grounded in two specific theories. Additional literature streams should be integrated to build a better understanding of efficient reverse logistics and responsive sustainable logistics as one strategy.

Examination of such an approach to SCM strategy could include many additional theoretical perspectives. For example, environmental issues across the supply chain almost always result in competing values (Gabler *et al.*, 2017). Competing values theory could therefore be similarly examined with an embedded resource-based perspective as detailed in this manuscript. Additionally, recent research has suggested that integrating theories from other disciplines is needed as "there continue to be relevant theories from management and economics that have yet to be applied to a [logistics and SCM] context" (Swanson *et al.*, 2017, p. 349). For example, midrange theory (Hedström and Udehn 2009) should be considered as a base for examining the specific contextual processes involved in the movement, recycling, remanufacturing, and many other processes and tasks. Finally, knowledge-based theory (Fletcher *et al.*, 2013) has yet to be employed concerning a sustainable reverse logistics learning capability in organizations and supply chains.

Yet this study makes an important contribution to the literature beyond the SCP theoretical-level framing, this is the first study that has connected reverse logistics capabilities to a sustainable reverse logistics capability. Researchers should note that as sustainable reverse logistics programs continue to grow, new structural solutions will emerge in the marketplace. For instance, third-party firms have begun offering services to handle, package, and resell returned products. Exploring the impact of secondary market options as structures to manage these goods provides an opportunity for detailed strategic reverse logistics research (Rogers *et al.*, 2012). These third-party providers can drive profits and reduce environmental costs (Douglas, 2016). Future research may investigate how these third-party solutions work with sustainable supply chain strategy to achieve sustainability goals.

We have intentionally presented a parsimonious model for focus on the key mediating condition/variable – a sustainable reverse logistics capability. This means that a large number of antecedents, moderators, contexts, and consequences have not been examined. For example, we limited the scope of the investigation to reverse logistics. Reverse logistics is one aspect of a broader SCM process that could be investigated to further the findings of this manuscript (Croxton *et al.*, 2001). Expanding on the work of Espinosa (2016), future research might look at specific resource commitments that increase information system speed in the returns management system. The impact of sustainable reverse logistics in this context might also be studied as it relates to maintaining customer relationship quality and reducing partner opportunism. Related literature could be incorporated to reposition constructs in models of integration, cost control, social responsibility, interdependence, and governance. Emerging opportunities include examining how blockchains, transparency, and risk are impacting sustainable reverse logistics and/or how big data can be used to improve logistics decision making (Richey *et al.*, 2016).

In closing, we draw attention to an empirically supported pathway between sustainable reverse logistics and superior performance. The results indicate that sustainability is key in linking reverse logistics to performance and therefore requires detailed examination of both past, present and future SCM process models. Initially, researchers should perform confirmatory work – including larger nomological networks – to examine how sustainability and reverse logistics impact extant supply chain performance study results. We believe that a deepened examination of a sustainable reverse logistics capability and performance will give both researchers and practitioners valuable conclusions for continuing to develop and improve reverse logistics capabilities.

Notes

1. http://rlmagazine.com/edition53p22.php
2. http://rlmagazine.com/edition79p36.php

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Appendix

	Factor loadings	Composite reliability	Cronbach's α
Commitment to sustainable supply chain management			
Scale: 1 = strongly disagree and 7 = strongly agree. My firm has done the following regarding sustainable supply chain management:		0.934	0.935
1. Allocated time properly	0.795		
2. Allocated responsibilities	0.861		
3. Defined expectations	0.858		
4. Defined sustainable supply chain management objectives	0.861		
5. Committed to specific performance objectives	0.807		
6. Provided adequate training to employees to meet supply chain goals	0.842		
Commitment to sustainable reverse logistics			
Scale: 1 = little commitment and 7 = substantial commitment		0.957	0.957
1. Please indicate the level of financial resource commitment to sustainable reverse logistics within your company	0.920		
2. Please indicate the level of technological resource commitment to sustainable reverse logistics within your company	0.923		
3. Please indicate the level of physical resource commitment to sustainable reverse logistics within your company	0.950		
4. Please indicate the level of managerial resource commitment to sustainable reverse logistics within your company	0.891		
Sustainable reverse logistics capability			
Scale: 1 = strongly disagree and 7 = strongly agree		0.944	0.945
1. Our firm has integrated sustainable reverse logistics issues into our strategic planning process	0.792		
2. In our firm, "quality" includes reducing the environmental impact of our reverse logistics practices	0.865		
3. At our firm, we link sustainable reverse logistics objectives with our other corporate goals	0.916		
4. Our firm is engaged in developing products and processes that minimize environmental impact of our reverse logistics practices	0.834		
5. Sustainable reverse logistics issues are always considered when we develop new products	0.883		
6. We emphasize the sustainable reverse logistics aspects of our products and services in our ads	0.690		
7. Our marketing strategies for our products and services have been influenced by sustainable reverse logistics	0.764		
8. In our firm, product-market decisions are always influenced by sustainable reverse logistics	0.787		
Operational performance			
Scale: 1 = not at all; 2 = a little bit; 3 = to some degree; 4 = relatively significant; 5 = significant Please indicate the amount of improvement your company has experienced in the following areas since implementing sustainable supply chain activities		0.916	0.923
1. Increase in amount of goods delivered on time	0.712		
2. Decrease in inventory levels	0.697		
3. Decrease in scrap rate	0.736		
4. Increase in promotion of quality	0.874		
5. Increase in product line	0.874		
6. Improvement in capacity utilization	0.905		

Table AI. Measurement model – confirmatory factor analysis

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