

The effect of supplier sustainability risk management strategies on supply chain performance

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Abstract

Purpose – This study aims to evaluate the adoption of four types of supplier sustainability risk management (SSRM) strategies, namely, risk avoidance (RA), risk acceptance (RAC), collaboration-based risk mitigation (CBM) and monitoring-based risk mitigation (MBM) in Sri Lankan apparel and retail industries, and to investigate their effect on supply chain performance (SCP).

Design/methodology/approach – This study uses the dynamic capability view (DCV) to develop its hypotheses. Data collected from 89 firms were analysed using partial least square (PLS) structural equation modelling and PLS-based multiple group analysis.

Findings – Sri Lankan apparel and retail firms adopt RA and MBM strategies relatively more than CBM and RAC strategies, whereas there is no significant difference between the two industries in terms of the use of SSRM strategies. The path analysis revealed significant effects of RA and RAC strategies on SCP of both industries. The effect of CBM strategy on SCP is moderated by industry, while MBM has no significant impact.

Research limitations/implications – While managing supplier sustainability risks effectively, RA and RAC strategies provide more opportunities for managers to improve SCP. In achieving SCP, CBM strategies are proven to be more effective for retail industry compared with the apparel sector. Although MBM strategies offer sustainability advantages to firms, their contribution to improving the performance of apparel and retail supply chains is not significant. This research is limited to only two industries (apparel and retail) in Sri Lanka, where the evidence for the effects of SSRM strategies is not available for other contexts.

Originality/value – Either the effects of the four types of SSRM strategies on SCP or the moderating effect of industry on these effects have not been empirically confirmed in the literature. Evaluating the extent to which different strategies are implemented in Sri Lankan apparel and retail industries is another significant contribution of this research. Furthermore, this study contributes by using DCV to a sustainability-based supply chain risk management research.

Keywords Supplier sustainability risks, Risk management strategies, Supply chain performance, Apparel, Retail, Moderating effect, PLS-MGA

Paper type Research paper



Introduction

Risk management practices assist firms to reduce the uncertainty of recovering costs paid on various business activities. Effective management of supply chain risk is vital to ensure greater supply chain flexibility, utilization of resources, better customer service and hence

improved supply chain performance (SCP). The degree to which the present decisions of organizations impact on the future situation of the natural environment, societies and business viability is broadly known as sustainability (Krysiak, 2009). Therefore, sustainability performance management aims at addressing the social, environmental and economic aspects named as triple bottom line of a business. Recent research highlights that process- and product-related risks associated with unethical and socially irresponsible behaviour of suppliers can negatively affect a firm's shareholder value (Kim *et al.*, 2019). Thus, it would be important for buyer firms to identify suitable strategies to mitigate the effects of such risks.

Sustainable leaders intensively invest in managing ecological and social sustainability in collaboration with their suppliers as part of supplier management (Leppelt *et al.*, 2013). Subsequently, assessing sustainability performance of suppliers becomes a fundamental requirement of focal firms to avoid any supplier misconduct. Any deviance from the agreed sustainability standards of suppliers may lead to negative consequences on supply chain activities of these firms (Lee and Vachon, 2016). Therefore, manufacturing and service organizations follow various strategies to manage the risks of suppliers' sustainability practices. These are basically of four types, namely, risk avoidance (RA), risk acceptance (RAC), collaboration-based risk mitigation (CBM) and monitoring-based risk mitigation (MBM) (Hajmohammad and Vachon, 2016). As the implementation of these strategies requires different sort of resources and management capabilities, organizations select one or more of the alternatives based on their capabilities and priorities. However, literature other than reviews or qualitative studies into these strategies, benefits and limitations of them (Arrigo, 2020; Lee and Vachon, 2016; Rashidi, Noorizadeh, Kannan, and Cullinane, 2020) and the effect of a few selected strategies on focal firm's sustainability performance (Shafiq, Johnson, Klassen, and Awaysheh, 2017) was not available.

Sri Lanka is a developing South Asian country where majority of the economy depends on low-tech manufacturing industries such as apparel and services such as retail. Both sectors supply essential products to cater very large markets and sustainability practices are of great importance in supply chains of these industries because of the essentiality of products and the large markets. Therefore, many apparel manufacturers and retailers are involved in social/environmental programmes of their suppliers as a strategy to mitigate risk caused by suppliers' sustainability practices. In addition, buyer firms follow avoidance and acceptance strategies to minimize possibilities of any negative impacts of supplier activities on their societal, environmental and financial performance. As the buyer dependence and industry-specific supply chain characteristics are likely to affect the effectiveness of different strategies, it would be important to examine the effects of supplier sustainability risk management (SSRM) strategies on SCP for different industries. Therefore, drawing on dynamic capability view (DCV), this study aimed to answer the following research questions with special reference to Sri Lankan apparel and retail industries:

- RQ1. What is the level of adoption of supplier sustainability risk management strategies in apparel and retail industries in Sri Lanka?
- RQ2. What is the effect of different supplier sustainability risk management strategies on buyer firms' supply chain performance?
- RQ3. Does industry moderate the effect of supplier sustainability risk management strategies on buyer firms' supply chain performance?

Literature review

Sustainability of apparel and retail supply chains

Sustainability directs attention to both the production processes and the products that result from these processes. Apparel is one of the largest industrial sectors in Sri Lanka, which mainly engage in the export trade ([Key export categories, 2021](#)). Because of the intrinsic ecological and social issues throughout their supply chains, there is a huge pressure for textile and apparel manufacturing firms for supply networkwide adoption of sustainability practices and risk management ([Raian et al., 2022](#); [Warasthe et al., 2020](#)). Consequently, textile manufacturers have started using recycled materials from production, redesigning production process to be environmentally sensitive. Buyer firms increasingly include sustainability standards to their supplier selection criteria and collaborate with suppliers in meeting environmental objectives of supply chains ([Rashidi et al., 2020](#); [Styles et al., 2012](#)). Consequently, suppliers will need to develop environmentally friendly products and facilitate sustainability in supply chains.

Retail is one of the fastest growing industrial sectors in Sri Lanka ([Oxford Business Group, 2022](#)). As retail sector represents a prominent position of the market, concerns on the triple bottom line of firms have received a significant attention during the recent past. In all areas of retail businesses, including fashion, grocery, food and transportation, purchasing behaviours of consumers are increasingly reflecting their improved awareness about social and environmental aspects of goods and services ([Jung et al., 2020](#); [Su et al., 2021](#)). Consequently, retailers tend to move towards sustainable sourcing and influence suppliers for eco-friendly products, production processes, packaging and transportation ([Arrigo, 2020](#)). Therefore, the strategies followed by retail firms to ensure the adherence of suppliers into the necessary sustainability standards would be worthwhile investigating.

Supplier sustainability risk management strategies

Typical supply chain risks involve disruptions and delays caused by supply risks such as supply capacity constraints and delivery delays ([Chopra and Sodhi, 2004](#)), procurement risks such as exchange rates, inventories and stockouts ([Hallikas et al., 2002](#)), demand risks such as information distortion and stock accumulation because of the bullwhip effect ([Lee et al., 1997](#)) and infrastructure and systems risks such as breakdowns and equipment malfunctions ([Zsidisin et al., 2004](#)). The focus of firms on their triple bottom line leads to greater supply chain sustainability ([Shafiq et al., 2017](#)). Buyer firms often identify their suppliers' adherence to ecological and social standards as an important underpinning to mitigate supply chain risks ([Key export categories, 2021](#)). The effectiveness of sustainability practices in mitigating supply chain risks has been examined in the literature, while the evidence is not always positive ([Gouda and Saranga, 2018](#)). Hence, poor sustainability efforts of suppliers may create risks for buyer firms such as loss of reputation ([Lee and Vachon, 2016](#)). In general, the purpose of supply chain risk management (sustainability related or not) is to address the likelihood of the risks and their consequences by analyzing the sources and implementing appropriate tools ([Ritchie and Brindley, 2007](#)).

Prior research has shown that social sustainability is a part of strategic goals of apparel and retail supply chains ([Bubicz et al., 2021](#); [Styles et al., 2012](#)) and sourcing intermediaries have an important role to play in managing this sustainability ([Köksal, Strähle, and Müller, 2018](#)). However, it is doubtful whether focal firms receive the expected contribution from its upstream supply chain partners in their sustainability efforts ([Lee and Vachon, 2016](#)). Drawing from supply chain risk management literature, [Hajmohammad and Vachon \(2016\)](#) have identified four distinct SSRM strategies: RA, MBM, CBM and RAC. RA or risk avoidance is the elimination of suppliers who can negatively affect the organization's assets and switching to an alternative

supplier with a relatively clean sustainability record. MBM strategy compares the actual performance of suppliers with performance criteria to verify their compliance with the requirements (Jiang, 2009). CMB strategy aims at improving the suppliers' ecological and social performance through collaborations (Golicic and Smith, 2013; Jiang, 2009). RAC is a reactive strategy where supply managers simply decide to deal with the potential risk event by taking no further actions but budgeting for damage control (Sodhi and Tang, 2012).

Supply chain performance and supplier sustainability risk management

SCP refers to the extent to which the supply chain's activities are successful in meeting end-customer requirements, including product availability, on-time delivery and all the necessary inventory and capacity. SCP and effective management of supply chains have been identified as critical factors for organizations in achieving competitive advantage (Christopher, 2016). Sezen (2008) adopted a comprehensive SCP framework (Beamon, 1999) that comprises three dimensions, namely, flexibility, resource and output (Appendix). Flexibility performance (FP) is the ability of supply chains to respond any changes in products, delivery times, volume and mix. Resource performance (RP) measures comprise the costs of using resources, inventory levels in the supply chain and the return on investments. Output performance (OP) measures the degree of customer satisfaction (in terms of on-time deliveries, order fill rate and response times), sales quantities, and profit. Selecting a scale comprising all these three performance dimensions would be vital as it ensures the ability to capture every essential performance aspect in a supply chain, and without any of these, a supply chain is hardly considered to be satisfactory in its performance.

The effectiveness of strategies adopted by a firm can be assessed by evaluating their effect on the firm's performance. In regard to supply chain-related strategies, the effectiveness should be indicated by the effect of the strategies on SCP. However, in a context that the amount of existing literature on SSRM itself is extremely limited (Hajmohammad and Vachon, 2016; Raian *et al.*, 2022), research into the effect of the risk management strategies on SCP was not found while there is a few addressing the impact of supplier sustainability risks (Kim *et al.*, 2019). Also, understanding the effect of SSRM strategies on SCP could be complex as some of the activities under these strategies use up reasonably high amounts of financial and human resources of the company (Shafiq *et al.*, 2017), and to be effective, these all have to be paid back. For example, providing training/education to suppliers' personnel with regard to social/environmental issues is part of CBM strategy (Hajmohammad and Vachon, 2016). In addition, monitoring of supplier non-compliance to social and environmental requirements often needs long-term investment in resources, and thus consistent auditing could be challenging (Shafiq *et al.*, 2017). Therefore, investigating the effect of each type of SSRM strategy on each facet of SCP would offer valuable theoretical insights as well as be important for firms to identify the most viable and beneficial strategic direction for their supply chain management (SCM).

Theoretical basis and hypothesis development

Dynamic capability view

Dynamic capability or the capability of organizations to understand and effectively respond to unstable environments is important to achieve organizational performance (Sabahi and Parast, 2020; Teece, 2007), identify opportunities and mitigate risks in achieving performance (Teece *et al.*, 2016). Once a firm connects with its suppliers in its sustainability programmes, there is a risk whether the suppliers adhere to the social and environmental requirements of the buyer firm. The capability of the focal firm to face this uncertainty is indicated by its degree of implementing sustainability risk management strategies. In the

light of DCV, the companies that adopt SSRM strategies are more likely to achieve greater performance in their supply chains. Therefore, this study uses the DCV as a suitable underpinning for developing its hypotheses concerning the relationship between SSRM strategies and SCP.

Hypotheses

Assessing and close monitoring of sustainability performance of suppliers will be useful as a strategy to mitigate the supplier sustainability risks. According to [Shafiq et al. \(2017\)](#), this monitoring will help focal firms achieve better sustainability performance. Therefore, novel data-driven analytical tools are increasingly developed for facilitating such assessment ([Tavassoli et al., 2020](#)). In addition, direct interaction, effective communication and providing training and education for suppliers are common collaboration-based strategies for enhancing supply chain sustainability processes and problem-solving ([Berning and Venter, 2015](#)). These collaboration efforts encourage suppliers' compliance with social and environmental practices, which will ensure higher levels of customer satisfaction through sustainable goods and services offered ([Kashyap and Lakhanpal, 2019](#)). Therefore, firms practicing collaboration and monitoring-based sustainability risk management strategies are likely to achieve better SCP.

However, MBM and CBM strategies are usually resource-consuming ([Lee and Vachon, 2016](#)). Thus, it could be uncertain whether these strategies will have positive or negative impact on overall SCP of focal firms. Instead, some firms simply follow a strategy of avoiding risks through supplier termination, which may enable firms not be affected by reputation and related supplier sustainability risks ([Lee and Vachon, 2016](#)). Reputation is an important asset for a company, which can support more market acceptance. Therefore, managing supply chain risks through avoidance may help increasing SCP in terms of resources and output. However, this strategy may not be feasible when the supplier with poor sustainability performance is critical for the buying organization. At this kind of a situation, the buyer will have no choice other than accepting the risk ([Lee and Vachon, 2016](#)). Although there are some literature suggesting possible effects of SSRM on firms' performance, research addressing the effect of these strategies on SCP of buying firms was not found. Furthermore, many of the available evidence is limited to case studies and literature reviews highlighting the need for exploring the relationships ([Arrigo, 2020](#); [Lee and Vachon, 2016](#)). Therefore, drawing on the DCV, this study examines the following hypothesis to offer stronger empirical evidence for the effect of SSRM strategies on SCP:

- H1.* Supplier sustainability risk management strategies will lead to increased supply chain performance of buyer firms.

As the SSRM strategies identified in this study are fourfold, the above main hypothesis will be tested through four sub-hypotheses (H_{1a-1d}) addressing the effect of four strategies, namely, RA, MBM, CBM and RAC respectively on SCP.

Recent research on textile and retail industries highlights the need of exploring the industry variations in the effectiveness of collaborations towards supply chain sustainability ([Oelze, 2017](#); [Ruiz-Real et al., 2019](#)). SSRM strategies are the means for managing risks associated with sustainable supply chain collaborations ([Hajmohammad and Vachon, 2016](#)). Based on these grounds, this study tests a hypothesis suggesting the following moderating effect of industry with the data collected from textile and retail firms:

- H2.* The effect of supplier sustainability risk management on supply chain sustainability is moderated by the industry.

Methodology

Data collection and sample

This study aimed to study the effect of SSRM strategies of buyer firms on SCP of these firms. Considering their importance and availability in Sri Lanka, apparel and retail industries were selected for the study. A structured online survey was developed to collect data. In addition to a few multiple-choice questions for collecting background information on the company and the respondent, seven-point Likert scale questions were included to evaluate the model constructs (Figure 1). First, the questionnaire was reviewed for clarity, face validity and content validity by an academic expert in the field of SCM. The finalized survey was distributed to 170 companies in retail or apparel industries, and 89 surveys were returned upon sending one to two reminders. A total of 46 apparel firms and 43 retail companies representing the common categories of retail such as fashion, grocery, food and pharmaceutical were included in the sample. Table 1 presents the composition of the sample based on the broad industrial sector and the years of experience of respondents in the industry as well as in the field of SCM. According to the online sample size calculator developed by Soper (2021) based on Cohen (1988), this sample size was sufficient to detect a moderate level effect of $f^2 = 0.16$ in the partial least square structural equation modelling (PLS-SEM) analysis applied in the present study.

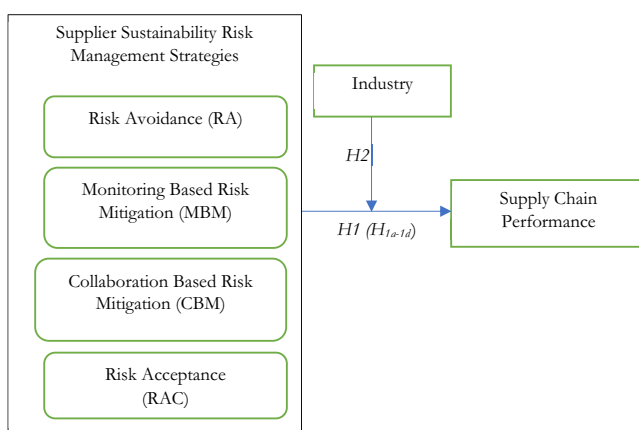


Figure 1.
Conceptual research
model

Industry	Apparel and textile	46 (51.7%)
	Retail	43 (48.3%)
Experience in the industry	Below 2 years	16 (18.0%)
	Between 2 and 5 years	37 (41.6%)
	Between 5 and 10 years	29 (32.6%)
	Above 10 years	07 (7.9%)
Experience in SCM	Below 2 years	34 (38.2%)
	Between 2 and 5 years	35 (39.3%)
	Between 5 and 10 years	18 (20.2%)
	Above 10 years	02 (2.2%)

Table 1.
Sample profile

Measures

This study selected four SSRM strategies and three SCP dimensions to test the hypotheses stated above. The SSRM framework developed by [Hajmohammad and Vachon \(2016\)](#) was used to operationalize the four risk management strategies, namely, RA, MBM, CBM and RAC. The scales for SCP were adopted from [Sezen \(2008\)](#). It included three dimensions of SCP, namely, FP, OP and RP. Operationalization of all the variables is provided in the [Appendix](#), and seven-point Likert scale was used to measure these variables.

All the independent and dependent variables used in the study were conceptualized as reflective latent constructs. SCP was used as a second-order latent construct of its three dimensions (FP, OP and RP). Therefore, suitable statistical criteria were sought to confirm validity and reliability of the measurement variables. The research model presented in [Figure 1](#) was tested using PLS-SEM with SmartPLS 3.0. In assessing the validity and reliability of the hierarchical model (with the second-order construct), the disjoint two-stage approach ([Sarstedt et al., 2019](#)) was used. Accordingly, the latent variable scores of the three first-order constructs of SCP generated in Stage I (path analysis excluding the second-order construct) were used as the indicators of the second-order construct in the validation process (Stage II).

The significance of the manifest variables was tested using bootstrapping. All the indicator loadings were significant at 1% level and they all were higher than 0.7 except one, which is also above 0.6 indicating sufficient level of indicator reliability ([Hair et al., 2011](#)). [Table 2](#) provides all the indicator loadings together with other validity measures. Internal consistency reliability and convergent validity of the constructs were examined using composite reliability and average variance extracted (AVE) values, respectively. [Table 2](#) presents these values, and all the composite reliability values are greater than the minimum recommended threshold of 0.7. Thus, internal consistency reliability of all the model constructs is satisfactorily confirmed. AVE values higher than 0.5 establishes convergent validity of all the latent constructs.

The Fornell and Larcker criterion was used to test the discriminant validity of the constructs. According to the criterion, AVE of each latent construct needs to be larger than the construct's highest squared correlation with any other latent construct. [Tables 3 and 4](#), respectively, present the results of discriminant validity assessments of the first-order constructs and the hierarchical model. Both results satisfactorily confirm discriminant validity of the measurement model.

Common method bias

As this study used a self-administered questionnaire, there was a risk of common method bias. Therefore, Harman's one-factor test was applied to check the common method bias. The factor analysis performed, including all the measurement items in the research model, did not produce a single factor that explains more than 50% of total variance. The first factor explained only 39.3% of variance, indicating clearly that there is no risk of common method bias in the study.

Results and discussion*Adoption of supplier sustainability risk management strategies*

First, the descriptive statistics of four SSRM practices, RA, MBM, CBM and RAC, were computed for apparel and retail sectors separately. This was to answer the first research question on the level of adoption of SSRM strategies in the two industries. The results are shown in [Table 5](#). The skewness coefficients of the four variables (factor scores) did not indicate a significant deviation from symmetry (between -1 and $+1$), and this implied the

			Risk management strategies
Model construct	Indicators	Outer loadings	
Risk avoidance (RA) [†] (CR = 0.777, AVE = 0.637)	RA02	0.861***	341
	RA03	0.731***	
Monitoring-based risk mitigation (MBM) (CR = 0.848, AVE = 0.585)	MBM01	0.818***	
	MBM02	0.807***	
	MBM03	0.786***	
	MBM04	0.632***	
Collaboration-based risk mitigation (CBM) [†] (CR = 0.856, AVE = 0.598)	CBM01	0.815***	
	CBM03	0.773***	
	CBM04	0.742***	
	CBM05	0.762***	
Risk acceptance (RAC) [†] (CR = 0.823, AVE = 0.608)	RAC02	0.754***	
	RAC03	0.769***	
	RAC04	0.815***	
Supply chain performance (SCP) (CR = 0.919, AVE = 0.791)	FP	0.901***	
	RP	0.922***	
	OP	0.843***	
Flexibility performance (FP) [†] (CR = 0.871, AVE = 0.627)	FP02	0.782***	
	FP03	0.775***	
	FP04	0.815***	
	FP05	0.794***	
Resource performance (RP) (CR = 0.905, AVE = 0.762)	RP01	0.844***	
	RP02	0.903***	
	RP03	0.870***	
Output performance (OP) [†] (CR = 0.886, AVE = 0.722)	OP02	0.861***	
	OP03	0.845***	
	OP04	0.842***	
Notes: [†] Items were deleted during measurement model validation; *** <i>p</i> -value < 0.01			Table 2. Measurement model evaluation

Construct	CBM	FP	MBM	OP	RA	RAC	RP	Table 3. Discriminant validity of first-order constructs
CBM	0.774							
FP	0.548	0.791						
MBM	0.712	0.544	0.764					
OP	0.345	0.604	0.431	0.849				
RA	0.531	0.606	0.523	0.549	0.798			
RAC	0.726	0.675	0.690	0.477	0.616	0.781		
RP	0.496	0.760	0.619	0.692	0.587	0.617	0.873	
Note: Diagonal values represent the square root of AVE, whereas cell values are the correlations between latent constructs								

validity of mean comparison. Therefore, a *t*-test was performed to test the significance of the mean difference between apparel and retail industries. The results given in [Table 5](#) indicate that there is no significant difference between the mean scores of the four strategies across two industries. This reveals that both industries equally adopt the four supplier sustainability strategies: RA, MBM, CBM and RAC. Therefore, the percentages of companies that adopted

SSRM strategies more than the average were calculated taking the whole sample together. The calculated values are shown in Table 5, and they further confirm that apparel and retail firms in Sri Lanka adopt RA and MBM strategies relatively more than CBM and RAC strategies.

Effect of supplier sustainability risk management strategies on supply chain performance
Bootstrapping algorithm in PLS-SEM was used to test the hypotheses concerning the direct effects of four SSRM on SCP. Figure 2 shows the empirical path model, and Table 6 provides the results obtained in the path analysis.

The results only support two hypotheses related to the effects of SSRM strategies on overall SCP and its dimensions. These are RA and RAC, which in fact have opposite strategic orientations. As observed in the descriptive statistical analysis (Table 5), RA is the most widely practiced SSRM strategy in Sri Lankan firms. According to this result, changing of suppliers to avoid possible negative impacts of their sustainability practices seems to be effective. On the contrary, RAC also affects significantly on SCP of focal firms. These strategies would also be important to ensure supply chain success in terms of flexibility, resources and output. As implied by the unsupported hypotheses in the path analysis, CBM and MBM do not have any significant impact on SCP. However, all the relationships identified above are subject to the moderating effect of industry that was to be tested under H2 and discussed in detail in the following section.

Moderating effect of industry
PLS-based non-parametric multiple group analysis (PLS-MGA) (Sarstedt et al., 2011) was applied to test the moderating effect of industry on the relationship between SSRM strategies and SCP. Table 7 presents these results with the bootstrapping p-values corresponding to two groups.

Table 4.
Discriminant validity
of the hierarchical
model

Construct	CBM	MBM	RA	RAC	SCP
CBM	0.773				
MBM	0.712	0.764			
RA	0.534	0.524	0.798		
RAC	0.727	0.692	0.618	0.779	
SCP	0.526	0.593	0.653	0.669	0.889

Note: Diagonal values represent the square root of AVE, whereas cell values are the correlations between latent constructs

Table 5.
Adoption of supplier
sustainability risk
management
strategies in apparel
and retail industries

SSRM strategy (skewness)	Industry	Mean	SD	t-Test (p-value)	Adopted above average (%)
RA (Skp = -0.497)	Apparel	-0.125	1.117	0.221	55.1
	Retail	0.134	0.851		
MBM (Skp = -0.861)	Apparel	-0.060	1.080	0.559	53.9
	Retail	0.064	0.916		
CBM (Skp = -0.809)	Apparel	-0.150	1.062	0.143	48.3
	Retail	0.161	0.914		
RAC (Skp = -0.497)	Apparel	0.000	1.000	1.000	48.3
	Retail	0.000	1.000		

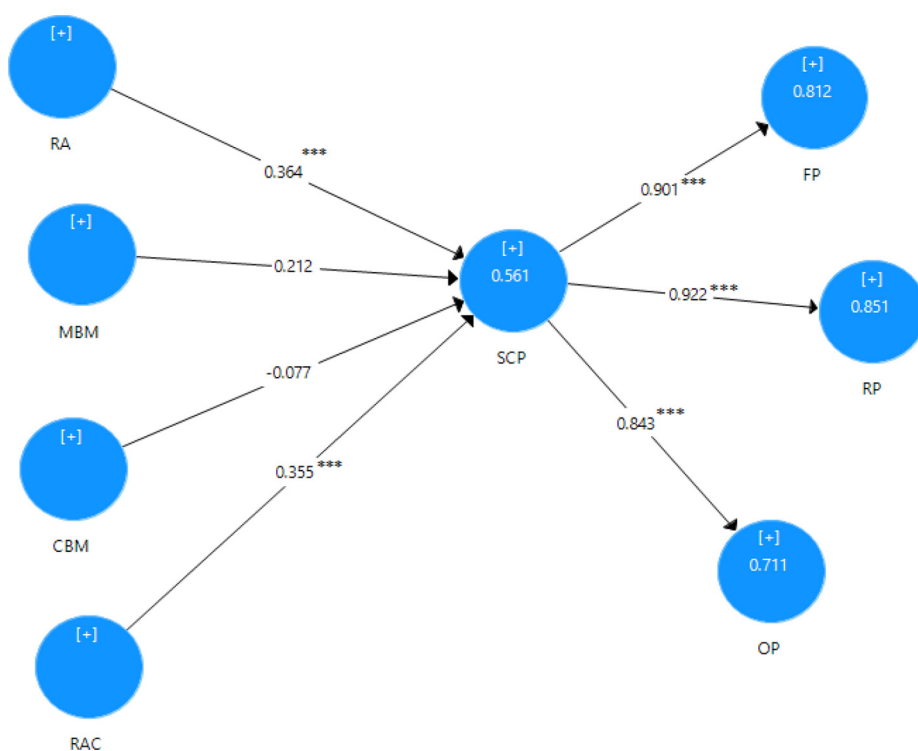


Figure 2.
Empirical path model

Path	Effect	Result
RA → SCP	0.364***	H_{1a} is confirmed
RA → FP	0.328***	
RA → OP	0.307***	
RA → RP	0.336***	
MBM → SCP	0.212	H_{1b} is not confirmed
MBM → FP	0.191	
MBM → OP	0.179	
MBM → RP	0.195	
CBM → SCP	-0.077	H_{1c} is not confirmed
CBM → FP	-0.070	
CBM → OP	-0.065	
CBM → RP	-0.071	
RAC → SCP	0.355***	H_{1d} is confirmed
RAC → FP	0.320***	
RAC → OP	0.300***	
RAC → RP	0.328***	

Table 6.
Effects of SSRM
strategies on supply
chain performance

According to the PLS-MGA, industry can be identified as a moderator to the relationship between SSRM strategies and SCP. However, as the p -values of the test indicate, industry significantly moderates the effect of only CBM on SCP (p -value = 0.016). The bootstrapping p -values of the separate path coefficients of the two industries imply that the effect of CBM

Table 7.
PLS-MGA for the
Moderating effect of
industry

Path	Direct/indirect effect		PLS-MGA
	(apparel)	(retail)	<i>p</i> -value for the difference (apparel–retail)
CBM → SCP	−0.563**	0.323**	0.016**
CBM → FP	−0.524**	0.284**	0.015**
CBM → OP	−0.493**	0.252*	0.017**
CBM → RP	−0.530**	0.286**	0.016**
MBM → SCP	0.552**	0.005	0.123
MBM → FP	0.513**	0.004	0.108
MBM → OP	0.483**	0.004	0.115
MBM → RP	0.519**	0.004	0.116
RA → SCP	0.232	0.347**	0.555
RA → FP	0.215	0.306***	0.598
RA → OP	0.203	0.272**	0.666
RA → RP	0.218	0.308**	0.605
RAC → SCP	0.519**	0.320**	0.394
RAC → FP	0.482**	0.281**	0.369
RAC → OP	0.454**	0.250**	0.342
RAC → RP	0.488**	0.283**	0.355

Notes: ****p*-value < 0.01; ***p*-value < 0.05; **p*-value < 0.10

on all dimensions of SCP (FP, OP and RP) are negative for apparel industry and positive for retail industry. Earlier observed statistical insignificance of CBM strategy could be a result of this moderating effect. This is an interesting finding, which suggests that CBM strategies tend decrease the SCP in apparel sector while supporting SCP in retail sector. This finding is in line with earlier research findings on the Sri Lankan apparel sector (Abeysekara *et al.*, 2019) that revealed no significant impact of supply chain risk management culture and collaboration enabled by that culture on firm performance. The present study extends this literature by exploring a negative effect of CBM strategies on apparel firms' SCP. According to Abeysekara *et al.* (2019), supply chain risk management culture in Sri Lankan apparel firms largely supports supply chain agility. Agility or quickly responding to market requirements is essential for achieving SCP (Dhaigude and Kapoor, 2017). However, as suggested by this study, when apparel firms implement collaboration-based SSRM strategies, they become too much supplier orientated and might fail to pay adequate attention on downstream supply chain, which could result in a negative effect on overall SCP. As CBM requires serious attention of supply managers and substantial allocation of resources for joint sustainability programmes with suppliers (Lee and Vachon, 2016), the detected negative effect is justifiable. However, according to the moderating effect detected in this study, CBM can be effective in the retail sector. This finding fills a gap in the literature highlighting the industry variations of sustainable supply chain practices where available empirical evidence is extremely limited (Ruiz-Real *et al.*, 2019).

The moderating effect of industry on the relationship between MBM strategy and SCP is not statistically significant (*p*-value = 0.123). Therefore, the overall result obtained in the previous path analysis is acceptable for the effect of MBM strategy. Accordingly, MBM does not seem to be an effective SSRM strategy for Sri Lankan apparel and retail companies in achieving SCP. This extends the existing literature on a positive effect of sustainability monitoring practices on focal firm's sustainability performance (Shafiq *et al.*, 2017) by suggesting that no such effect exists on SCP in terms of FP, RP and OP. The value of time

and resources that must be committed for implementing MBM strategies for managing supplier sustainability risks (Lee and Vachon, 2016; Shafiq *et al.*, 2017) could be as high as their effect on SCP, which is not apparent, and this is a possible reason for the revealed insignificant effect.

As the effects of RA (p -value = 0.555) and RAC (p -value = 0.394) are not significantly moderated by industry, the overall path analysis result is valid for these variables. As all the statistically significant path coefficients in this analysis are positive (Table 6), both RA and RAC strategies are most likely to have positive effects on SCP of apparel and retail firms. Hence, RA and RAC strategies are equally important for both apparel and retail companies to mitigate the supplier sustainability risks and achieve better SCP. However, for sound confirmation of such positive effect, the corresponding right-tailed hypotheses need to be examined in future studies with larger samples.

RA is terminating the contract with the supplier that does not meet the company's sustainability standard and replacing them with other suppliers (Hajmohammad and Vachon, 2016). This is a simple solution when the buyer firm's influential power on supplier is low, and it is also possible that this will occur before the formal contract is established, as part of supplier selection process (Lee and Vachon, 2016). According to the initial statistical analysis (Table 5), CA is the mostly adopted strategy in Sri Lankan apparel and retail industries, and it helps firms to achieve better SCP as well (Table 6). However, as the implementation of RA will increase the requirement for including clauses on supplier's poor sustainability management into contracts (Lee and Vachon, 2016), the respective supply chain managers should consider this matter. Continuing long-term relationships with existing suppliers without initiating any arrangement for social/environmental issues at supplier facilities is meant by RAC strategy (Hajmohammad and Vachon, 2016). Even though this is often resulted by excessive dependence of buyer firm on a supplier (Lee and Vachon, 2016), according to the results of our study, accepting the risks has been an effective strategy for Sri Lankan apparel and retail companies as it has a significant effect on SCP. As Arrigo (2020) observed, retailers recognize sustainability as an important supplier selection criterion. Therefore, the detected effect in this study may be because the firms engage with supplier firms that have already established proper sustainability practices. Furthermore, this proactive approach provides more opportunities for supply managers to pay more attention to responding to changing customer requirement, which in turn could lead to increased SCP (Dhaigude and Kapoor, 2017).

Theoretical implications

SSRM is an emerging area in supply chain risk management where the existing empirical evidence for the effect of different strategies is extremely limited. The effects of four SSRM strategies on SCP and the moderating effect of industry found in this study have not been previously confirmed in the literature. The study evaluated the extent to which different SSRM strategies are adopted in Sri Lankan apparel and retail industries. Although there is no significant difference across two industries in terms of the implementation of the strategies, the effect of collaboration-based strategies on SCP is varied. Both RAC and RA strategies were found to be effective in achieving SCP in the selected industries. As the scales for the four types of SSRM strategies, namely, RA, RAC, CBM and MBM, were adopted from a recent qualitative study, the empirical confirmation of the four constructs with quantitative data marked another significant contribution to theory. The study extends the application of DCV to SSRM, a novel area of sustainable SCM research.

Managerial implications

The moderating effect detected in this study offers implications that are valuable for managing supplier sustainability risks, particularly using CBM strategy. To achieve better SCP, it is always proposed for supply chain managers to pay adequate attention to the downstream supply chain, in spite of the collaborations with suppliers for sustainability. Although RA and RAC strategies are fundamentally opposing, as implied by the present results, they both manage supplier sustainability risks effectively and provide opportunities for managers to improve SCP. Avoiding suppliers that do not follow the promised sustainability standards permits cutting down unnecessary costs of poor performance such as maintenance and rework and switching into better suppliers so that greater flexibility is offered in supply chains. On the other hand, acceptance of risks or continuation with the existing suppliers would not harm as long as these suppliers comply with the sustainability requirements of a firm's supply chain. Therefore, for both of the above risk management strategies to be viable, agreements on sustainable behaviours in supplier contracts (Leppelt *et al.*, 2013) and incorporating sustainability performance standards to supplier selection criteria (Lee and Vachon, 2016) are strongly recommended. These will provide the supply chain strategic planners with the required protection against unacceptable socio-environmental behaviours of suppliers. Even though monitoring-based strategies offer sustainability advantages (Arrigo, 2020), they have not been much supportive in improving SCP in terms of flexibility, output and resource utilization. In fact, monitoring the suppliers' sustainability practices is more than collaborating in their sustainability efforts. Organizations should provide sustainability standards to its suppliers and assess, audit and provide feedback on the performance to practice monitoring-based risk management. As all these activities need financial and other resources to be allocated, the effect of the implementation of monitoring-based strategy on SCP could be non-substantial, particularly in a developing country such as Sri Lanka. However, with the involvement of advanced technologies for easy monitoring of suppliers' sustainability practices, the effects might be positive and significant in developed countries' contexts.

Conclusion

Buyer firms allow four types of strategies, namely, RA, RAC, CBM and MBM to manage risks of suppliers' noncompliance with the expected standards of sustainability (Hajmohammad and Vachon, 2016). However, it is not well explored which strategies are mostly used in managing supplier sustainability risks and is there any effect of these strategies on the level of SCP achieved by firms. Therefore, this study was sought to evaluate the level of adoption of SSRM strategies and the effect of these strategies on SCP of focal firms. As apparel and retail industries are two main fast growing industrial sectors in Sri Lanka, the study selected these industries for investigation. In addition, this study examined the moderating effect of industry on the effect of SSRM strategies on SCP.

The latent factor scores of the four SSRM strategies were used in the statistical analysis to evaluate the level of adoption of the four SSRM strategies in firms. The *t*-test result indicated that, there is no significance difference between two industries in terms of the average adoption level of SSRM strategies. Furthermore, CBM and RAC are equally adopted in apparel and retail firms, and approximately 48% of the firms in the sample has adopted these strategies more than the moderate level. RA (55%) and MBM (54%) are the mostly adopted SSRM strategies. Based on the DCV (Krysiak, 2009), this study developed a research model including the direct effect of four SSRM strategies on SCP and the moderating effect of industry on the above effect. PLS-SEM was used to test the research hypotheses. A PLS-MGA was performed to test the moderating effect, and it found that only

the effect of CBM is significantly moderated by the industry. Therefore, the result of the PLS-SEM analysis without grouping was accepted for the effects of the rest of the strategies on SCP.

Results of the moderator analysis suggest a negative effect of CBM strategies on SCP for apparel industry and a positive effect for retail industry. In addition, RA and RAC have significant effects on SCP and its dimensions, namely, FP, RP and OP. The effects of the two strategies are approximately equal. Monitoring-based risk management has no statistically significant effect on SCP. These results offer valuable insights to supply chain practitioners and strategic planners while contributing to theory with several original findings.

Limitations and future research

Although this study draws several novel empirical findings into the area of SSRM, it still has some limitations that could be rectified in future studies. This research is limited to only two industries in Sri Lanka whereas the knowledge in the field is vital but lacking for many other industries and countries. The hypotheses developed in this study are two-tailed because of the lack of prior empirical evidence to adequately support positive and negative effects of the four SSRM strategies on SCP. However, future researchers can consider the identified effects as valid grounds to propose relevant one-tailed hypotheses, which will lead to more specific insights.

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Appendix. Operationalization of variables

Risk avoidance (RA):

- Our company appropriately looks for other suppliers to replace the existing suppliers.
- Our company has established a set of strategies to imply during the negotiations with the suppliers that they are in danger of losing our business.
- Our company renews contracts with the suppliers in a timely manner.
- Our company terminates the relationships with the suppliers.

Monitoring-based risk mitigation (MBM):

- Our organization provides the suppliers with written social/environmental requirements such as a code of conduct and ask them to comply with it.

- Our organization assesses suppliers' social/environmental performance through formal evaluation, using established guidelines and procedures.
- Our organization performs audits at suppliers' facilities to monitor their social/environmental performance.
- Our organization provides the suppliers with feedback about the results of their evaluations to implement novel strategies to achieve better performance.

Collaboration-based risk mitigation (CMB):

- Our open, two-way dialogue with suppliers allows to develop a mutual understanding of their responsibilities regarding social/environmental issues.
- Our organization works closely with suppliers to improve their social/environmental performance.
- Our training/education programs are implemented to make aware suppliers regarding social/environmental issues.
- Our company works out solutions if suppliers struggle in achieving their social/environmental goals and targets.
- Our company invests resources in developing suppliers' capabilities to properly manage social/environmental issues.

Risk acceptance (RAC):

- Our company regularly makes no changes to the relationship with suppliers.
- We initiate any type of arrangements regarding environmental/social issues at suppliers' facilities.
- Our company suffices to inform the suppliers of buyer's concerns regarding social/environmental issues at their facilities.
- Our company continues the business with the suppliers for a long time.

Flexibility performance (FP):

- Our company is able to respond to and accommodate periods of poor supplier performance.
- Our company is able to respond to and accommodate periods of poor delivery performance.
- Our company is able to respond to and accommodate new products, new markets or new competitors.

Resource performance (RP):

- Our company uses cost-cutting methods for inventory management.
- Our company uses cost-cutting methods for labor, maintenance and re-work.
- Our company has high capability of investments.

Output performance (OP):

- Our company increases its sales annually.
- It is possible for our company to fulfill orders on time.
- It is possible for our company to decrease manufacturing lead time.
- The percentage of our after-sales customer complaints is relatively low.