Sustainability Related Supply Chain Risk: Causes and Consequences

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Abstract-- The prime objective of this research is to establish an insight for the sustainable supply chain development. A risk management perspective has been adopted in this research for sustainability taking into consideration the risk related to business decision and its impact on social, biophysical and financial environment. The principal purpose of the current study is to explore the nexus between sustainability related supply chain risk, supply chain performance and corporate sustainability. To achieve the objective of the current study we have proposed two direct and one indirect hypothesis. To achieve the objective of the current study, we have employed the structural equation modeling and used the statistical package of smart PLS-3. The data by mean of an adapted survey instrument in the form of questionnaire is collected from the operation and finance managers of manufacturing firms. The results of the current study are providing support to the hypothesized results as sustainability related supply chain risk appear in significant relationship with firm supply performance. Meanwhile the corporate sustainability is in significant relationship with supply chain performance and also significantly moderate the relationship between sustainability related supply chain risk and supply chain performance. The current study which in author knowledge is among few pioneering studies on this issue, will be helpful for supply chain experts, operation managers, academicians, researchers and other policy makers in formulating policies.

Keywords: Supply chain financial risk, supply chain operational risk, supply chain management

1.0 Introduction

In the literature studies on management of supply chain and recent operations, the risk management in supply chains has become crucial research topic. Several studies have been conducted on the operational risks and management of supply chain (Narasimhan & Talluri, 2009). The changing world economy and trends in business markets including offshoring and outsourcing has led to the emergence of risk management to be an important research topic. The development of global supply chains to be complicated has been due to innovations in the field of information technology and changing business world (Trkman & McCormack, 2009). The extended supply chains have put the organizations at high
risks because of their vulnerability, which does not hold with the major benefits.

In order to resolve the current challenges being faced by supply chains across the globe, sustainability has been emerged to be an effective strategy. Sustainability strategies adopted by business organizations result in increased competitiveness and better financial credibility (Wang & Sarkis, 2013). Companies are able to generate more income and avoid the risks related to businesses by implementing sustainability initiatives (Brockhaus et al., 2013). The extent to which the organizational decision influences the society, natural environment and business consequences in future is referred as Sustainability societies (Krysiak, 2009). The level of uncertainty in future should be taken into account because of the broader definition of sustainability along with the risks influencing the decisions of organizations. Organizations decisions are based on the risks related to business, which can influence the social and natural environment. Moreover, investment costs are made by organizations to make sustainable supply chains (Ali & Haseeb, 2019; Haseeb, Abidin, Hye, & Hartani, 2018; Haseeb., 2019; Suryanto, Haseeb, & Hartani, 2018).

The risks and investments were mainly linked with the society and natural environment in previous times. However, these have been extended to supply chains. These have emerged across a large number of suppliers over recent years (Petrudi et al., 2018). Customers have become increasingly aware of the issues of sustainability and need for sustainability initiatives by the organizations (Marhoon et al., 2019; Alavi et al., 2019; Gilani et al., 2019). Moreover, the consequences of triple bottom line including planet, profit and people along with the establishment of sustainable working conditions, reduction in carbon footprints and corruption issues are considered by the consumers these days (Rabbani et al., 2018). Consumers these days are concerned with the sustainable actions taken by the business organizations including reduction of emissions involved in the process of manufacturing, packaging as well as transportation. Businesses are likely to be affected by the risks of sustainability (Sandeepa & Chand, 2018). The key examples of such cases include the poor working conditions in supply chain management of Apple Incorporation, disaster of Rana Plaza and scandal of horsemeat in the supermarkets of Europe.

The businesses have shifted their focus from domestic optimization of factors of sustainability to relationships with the suppliers and related operations in formulating strategies (Kleindorfer et al., 2005). The reduction of cost is involved in sustainable supply chain management, which has become important for gaining profitability of businesses in long-term (Hashemi et al., 2018). Managers of supply chain have the responsibility of taking decisions related to development of local content, sourcing of sustainable inputs, managing relation with stakeholders, recovery of assets for reducing the cost structure as well as risks related to sustainability (Asadi & Sadjadi, 2017). Supply chain managers have to deal with critical issues of recognizing the risks related to sustainability in supply chains, assessing their impact and development of tools for managing such issues (Hoffmann et al., 2013).

Very rare studies have researched on risks emerging because of lack of sustainability in supply chains. However, the researchers are becoming keen to explore the relation between the risks and supply chain sustainability. Some of the research studies emphasize on the risks related to environment (Teuscher et al., 2006), while some are bound to specific segments (Triesch et al., 2006). Seminal articles were produced by Anderson and Anderson (2009), in which they supported the fact that risks related to sustainability should be taken into account in risk management strategies of organizations. The authors’ work has key focus on reducing the negative influences of poor initiatives of sustainability and is limited to the financial aspect of the management. The study was extended by Anderson and Anderson (2009), and it was analyzed that the development of use of
sustainable programs of supplier management can lead to the generation of competitive advantage. The processes were investigated by Hofmann et al. (2014), and it was found that issues in supply chain could result in risks related to sustainability.

In literature, research gap exists in exploring the risks related to supply chain sustainability in an integrated way along with the development of strategies for risk management to resolve them. The present research is based on exploring the issues and addressing them. Following research questions are addressed through this research study.

**Research Question 1:** What is the nature of supply chain sustainability risks, its causes and impact on supply chain performance?

**Research Question 2:** What is the role of corporate sustainability in the relationship between sustainability related supply chain risk and supply chain performance?

### 2.0. Literature Review

The purpose of this research is to establish an insight for the sustainable supply chain development. A risk management perspective has been adopted in this research for sustainability taking into consideration the risk related to business decision and its impact on social, biophysical and financial environment (Basheer et al., 2019). The concept of supply chain sustainability is referred as the management of specific risks related to supply chain in relation to the society, environment and firm viability. Resources can be allocated successfully across the supply chain by managing sustainability. In this way, supply chains can be made more sustainable (Hafeez et al., 2018). However, the concept of supply chain is not restricted to the reduction of cost and improving financial performance of businesses. Sustainability is related to creation of value by resulting in supply chains, which are more sustainable.

Over the past years, there have been extensive researches, which explored the nature of supply chains risks Wu and Blackhurst (2009). The typical risks of supply chain include delays, issues of quality, changes in product design, delays in delivery, constraints of supply capacity and problems of supplier liquidity (Chopra & Sodhi, 2004). Risks related to procurement including stock outs, inventories and exchange rates can emerge as well, along with risks of transportation and logistics. According to Zsidisin and Ellram, (2003). relational risks in supply chain include moral hazard and risks of hold up. Norrman and Jansson (2004), considered demand volatility, distortion of information and accumulation of stock related risks, improper forecast to be the result of bullwhip effect (Norrman & Jansson, 2004). Risks of malfunctions of equipment, breakdowns (mainly categorized as risks of infrastructure and systems) have been studied, All these risks can be mainly categorized into two main categories, which are endogenous risks and exogenous risks. The activities of organizations result in endogenous risks and the relation of organizations with the external environment result in exogenous risks (Afzal, 2011).

With the increase in awareness of communities and markets about the sustainable business practices, a number of additional risks have emerged other than the traditional risks for organization (Tom & Munemo, 2015; Giannakis & Papadopoulos, 2016). The additional risks include the social, environmental, economic and financial risks as per the Brundtland definition of sustainability considering triple bottom line. The risks related to sustainability are different from the typical risks of supply chain in several aspects. The consequences are considered to be on the natural environment, reputation of corporations, financial aspect rather than the issues in operations of supply chain. The requirements for quality of a shared ecosystem are satisfied by the risk guiding principle with respect to the environmental aspect.
The responsibilities of the organizations towards its customers, employees, stakeholders, society and government are involved in the social dimension (Porter & Kramer, 2006; Mahdavinejad, Sadraie and Sadraie, 2014; Salvioni and Gennari, 2014; Alkali and Imam, 2016; Rahma, 2017; Chang’ach, 2018). Risks in monetary terms because of financial environment, sustained economic growth and dishonest responses by the individuals and corporations are involved in the financial dimension (Pullman et al.,2009; Beleisyte, et.al. 2014; Aziz, et.al. 2015; Aziz, et.al. 2016).

It has been suggested by the Jeucken (2004), report that the common risks of sustainability include the emission of greenhouse gases, consumption of energy, waste during packaging, accidents, damages to the environment during transportation and logistics. Additional risks of sustainability can be the boycotts of products of a company, proceedings against companies to recover financial damages, which are caused due to accidents, failure to comply with laws, unethical behavior and risks related to social justices along with unfair working conditions and employment as well as increase in energy and product prices. A number of scandals in media related to businesses have been reported in the BSR report (Compact, 2013). The reported scandals involve the issues of forced labor, child labor, animal testing, damages to environment, allegations of bribery, infringements and frauds. A threat is portrayed by these risks to several companies in the form of negative repute. Moreover, the companies face loss in their revenue because of such scandals. Such risks without affecting the organizational operations can pose damaging threats to organizations in the form of loss of customers and revenue.

2.1. Supply Chain Sustainability as a Nexus of Risks

The effects of sustainability related supply chain risk, risks can damage the repute of business organizations. The management of the organizations should work on eliminating the potential cost of these effects along with the formulation of strategies for creating value and preserving as well as exchanging it (Chun et al.,2013). Supply chain sustainability can be regarded as a connection of different risks. According to this concept, the strategic objective of a corporation is based on identifying the risks to be embedded in the management structure and for transferring to the external environment (Saeedi et al. 2018). This must be done in a way to increase the value for customers. The management of corporations will work on allocating resources for mitigating the impact of risks (Hadrari et al., 2019). By developing suitable contracts with the suppliers, incentives can be re-allocated in the supply chain. Moreover, credible assurances can be provided by the corporations in which suitable actions are taken in case of any risk. The credibility of supply chain sustainability has increased in the area of politics and organizational marketing strategies. However, the involvement of sustainable supply chain has not been incorporated in the processes of decision making (James, 2015).

2.2. Management of Sustainability-Related Risks

A way to access and separate risks is through the mechanism of SCRM tools, which can ensure the lowest possible risks. In literature, there are different frameworks for risk management with the use of distinct terms (Hallikas et al., 2004). The main phases involved in SCRM are based on five stages, which occur in a sequence (Setyadi, 2019). These stages include identification of risk, assessment of risk, analysis of risk, risk treatment and its monitoring. With the example of sustainability related risks, these five stages have been described to support the formulation of the process of management for risks of supply chain sustainability.

Risk identification - The first step is to identify the risk among the expected risks related supply chain sustainability. The use of tools is made such as risk mapping, checklists and taxonomies (Carayannis et al., 2014).
Risk Assessment - After the identification of risk, the second step is risk assessment. This involves the assessment of all the risks, which are identified. These are typically in the expected sequence of their occurrence. Moreover, their impact on the performance of supply chain is assessed as well. Brainstorming is often adopted to analyze the impact. Other methods include (Inductive) fault tree analysis, preliminary hazard analysis, checklists and event analysis inductive as well as (deductive) controlled experimentation and investigation of accident (Oliveira et al., 2018).

Risk Analysis – After the assessment of risks, these are priorities based on their important. For this, technique such as Pareto analysis can be used. Other technical approaches, which can be adopted for risk analysis, include fuzzy AHP. The reasons behind the occurrence of risks and their affects are analyzed. In order to identify the factors behind the risks, cause and effect analysis, root cause, controlled experiments and sensitivity analysis can be used (Miller & O’Leary, 1994). In the process of risk management, this step is very crucial when the company is able to understand the potential reasons behind the risk. In this way, it can be decided about the suitable action. The process can include the correlation analysis and other controlled experiments.

Risk Treatment – The fourth step in the process is of risk treatment. To address the supply chain risks, there are four main suggestions existing in literature. These are related to the sustainability related risks. Risk Avoid – This involves avoiding any action, which results in risk occurrence or exposure (Vose, 2008). The actions include terminating the relation with suppliers who do not adopt sustainable processes or technologies, Control – Actions taken to avoid risks by reducing the event occurring risk chances are involved in this step. For instance, by establishing a development program of supplier in order to decrease the chances of environmental accidents, risk can be avoided. Moreover, actions to cope with the after effects of sustainability related risk could be involved in this stage. Share – This involves the establishment of mutual relation with the suppliers for the achievement of risk pooling (Miller & O’Leary, 1994), such as the formulation of agreements of collaboration in supply chain regarding the emissions of carbon in the complete supply chain. Partial avoidance of risk to the supply chain is involved in this response or with the use of insurance against risk. Retain – the potential damage is accepted in this response. However, this happens in the cases in which the total cost of damage incurred by the risk is less than the cost of any strategy adopted (Rao & Goldsby, 2009). These responses can be linked with the drivers of sustainability related risks to find different solutions that can be accepted and implemented. The cost is considered while formulating and implementing any action against the risk. The total cost of mitigating risk is small in case of retaining child labor risk. In this case, the risk avoidance is not acceptable for the businesses.

Risk monitoring – The last stage is of monitoring the risk. In this stage, the effects of strategy devised in response are monitored. Moreover, it involves the identification of any changes in the regulations, policies and nature of supply chains (Rao & Goldsby, 2009).

2.3. Risk Management Framework for Sustainability-related Risks

An initiative for the management of risk related to sustainability risks should be based on same grounds. There exists a basic different in the process of risk management of supply chain risks, which are typical in nature. It is easy to identify sustainability related risks. The analysis of their impact on the performance of a corporation is a complicated phenomenon. Monetary vale cannot be easily designated to human capital, the reputation of a corporation and long-term effects of risk. The use of expert opinions and controlled examination as part of the inductive methods can be used as a suitable approach rather than adopting the criterion of performance in financial aspect (Anderson-Cook, 2005). The aim of traditional supply chain risks is to decrease the
complications of supply chain, cost reduction and increasing operational efficiency and responsiveness. The focus of actions or treatment of sustainability-related risk is to eliminate the negative impact on the repute of an organization and value of shareholders. A comparison has been depicted in Table 2 among the management of traditional and extended sustainability related risks (Nakano et al., 2013). The process of risk management should be a key element of the risk strategy of business organization even though the nature of sustainability related risks is complex. The typical risks of supply chain can be less damaging than the sustainability-related risks (Pullman, et al., 2009). The disruption risks of supply and demand can be caused by environmental accidents and natural disasters. The already existing methods of risk management can be helpful in such cases for responding to sustainability related risks (Seuring & Müller, 2008).

H1: The SRSCR has significant impact on SCP.

H2: CS has significant impact on SCP

H3: CS moderates the relationship between SRSCR and SCP.

Figure 1 depicts the theoretical framework of this study. The resource-based theory and agency theory are used to conceptualize the framework shown in figure 1.

Figure 1: Conceptual framework

3.0. Methodology

The research aims at developing a deep insight to the supply chain sustainability through identification of sustainability related risks as a process of risk management. Techniques and tools, which are well recognized, are applied in the research for analyzing about the management of sustainability related risks. The currents have employed survey-based method using an adapted questionnaire. The operational managers, and finance managers working in the manufacturing industry are chosen as a final sample of the currents study. The 535 questionnaires were sent to mangers of manufacturing firms. The required number was sent to the departments for dispersion. Respondents were stiff-necked. They returned the questionnaire within the period. This procedure took four weeks to gather every one of the questionnaires from the respondents. In this study, researchers have used the questionnaire method for collecting data. This questionnaire is divided into four sections which the entire question was conducted in English. Section A in this questionnaire asked about the respondent background. Gender, ethnicity, educational level, age, marital status, length of services, job category and income (per monthly) were asked. Meanwhile, the question from Part B, C and D are the part of the instrument that tested for this study. The measurement scale for all the section is based on the Likert Scale of 1 to 5, where 1 = strongly disagreed, 2= disagreed, 3= neutral, 4 = agreed and 5 = strongly agreed. 520 respondents were selected to distribute questionnaires. Three hundred thirtee -nine questionnaires were received out of 297; the response rate was 69 per cent and hence accepted for further evaluation. Respondents’ average age was 47 years, and around 63 percent of them were working in operation departments from last 15 plus years. The greater part of the respondents
was held highest degrees; the response rate is above the threshold of 45-50 percent (Norrman & Jansson, 2004). Male respondents were 233 and the female was 64. The average working experience was 11 years.

4.0. Research Analysis and Discussion

To achieve the objective of the current study we have employed the PLS-SEM. The PLS-SEM, according to (Norrman & Jansson, 2004), the PLS-SEM is second generation is structural equation modelling, which not only new but also a robust as it integrates all the model into a structure of the equation and produces results with a simultaneous operation by producing a relationship with all direct and intervening phenomena. According to Anderson and Anderson (2009) PLS-SEM is one of the robust and most reliable statistical technique. Therefore, this study adopted PLS SEM to analyses the data. Before testing the hypothesis, data reliability and validity was scrutinized. These steps were taken through PLS 3. It is revealed in Table 1 which shows that factor loading is more than 0.5, average variance extracted (AVE) is more than 0.5 and composite reliability is also more than 0.7. Therefore, it is revealed that the current study attained convergent validity.

Table 1. Convergent and Discriminant Validity

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Loadings</th>
<th>CR</th>
<th>AVE</th>
</tr>
</thead>
<tbody>
<tr>
<td>SRSC</td>
<td>SRSCR1</td>
<td>.843</td>
<td>0.89</td>
</tr>
<tr>
<td>R</td>
<td>SRSCR2</td>
<td>.855</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SRSCR3</td>
<td>.802</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>SRSCR5</td>
<td>.925</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SRSCR7</td>
<td>.843</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SRSCR8</td>
<td>.802</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SRSCR9</td>
<td>.832</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SRSCR10</td>
<td>.905</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SRSCR11</td>
<td>.893</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SRSCR12</td>
<td>.855</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SRSCR13</td>
<td>.912</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SRSCR15</td>
<td>.805</td>
<td></td>
</tr>
<tr>
<td>CS</td>
<td>CS1</td>
<td>.884</td>
<td>0.93</td>
</tr>
<tr>
<td></td>
<td>CS3</td>
<td>.855</td>
<td></td>
</tr>
<tr>
<td></td>
<td>CS4</td>
<td>.703</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>CS5</td>
<td>.784</td>
<td></td>
</tr>
<tr>
<td></td>
<td>CS8</td>
<td>.905</td>
<td></td>
</tr>
<tr>
<td></td>
<td>CS9</td>
<td>.803</td>
<td></td>
</tr>
<tr>
<td>SCP</td>
<td>SCP1</td>
<td>.822</td>
<td>0.91</td>
</tr>
<tr>
<td></td>
<td>SCP2</td>
<td>.855</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>SCP3</td>
<td>.722</td>
<td></td>
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<tr>
<td></td>
<td>SCP4</td>
<td>.825</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SCP5</td>
<td>.841</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SCP6</td>
<td>.800</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SCP7</td>
<td>.880</td>
<td></td>
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<tr>
<td></td>
<td>SCP8</td>
<td>.881</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SCP9</td>
<td>.826</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SCP10</td>
<td>.821</td>
<td></td>
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<tr>
<td></td>
<td>SCP13</td>
<td>.882</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SCP15</td>
<td>.928</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SCP16</td>
<td>.840</td>
<td></td>
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<tr>
<td></td>
<td>SCP17</td>
<td>.921</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SCP18</td>
<td>.882</td>
<td></td>
</tr>
</tbody>
</table>

The determination of validity is one of the most important steps in the validation of measurement of model therefore for the current study, the discriminant validity is shown in Table 2.

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Loadings</th>
<th>CR</th>
<th>AVE</th>
</tr>
</thead>
<tbody>
<tr>
<td>SRSC</td>
<td>.91</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R</td>
<td>8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CS</td>
<td>.73</td>
<td>.89</td>
<td></td>
</tr>
<tr>
<td>SCP</td>
<td>.51</td>
<td>.55</td>
<td>.8</td>
</tr>
</tbody>
</table>

Discriminant validity is attained through the square root of average variance extracted (AVE). It is shown in Table 2 that square root in bold form is more than all other values.

Table 2. Discriminant Validity
The next step to the confirmation of reliability and validity is the development and estimation of structural model therefore after confirmation of reliability and validity, the SEM was used to analyze the hypothesis. The direct and indirect effect was examined. Indirect effect was examined to check the mediation. In this process, the p-value was considered. While analyzing the data, 0.05 minimum level of p-value was considered to test the hypothesis. According to the direct results, it is shown that all hypothesis has a p-value less than 0.05. Thus, the Hypothesis 1 and 2 are accepted

Table 3. Direct Effect

<table>
<thead>
<tr>
<th></th>
<th>(β)</th>
<th>SD</th>
<th>T-value</th>
<th>P-Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>H1</td>
<td>0.111</td>
<td>0.035</td>
<td>3.161</td>
<td>0.000</td>
</tr>
<tr>
<td>H2</td>
<td>0.467</td>
<td>0.132</td>
<td>3.978</td>
<td>0.023</td>
</tr>
</tbody>
</table>

The results of the moderating effect of corporate cash holdings is shown in the table 4. These results of moderation show that for both mediation hypothesis, the t-value is above 1.96 and p-value is below 0.05 which accept H3.

Table 4. In-Direct Effect through moderation

<table>
<thead>
<tr>
<th></th>
<th>(β)</th>
<th>SD</th>
<th>T-value</th>
<th>P-Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>H3</td>
<td>0.112</td>
<td>0.021</td>
<td>6.331</td>
<td>0.000</td>
</tr>
</tbody>
</table>

Moreover, variance extracted is shown in Table 5. R-square value is 0.662which is moderate according to Chin (1998). It indicates that all the independent variables are expected to bring 66.2% change in the dependent variable, namely; supply chain performance.

Table 5. Expected Variance

<table>
<thead>
<tr>
<th></th>
<th>R²</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCP</td>
<td>66.2%</td>
</tr>
</tbody>
</table>

The results of the current study have shown a great deal of agreement with the hypothesized results.

5.0. Conclusion

The purpose of this research is to establish an insight for the sustainable supply chain development. A risk management perspective has been adopted in this research for sustainability taking into consideration the risk related to business decision and its impact on social, biophysical and financial environment. The concept of supply chain sustainability is referred as the management of specific risks related to supply chain in relation to the society, environment and firm viability. It has been suggested by the report that the common risks of sustainability include the emission of greenhouse gases, consumption of energy, waste during packaging, accidents, damages to the environment during transportation and logistics. Additional risks of sustainability can be the boycotts of products of a company, proceedings against companies to recover financial damages, which are caused due to accidents, failure to comply with laws, unethical behavior and risks related to social justices along with unfair working conditions and employment as well as increase in energy and product prices. Resources can be allocated successfully across the supply chain by managing sustainability. In this way, supply chains can be made more sustainable. However, the concept of supply chain is not restricted to the reduction of cost and improving financial performance of businesses. Sustainability is related to creation of value by resulting in supply chains, which are more sustainable. The principal purpose of the current study is to explore the nexus between sustainability related supply chain risk, supply chain performance and corporate sustainability.
To achieve the objective of the current study we have proposed two direct and one indirect hypothesis. To achieve the objective of the current study, we have employed the structural equation modeling and used the statistical package of smart PLS-3. The data by mean of an adapted survey instrument in the form of questionnaire is collected from the operation and finance managers of manufacturing firms. The results of the current study are providing support to the hypothesized results as sustainability related supply chain risk appear in significant relationship with firm supply performance. Meanwhile the corporate sustainability is in significant relationship with supply chain performance and also significantly moderate the relationship between sustainability related supply chain risk and supply chain performance. The current study which in author knowledge is among few pioneering studies on this issue, will be helpful for supply chain experts, operation managers, academicians, researchers and other policy makers in formulating policies. From the earlier studies it is clear that the risks and investments were mainly linked with the society and natural environment in previous times. However, these have been extended to supply chains. These have emerged across a large number of suppliers over recent years. Customers have become increasingly aware of the issues of sustainability and need for sustainability initiatives by the organizations. Moreover, the consequences of triple bottom line including planet, profit and people along with the establishment of sustainable working conditions, reduction in carbon footprints and corruption issues are considered by the consumers these days. Consumers these days are concerned with the sustainable actions taken by the business organizations including reduction of emissions involved in the process of manufacturing, packaging as well as transportation. Businesses are likely to be affected by the risks of sustainability. The key examples of such cases include the poor working conditions in supply chain management of Apple Incorporation, disaster of Rana Plaza and scandal of horsemeat in the supermarkets of Europe.

References


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Appendix A. Measure items for Green Supply Chain Integration Environmental uncertainties and Sustainable Performance

The Authors have used the following Measure items for Green Supply Chain Integration Environmental uncertainties and Sustainable Performance in survey-based instrument for the collection of data. The five-point Likert scale is used to gauge the response.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Items</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supplier Integration</td>
<td>1. Collaborating with suppliers to set up environmental goals. 2. Implementing environmental audit for suppliers’ internal management. 2. Providing suppliers with environmental design requirements related to design specifications and cleaner production technology. 3. Requiring suppliers to implement environmental management or obtain third-party certification of environmental management system (e.g., ISO 14001). 4. Selecting suppliers according to environmental criteria. 5. Provides information to help supplier to improve logistic management. 6. Exchange operational and logistical information with supplier.</td>
<td>Canning and Hanmer-Lloyd (2001)</td>
</tr>
<tr>
<td>Customer Integration</td>
<td>1. Achieving environmental goals through joint planning with customers. 2. Cooperating with customers to reduce environmental impact of the products. 3. Cooperating with customers for cleaner production, green packaging, or other environmental activities. 4. Sharing organizational know-how and experience with customers for environmental management and find solutions to environmental challenges. 5. Customer provides information that help company’s operations. 6. Customer discusses the issues related to major design changes in existing packaging (colours, size). 7. Customer share information informally without specific agreement.</td>
<td>Wu (2013)</td>
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| Internal Integration | 1. Senior and middle managers are committed to GSCM practices.  
2. Cross-functional cooperation for environmental improvements.  
3. Environmental issues are well communicated among departments.  
4. Environmental compliance and auditing programs are implemented.  
5. Environmental knowledge is accumulated and shared across departments.  
|----------------------|---------------------------------------------------------------|---------|
| Sustainable Performance | 1. Reduction of the negative impact of products and processes on the local community.  
2. Improvement of community health and safety resulting from green practices.  
3. Decrease in cost for materials purchasing.  
4. Decrease in consumption for hazardous/harmful/toxic materials.  
5. Decrease in frequency for environmental accidents of the firm  
6. Reduction in air emission caused by firm’s manufacturing activities.  
7. Reduction in waste water caused by firm’s manufacturing activities.  
8. Reduction in solid wastes caused by firm’s manufacturing activities.  
9. Improvement of employees’ health and safety resulting from green practices. | Brent’ and Labuschagne’ (2004); |
| Environmental Uncertainty | 1. The external environment our firm operates in has a high level of risk and uncertainty  
2. The external environment poses serious threats to our firm’s survival and well-being  
3. Our firm must deal with a wide range of external environment influences  
4. Declining markets for products are a major challenge in our industry  
5. Tough price competition is a major challenge in our industry.  