Analysing supply chain risk management capabilities through collaborative and integrative approach

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Abstract: In the era of market turbulence and external uncertainty, supply chain risk management is getting top attention in almost every dynamic business. The study is carried out to empirically investigate relational factors influencing demand side and supply side risk management. A sample of 149 valid responses was gathered through a structured questionnaire from marketing, planning, supply chain and logistics professionals from the textile sector and was analysed using partial least square smart (PLS) structural equation modelling (SEM) using SmartPLS 3.2.4. This research will significantly contribute to the literature of supply chain risks management (SCRM) as well as helping risk management professionals to understand the integrative and collaborative approach to improve supply chain resilience and robustness.

Keywords: supply chain risk management; SCRM; supply chain integration; SCI; supply chain collaboration; SCC; organisational performance.

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1 Introduction

Risk management is the process that helps an organisation to protect them from any uncertainty to achieve the specified strategic objectives. It is a very challenging task to foresee supply chain and operational risks to prevent an organisation from any loss (Ahmed and Huma, 2018). Organisations that can successfully assess their risks have acquired unique capability which can be effectively used as a competitive advantage for their organisation. Risk management has been defined risk as, "Combination of the probability of an event and its consequences" (ISO, 2002). According to Zhao et al. (2013), today businesses are becoming riskier because of globalisation that leads to increased use of outsourcing, and shorter product life cycles. This is the reason why the supply chain is becoming more complicated and more time-sensitive. Therefore, it is necessary for all companies to strategically deal with their major customers and suppliers to compete and deliver effectively in such a global business environment (Ahmed et al., 2019). Similarly, Ralston et al. (2014) suggested that it is necessary for organisations to link supply chain processes to create efficiencies, helps to generate customer value and also in gaining competitive advantage. Supply chain risk management (SCRM) may be defined as "the management of supply chain risks through integration and collaboration among the supply chain partners to ensure profitability and continuity" (Trkman et al., 2016). It is also very important for organisations to make their global supply chain more responsive and effective because there is a lot of competition and also the environment is changing rapidly. Therefore, to respond to a rapidly changing environment and changes in the upstream and downstream market, management of both demand and supply related information plays a vital role in developing and maintaining such a system that helps in achieving such goals (Williams et al., 2013).

The textile sector is one of the manufacturing strengths of the Pakistani economy but it is facing multiple challenges which is resulting in a decline. Pakistan textile industry is playing a vital role in terms of GDP 9% shares, 38% labour force, local and Pakistan textile industry provide 9% of the global textile needs and ranked at world's number 10 textile producer and third leading consumer of cotton. Numerous things are the reason for this decreasing growth rate such as energy shortfall, technology obsolescence, political instability, currency fluctuations and decreasing trend of imports by the EU and USA. All the above factors are magnified due to bad supply chain planning and management both at the upstream and downstream.

It is important for every organisation to keep an eye on the supply chain risks (SCR) because these are the factors that cause disruptions in the overall supply chain processes. Therefore, this issue of supply chain operational risk is considered as the most challenging risk in today's business environment and companies should also identify and mitigate these risks through creating more strong supply chains (Christopher and Peck, 2004). In past years several studies have been conducted to learn the integration and collaboration in the supply chain. In past studies, researchers describe integration and collaboration planning in a supply chain to improve company performance in Europe (Cassivi, 2006; Whipple and Russell, 2007; Vereecke and Muylle, 2006). Through the information technology supply chain integrates business processes and operations to create better scheduling. The organisation focused to take significant benefits by organising supply chain practices and operations (Dyer and Nobeoka, 2000; Kannan and Tan, 2010). Issues that are needed to keep in mind while making decisions are trust, justice, and relationship with supply chain partners. Few firms do not focus on such issues. It is very important to have a strong supply chain collaboration (SCC) because it leads to the overall supply chain performance of the firm (Najmi and Khan, 2017). According to Fawcett and Magnan (2002) many firms focus more on internal activities and do not concentrate on the relationship with external partners. Integration is a difficult process for some of the companies that is why they ignore this process and only focus on internal activities. It is observed that the impact of behavioural supply chain integration (SCI) on the performance of the firm has not been studied extensively.

According to Mathuramaytha (2011) collaboration is one of the most important topics that is considered as the key to successful supply chain management. He also identified that there are very few firms that have truly adopted supply chain practices. A lot of companies need to focus on adopting supply chain practices to make it more efficient and effective (Ahmed and Omer, 2019). It has been frequently observed that integration and collaboration are linked directly with the performance of the supply chain.

This study aims to identify and analyse the factors which can improve SCRM from external partners. This study will help the textile industry to identify the main factors that directly affect their firm's performance. It is vital for organisations to know about what are the risk factors that lead them towards the problem and find the most possible and suitable ways to mitigate those risks to achieve success. Because nowadays, every organisation in the industry is facing this problem of identifying and mitigating risks because of the global and changing environments; this research will help organisations in identifying and mitigating the risks and help them to achieve success in the future. It is very important for textile

companies to manage their upstream and downstream supply chain partners and concentrate on linkages between these constructs. There are very limited studies conducted on this issue so far. This makes this study valuable and useful. It will not only add value to the existing literature but also open the door to more researches. It is also noticed that the relationship between integration and performance is not fully established, it is recommended that future studies should concentrate more on this relationship (Fabbe-Costes and Jahre, 2008). This study contributes an opportunity for literature and practice, we investigate supply risk management (SRM) and demand risk management (DRM). There are many other risks to investigate such as internal risk and many others. Future research should investigate the relationship between other dimensions of supply chain risk and SCI/collaboration.

This paper is divided into five sections. Section 2 presents a review of the research on the subject and concludes with the development of hypotheses. Section 3 presents the research methods identified for analysing the primary data that is collected for testing the hypotheses. Section 4 will present the results of this study while Section 5 will discuss the outcome of the research study and draws a conclusion on it.

2 Review of related literature

Nowadays, it is very important for the partners of the supply chain to focus on factors that improve efficiency and effectiveness of supply chain performance. In order to determine the factors that are vital for the improvement of a firm's performance are studied in several previous pieces of research. For instance, Van der Vaart et al. (2006) analysed different aspects related to SCI. These aspects include different practices, patterns and attitudes and their relationship with the performance of the firm. They concluded that communication and integrated patterns between partners are vital for achieving improvements in supply chain performance.

2.1 Configuration theory

It is a newly applied approach in the field of SCRM (Mikalef et al., 2015) which is best suited for studying complete relationships between elements (Fiss, 2007). Such approaches were until recently applied primarily in organisational research studies. The configuration theory aims to identify patterns and combinations of variables and reveal how their synergistic effects lead to specific outcomes. Configurations occur by different combinations of causal variables that affect an outcome of interest (Ragin and Rihoux, 2009). The main difference of configuration theory is that it views elements through a complete lens that must be examined simultaneously, and is therefore particularly attractive for context-related studies of the SCRM strategy field examining complex causality. A combination of elements leading to the presence of an outcome may be quite different than those leading to an absence of the outcome (Fiss, 2007).

2.1.1 Supply chain risks

Most of the studies showed that disruption in any of the stages of the supply chain can directly affect the ability of an organisation to continue its operations and make it difficult to get the finished goods in the market. Supply chain risk has been a serious issue since the past few years. To increase awareness regarding supply chain vulnerability and risk management, Martin Christopher (2003) studied the existing literature and came up to the conclusion that SCRM has four critical characteristics i.e., assessing the risk, defining, identifying and mitigating the risk. It is the deviation from the expected value. In this sense, the risk is simply missing the target (Ellis et al., 2010).

2.1.2 Supply chain risk management

SCRM has become a differentiating competency as a network of interdependent organisations strives to manage and avoid supply chain risk (Ellinger et al., 2015). The variation in a supply chain includes all those affecting the flow of goods across the supply chain and the match between supply and demand (Jüttner et al., 2003). For this study, two aspects of risk are considered, namely SRM and DRM.

SRM is the potential deviation in the inbound supply in terms of quantity, time, quantity and requirements that may result in incomplete orders (Kumar et al., 2010). Inconsistency in the suppliers' performance will lead to their performance being unpredictable and this increases supply risk (Zsidisin and Ellram, 2003).

DRM is the potential deviation of the predicted demand from the required demand (Kumar et al., 2010). Rapid variations in order cycle make it more difficult for manufacturers to forecast the demand and handle high demand risk (Ho et al., 2005).

2.1.3 Supply chain integration

Authors have talked about the importance of integration in supply chain performance (Moshkdanian and Molahosseini, 2013). They studied integration concerning both information integration and material integration between supply chain partners to increase supply chain performance. They observed long term relationships of the firm with its suppliers to analyse integration. For this purpose, they distributed questionnaires among managers and staff of various departments and concluded that information integration positively influences material integration which leads to improvement of supply chain performance. It means that information sharing is important for logistics integration and both these integrations combine to enhance supply chain performance.

SCI is the way by which a firm can participate with its key supply chain members (upstream and downstream) to structure their practices, inter-organisational strategies,

procedures and behaviours into synchronised, collaborative and manageable processes (Zhao et al., 2013). For this study, two aspects of SCI are considered, namely supplier integration and demand integration.

Supplier integration, including sharing information regarding inventory data, communication, production scheduling, and working together with the supplier, can reduce upstream complexity (Najmi and Khan, 2017; Lee et al., 1997; Devaraj et al., 2001; Das et al., 2006).

Demand integration is the communication of ongoing and future orders information and capacity making it easier for manufacturers to adjust and forecast their production scheduling and capacity in advance (Lee et al., 1997).

2.1.4 Supply chain collaboration

A collaborative supply chain means that two or more independent firms work together to execute and plan supply chain operations with more success than when working alone. A particular relationship among supply chain members in terms of shared risks and rewards leads to higher business performance than would be expected by the companies individually. For this study, two aspects of collaboration have been considered, namely supplier collaboration and customer collaboration.

Supplier collaboration leads buying companies to participate directly in the goods processes and other activities of their suppliers to ensure that the desired quality of supplied items is as per their requirement. The buying company can help suppliers implement a quality management program in supplier facilities. The buyer can visit the supplier's facility and provide training to their employees or even locate their employees at a supplier's facility (Krause, 1997).

Customer collaboration allows the customer to share timely and reliable information with the manufacturer and make their forecast better aligned with ongoing orders. Sharing information with manufacturers such as consumer preferences and market trends will also allow firms to improve forecasting and customer's needs (McNally and Griffin, 2007).

2.1.5 Organisational performance

Organisational performance is how correctly a company achieves its goals and targets. The short-term objectives of supply chain management are primarily to reduce cycle time and inventory and increase production, while long-term objectives are to increase market share and profits for all members of the chain (Li et al., 2006). For this study, two aspects of performance have been considered, namely robustness and resilience.

Robustness in a supply chain can deal with reasonable inconsistency in input at the same time as maintaining good control over output variability (Christopher and Lee, 2004).

Resilience is the ability of an organisation to stand potentially in front of high-impact disruptive events, which is characterised by the strength and weaknesses of the organisation to reduce disruptive event impact, and lose recovery i.e., quickly resume production or transportation by redistributing its resources (Cheng and Zhu, 2010).

A study conducted by Ralston et al. (2014) highlighted some factors that would tell about the capability of a firm to collaborate internally and externally for the improvement and betterment of the organisation. Through this research, they tried to portray the relationship between a firm's strategy, its SCI and its performance. It is observed that if a firm is internally and externally integrated, it will be very easy for them to improve their efficiency and effectiveness. With a high level of integration, a firm can provide better and valued products to its customers relative to its competitors. With a high level of internal and external integration with its suppliers, they do not want to rely on other parties for providing value to their customers. That is why firms need to focus on both internal and external integration.

2.2 Development of hypothesis

2.2.1 Impact of SCI on SCRM

Successful SCRM is highly dependent on how firms are oriented towards learning across traditional inbound and outbound firm boundaries to effectively deploy business intelligence to mitigate the effects of supply chain disruptions (Sheffi and Rice, 2005; Deloitte Consulting, 2013). Effective SCRM requires participation from both internal and external partners (Ellinger et al., 2015). The time-based performance of the supply chain is highly effected by implementing an informative and concentrated IT structure, utilising process enhancements practices and combinable implementing IT structure (Jayaram et al., 2000). Therefore, integration between entities of the supply chain enhances both capability to visualise the change and the speed of response to those changes, it is hypothesised as,

H1 Supplier integration has a significant impact on SRM.

H2 Demand integration has a significant impact on DRM.

2.2.2 Impact of SCC on SCRM

Collaborative sharing of information and best practices among supply chain partners (upstream and downstream) is essential in identifying weaknesses and in preparing for and executing effective risk management. Collaboration, cooperation, and coordination have to succeed both cross-functionally within the firm and across supply chain partners. The weak linkage cannot be identified and enhanced without such collaboration. Practitioners at all levels have to seek and achieve a 'win-win outcome' (Rice and Caniato, 2003). Cooperation actuates the active signal sending about the variability of the supply chain, signalling improves visibility and depletes the risk of both opposing selection and moral hazards (Sanders and Boivie, 2004). It has been identified that better relationship can enable to gain premium services from the supplier (Bruce et al., 2004), and this relationship helps to make risk response

activity speedy because a company's commitment to the partner leads to continuous improvement in the supply chain

H3 Supplier collaboration has a significant impact on SRM.

H4 Customer collaboration has a significant impact on DRM.

2.2.3 Impact of SCC on SCI and SCRM through SCI

Collaboration with the supply chain partners is the parallel approach of SCI. SCC has a direct positive relation with SCI and vice versa. Therefore, SCC and SCI also have an indirect positive relation to SRM and DRM. Joint responsibility can play a vital role in managing the supply chain (Jacobs and Subramanian, 2012). More collaboration along the supply chain partners leads towards better trust among them, a sense of responsibility is built towards the betterment of the supply chain, which in turn assists in anticipation of risks. Non-cooperative attitude will damage anticipation i.e., information regarding shared demand forecast, there is no room for the supplier if they distrust that information (Cohen et al., 2003).

H5 Supplier collaboration has a significant impact on supplier integration.

H6 Customer collaboration has a significant impact on demand integration.

H7 Supply-side collaboration mediates the relationship between supply-side risk management and supplier integration.

H8 Demand-side collaboration mediates the relationship between supply demand-side risk management and demand integration.

2.2.4 Impact of SCRM on OP

The firm can start reducing the negative effects of risks by placing a priority on developing adequate SCRM strategies. Effective communication of organisational priorities and approach meant to cope with risks in the context of supply chains is paramount to organisational performance in today's volatile business environment (Wagner and Bode, 2008). Supply chain resilience could be analysed as the company's dynamic ability to recover from supply chain disturbances (Ponomarov and Holcomb, 2009) thus attaining the earlier optimum performance level. The prepared supply chains experience less negative effects when targeted by disruptions (Hendricks et al., 2009) which implies to absorb the shock and the performance of the supply chain is not affected. Therefore, it can be hypothesised as:

H9 SRM has a significant impact on robustness.

H10 DRM has a significant impact on robustness.

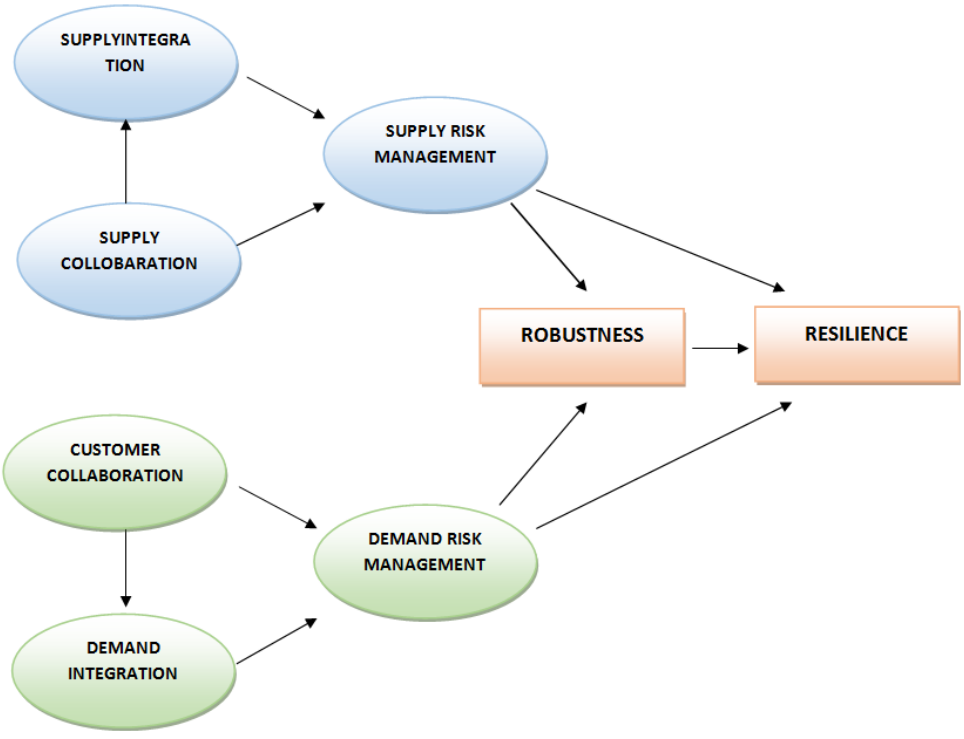
H11 SRM has a significant impact on resilience.

H12 DRM has a significant impact on resilience.

H13 Robustness has a significant impact on resilience.

Based on the aforementioned discussion, the framework of the present study is shown in Figure 1.

Figure 1 Hypothesised framework (see online version for colours)



3 Research methods

The present study aims to explain the factors affecting supply chain robustness and resilience and its impact on supply chain customer value and supply chain purpose. Thereby, the study has an explanatory purpose behind completing this investigation. With a co-relational approach/design authors intend to test the relationship between the variables.

Table 1 Sources of measuring items

SRM	Chen and Paulraj (2004)
DRM	Chen et al. (2013)
Supply integration	Ellinger et al. (2015)
Demand integration	Ellinger et al. (2015)
Supply collaboration	Li et al. (2005)
Customer collaboration	McNally and Griffin (2007)
Robustness	Brandon-Jones et al. (2014)
Resilience	Brandon-Jones et al. (2014)

Table 2 Demographic profile

Description (sample size = 149)		*Frequency*	*Percentage*
Business type	Local	2	1.35%
	Export	72	48.32%
	Local and export	75	50.33%
Company size	Medium	26	17.45%
	Large	26	17.45%
	Above 5,000	97	65.10%
Designation	Executive	6	4.03%
	Sr. executive	45	30.20%
	Asst. manager	37	24.83%
	Deputy manager	14	9.40%
	Manager	41	27.51%
	DGM	6	4.03%
Department	Marketing	90	60.40%
	Supply chain	23	15.43%
	Planning	24	16.11%
	procurement	12	8.06%
Experience in year	1 to 5	43	28.86%
	5 to 10	49	32.88%
	10 to 15	31	20.80%
	15 above	26	17.46%

Source: Author estimation

The instrument that is used for this study is a structured questionnaire. The questionnaire is adopted from various past researches listed in Table 1 and few changes are made. It contains structure, organised and clear statements to collect responses from customers. It is asked from respondents to indicate whether they agree or disagree with 61 statements, clear and simple declarations are used to make it easy for respondents to understand the statements. Five-point Likert scale is developed ranging from strongly disagree 1 to strongly agree 5 whereas, for the validity of questions, approval from three professionals is taken before conducting the research. Furthermore, the demographic profile of the respondents is summarised in Table 2.

4 Statistical analysis and results

The statistical analysis of data and hypotheses is examined via Smart PLS3.2.3 (Ringle et al., 2015). Hair et al.'s (2012) review study shows that partial least squares structural equation modelling (PLS-SEM) has become an increasingly applied multivariate analysis technique in management research.

4.1 The measurement, outer model

The construct validity and reliability of the outer model are examined via content validity, discriminant validity, and conversion validity as explained in the below sections.

4.1.1 Content validity

Factor analysis is applied to examine content validity, and it is known to be strong when factor loadings are higher than the rest of the constructs in the model (Chin, 1998; Hair et al., 2012). Those items which were below 0.50 are removed from the constructs to improve outer model validity. As shown in Table 3, the majority of the factor loadings are greater than 0.7 i.e., they meet the threshold criteria, however for loadings less than 0.7 then they can also be kept in the model when their loadings are closer to 0.7 and share significant contribution (Hair et al., 2012) therefore there are three loadings less than 0.7 but closer to the threshold i.e., 0.679, 0.649 and 0.695, consequently they are kept in the model for consideration.

4.1.2 Convergent validity

It is the degree to which a group of the items meets to compute the same concept (Hair et al., 2012; Mehmood and Najmi, 2017). It is inspected in three ways. First highly loaded factors loadings with at least 0.7 of factor loadings and must be statistically significant. Second, the value of the average variance extracted (AVE) must be above 0.5 (Fornell and Larcker, 1981). Third, it is further validated via composite reliability which should be higher than 0.7 (or 0.649). Table 4 explains all the values above the limits which validate the above-discussed assumptions of convergent validity.

Table 3 Factor analysis result

Construct	*Items*	*CC*	*DI*	*DR*	*RES*	*ROB*	*SC*	*SI*	*SR*
CC	CC1	0.821	0.369	–0.188	0.107	–0.020	–0.009	0.303	–0.027
	CC2	0.826	0.448	–0.095	–0.001	–0.095	–0.025	0.216	–0.105
	CC3	0.840	0.474	–0.242	0.205	–0.049	–0.192	0.442	–0.005
DI	DI1	0.493	0.924	0.405	0.429	0.327	0.276	0.638	0.214
	DI3	0.497	0.842	0.167	0.196	0.283	0.292	0.443	–0.043
	DI4	0.320	0.779	0.224	0.266	0.088	0.113	0.246	0.016
DR	DR1	–0.261	0.230	0.830	0.472	0.455	0.221	0.323	0.246
	DR2	–0.049	0.412	0.921	0.595	0.330	0.277	0.548	0.405
	DR4	–0.261	0.179	0.825	0.458	0.269	0.435	0.236	0.447
RES	R2	0.152	0.452	0.425	0.790	0.558	0.348	0.463	0.302
	R3	–0.002	0.197	0.258	0.679	0.282	–0.213	0.329	0.269
	R4	0.110	0.157	0.582	0.780	0.358	0.116	0.658	0.507
ROB	ROB1	–0.157	–0.032	0.292	0.371	0.804	0.023	0.118	0.395
	ROB3	0.024	0.470	0.395	0.532	0.882	0.456	0.464	0.372
SC	SC1	0.033	0.383	0.311	0.162	0.185	0.776	0.240	0.319
	SC2	–0.022	0.257	0.334	0.182	0.337	0.884	0.154	0.265
	SC3	–0.346	–0.090	0.199	0.003	0.281	0.649	0.124	0.317
	SC4	0.027	0.287	0.226	0.175	0.157	0.773	0.294	0.098
SI	SI2	0.432	0.368	0.113	0.495	0.387	0.044	0.820	0.487
	SI4	0.248	0.551	0.596	0.633	0.243	0.375	0.867	0.394
SR	SR1	–0.130	–0.018	0.348	0.506	0.511	0.329	0.357	0.885
	SR4	0.091	0.215	0.329	0.244	0.141	0.194	0.515	0.695

Source: Author estimation

Table 4 The convergent validity analysis

Construct	*Items*	*Loadings*	*Composite reliability*	*Average variance extracted (AVE)*
CC	CC1	0.8210	0.868	0.687
	CC2	0.8260		
	CC3	0.8400		
DI	DI1	0.9240	0.886	0.723
	DI3	0.8420		
	DI4	0.7790		
DR	DR1	0.8300	0.895	0.740
	DR2	0.9210		
	DR4	0.8250		
RES	R2	0.7900	0.795	0.565
	R3	0.6790		
	R4	0.7800		
ROB	ROB1	0.8040	0.831	0.712
	ROB3	0.8220		
SC	SC1	0.7760	0.856	0.600
	SC2	0.8840		
	SC3	0.6490		
	SC4	0.7730		
SI	SI2	0.8200		
	SI4	0.8670	0.832	0.712
SR	SR1	0.8850		
	SR4	0.6950	0.773	0.633

Source: Author estimation

4.1.3 The discriminant validity

This can be explained as the level or extent to which a set of items can differentiate a variable from another variable in the suggested model (Mehmood and Najmi, 2017). In this study, discriminant validity is analysed via two criteria. First, all items in a construct are checked to be strongly loaded to their respective construct than other constructs and differentiation between loadings on respective construct and cross-loadings should be higher than 0.1 (Gefen and Straub, 2005), as shown in Table 3. Second discriminant validity approach is suggested (Fornell and Larcker, 1981), the correlation matrix in Table 5 shows diagonal line of elements displays the square roots of AVE with the absolute value of the correlation of the constructs in row and columns, i.e., the values in diagonal lines should be greater than values in rows and columns value in order to confirm discriminant validity.

4.2 The structural model (inner model) and hypotheses testing

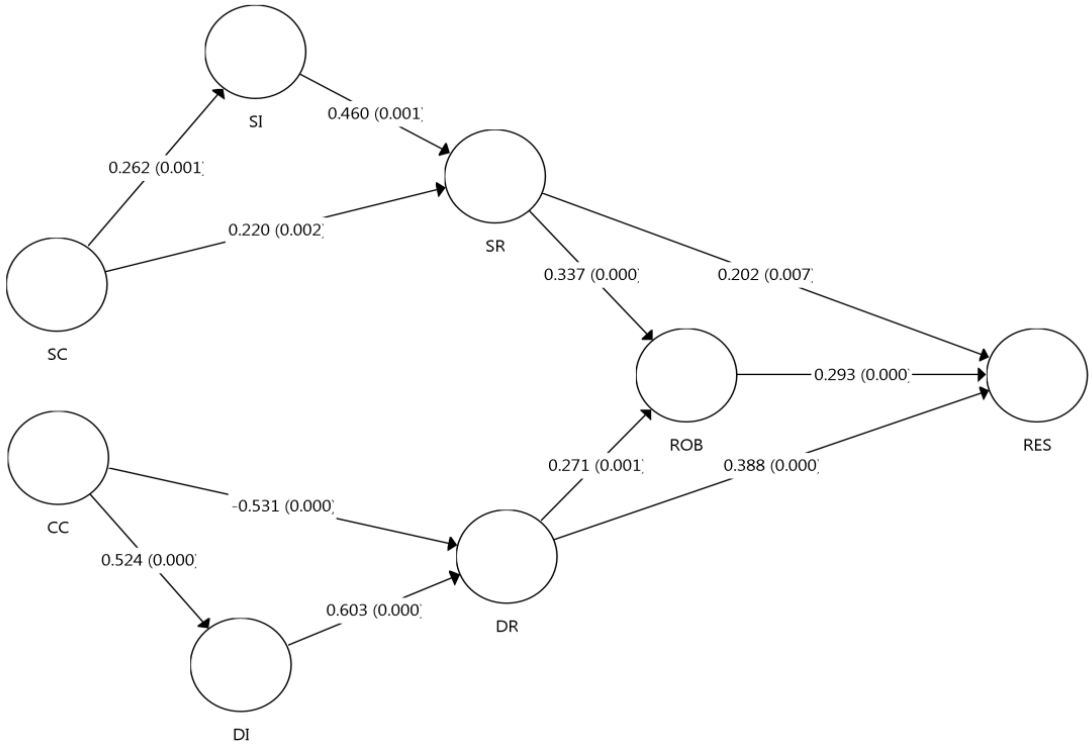
In order to test the proposed hypothesis PLS-SEM in Smart PLS 3.2.3 (Ringle et al., 2015) is used, because of its appropriateness for managing complex data and it provides better estimates than covariance-based approaches (Hair et al., 2012). To estimate the measurement model and the structural model PLS uses bootstrapping (Efron and Tibshirani, 1986; Haenlein and Kaplan, 2004). Results are reported in Figure 2 using bootstrap and resampling procedure of 500 subsamples.

Table 5 Correlations for discriminant validity

Construct	*CC*	*DI*	*DR*	*RES*	*ROB*	*SC*	*SI*	*SR*
CC	*0.829*							
DI	0.524	*0.850*						
DR	–0.215	0.325	*0.860*					
RES	0.132	0.360	0.594	*0.751*				
ROB	–0.067	0.292	0.413	0.544	*0.844*			
SC	–0.101	0.279	0.353	0.168	0.312	*0.775*		
SI	0.395	0.551	0.439	0.673	0.367	0.262	*0.844*	
SR	–0.053	0.090	0.420	0.497	0.451	0.341	0.517	*0.796*

Source: Author estimation

Figure 2 SEM output (P-statistics)



There are eight variables under consideration with two variables corresponding to risk dimension, two for collaboration dimension, two for integration dimension and two for performance dimension. The predictive power of variables is analysed through R square, the value of R square higher than 16% is considered acceptable (Cohen, 1988). Table 6 shows the value of R square for all constructs is higher than 16% except for supply integration (SI) i.e., 6.8%.

Table 6 Predictive power of constructs

Construct	*R square*	*Q square*
DI	0.274	0.192
DR	0.311	0.220
RES	0.490	0.249
ROB	0.264	0.175
SI	0.068	0.045
SR	0.313	0.191

Source: Author estimation

The beta coefficient is a depiction of how much and in what direction, positive or negative, a dependent construct will shift with a unit's change in an independent variable with every other quantitative aspect remaining constant (Hair et al., 2010; Leech et al., 2005). Supply integration (SI) on supply risk management (SRM) β = 0.460, supply collaboration (SC) on supply risk management (SRM) β = 0.220, supply collaboration (SC) on supply integration (SI) β = 0.262 supply risk management (SRM) on robustness (ROB) β = 0.337, supply risk management (SRM) on resilience (RES) β = 0.202, robustness (ROB) on resilience (RES) β = 0.293 customer collaboration (CC) on-demand integration (DI) β = 0.524, demand integration (DI) on-demand risk management (DRM) β = 0.603, demand risk management (DRM) on robustness (ROB) β = 0.271, demand risk management (DRM) on resilience (RES) β = 0.388 respectively with p-value less than 0.07 therefore, all the hypothesis have been supported by the analysis shown in Table 7 except customer collaboration (CC) β = –0.531 which has significant negative impact on demand risk (DR).

4.3 Mediation analysis

The final hypotheses, H7 and H8 assess the theoretical foundations of the proposed model by examining the mediation effect of two discrete dimensions of DI on the relationship between CC and DRM& SI on the relationship between SC and SR. Bootstrapping sampling is utilised to assess mediation (Zhao et al., 2010). According to Baron and Kenny (1986), mediation requires a significant direct effect of the independent variable on the dependent variable and an insignificant or a diminished effect when the mediator is added to the model. For H8 as shown in Table 8 indirect effect is significant but the direct effect is negative (β = –0.531, p= 0.000) significant indicating that the hypothesis is full mediate and complements the relationship between CC and DRM. For H7 as shown in Table 8 indirect effect is the significant and direct effect remains significant (β = 0.220, p= 0.002) indicating that there is partial mediation between the critical relationship between CC and DRM.

Above demonstrated results provide support for the risk theory as they are the barriers to collaboration and integration with suppliers and customers to get organisational robustness.

Table 7 Hypotheses testing results

No.	*Hypothesis*	*Estimates*	*Standard error*	*T-value*	*P values*	*Decision*
H1	SI → SR	0.460	0.142	3.228	0.001	Supported
H2	DI → DR	0.603	0.084	7.150	0.000	Supported
H3	SC → SR	0.220	0.072	3.060	0.002	Supported
H4	CC → DR	-0.531	0.074	7.174	0.000	Supported
H5	SC → SI	0.262	0.081	3.214	0.001	Supported
H6	CC → DI	0.524	0.060	8.733	0.000	Supported
H9	SR → ROB	0.337	0.094	3.583	0.000	Supported
H10	DR → ROB	0.271	0.083	3.266	0.001	Supported
H11	SR → RES	0.202	0.074	2.716	0.007	Supported
H12	DR → RES	0.388	0.049	7.988	0.000	Supported
H13	ROB → RES	0.293	0.079	3.724	0.000	Supported

Source: Author estimation

Table 8 Test of mediation

No.	*Mediation hypothesis*	*a*	*b*	*c*	*c'*	*Significance*	*Mediation*
H7	SC-SI-SRM	0.220 (0.002)	0.262 (0.001)	0.460 (0.001)	0.120 (0.024)	Significant	Partial mediation
H8	CC-DI-DRM	–0.531 (0.000)	0.524 (0.000)	0.603 (0.000)	0.316 (0.000)	Significant	Full mediation

Source: Author estimation

5 Discussion, conclusions, and recommendation

5.1 Discussions

It has been found that SCRM is essential for organisational performance (OP) through SCI and SCC. These results provide implications for SCRM strategies and SCI, SCC theories and practices.

5.1.1 SCRM through SCC and SCI

The present study validates the SCRM practice concept that has generally been poorly defined and about whose meaning there has been a degree of variability in people's understanding. Some organisations have realised the importance of implementing SCRM, by proposing, developing and validating multi-dimensional supply chain measures and by demonstrating its efficiency in enhancing organisational performance and competitive advantages. The present study provides SCRM managers with a useful tool for evaluating the comprehensiveness of their current SCRM practices.

This study informs managerial practice in two important ways. One is supplier risk management because of the complexity and globally outsourced nature of today's supply chains combined with the practice of optimisation techniques such as lean and just-in-time manufacturing to improve efficiency which has increased supply chain vulnerabilities to even minor supply disruptions. While this study has allowed companies to reduce overall costs and expand quickly into new markets, among the several types of supply disruptions, most severe are those that have a relatively low probability of occurrence with very high severity of impact when they do occur. While such risks cannot be eliminated, however, their severity can be reduced. In subjected research supplier risk management is depending upon supplier integration and collaboration and shows significant positive relation (SC on SRM p-value 0.002, β = 0.220 and SI on SRM p-value = 0.001, β = 0.460) while supplier collaboration has significant positive relation on supplier integration (SC on SI p-value = 0.001, β = 0.262). When we check mediation between SC and SRM through SI it also shows significant positive relation (SC-SI-SRM p-value 0.024, β = 0.120) thus H1, H2, H3 and H4 are accepted. For example, if the supplier has an insight of ongoing orders, helps him to manage supplies, lead-time, quality, quantity, customer need and cost by its own or more appropriate way meanwhile manufacturer can create defensive and offensive strategies that turn risk into a completive advantage. Second, DRM depending upon customer collaboration and demand integration, finding shows that demand integration has a strong significant positive relation with DRM (DI on DRM p-value = 0.000, β = 0.603) and customer collaboration has strong positive relation with demand integration (CC on DI p-value 0.000, β = 0.524 whereas customer collaboration has negative significant relation on-DRM (CC on DRM p-value = 0.000, β = –0.531). However, by making indirect relation of customer collaboration and DRM through demand integration mediation result shows significant positive relation (CC-DI-DRM p-value 0.000, β = 0.316). Although, customer collaboration is a common practice in the Pakistan textile scenario seems to have a negative impact. Pakistan's supply chain is more critical than any other country and there are numerous reasons for that e.g., old technology, law and order situation, energy shortfall, unpredictable supplies, currency fluctuation, etc. which makes supply chain vulnerable. We can only afford limited collaboration with the customer because we cannot fulfil all the said demand of the customer due to unpredicted industry conditions. But if customer collaboration takes place through proper integration we can mitigate the demand risk. (H5, H6, H7, and H8 = accepted).

SCC and integration encourage the manufacturer to predict and meet business goals in the long term by gaining supply chain partners' trust and improving competitive position in the market.

5.1.2 SCRM as facilitator to organisational performances (OP)

The results of this research study also support SCRM literature, that risk management is useful for organisational performance (Hoffmann et al., 2013). The result shows the depending relationship between SCRM and OP.

The finding shows SRM has a significant positive relation with robustness (SRM p-value = 0.000, β = 0.337). And DRM also has a direct significant positive relation with robustness (DRM on ROB p-value = 0.001, β = 0.271). DRM also has a direct significant positive relation with robustness (DRM on ROB p-value = 0.001, β = 0.271) Robustness is widely accepted as one performance measure to value sustainable returned in a perturbed business environment. This study also leads SRM to correlate with resilience and the result shows direct positive relation (SRM on RES p-value = 0.007, β = 02.02) whereas DRM has a direct strong positive relation on resilience (DRM on RES p-value = 0.000, β = 0.388). Organisations used resilience strategy to mitigate the risk before it happens and have a smooth working flow therefore, reliance is very essential along with robustness for positive organisational performance (H9, H10, H11, H12 and H13 = accepted).

5.2 Recommendation

This study contributes to the literature of SCRM practices by examining the relationship between SCRM, SCI, SCC and organisational performance. The study reveals that SCI and SCC are essential to obtain organisational performance by SCRM. Particularly in risk management when an organisation is planning to introduce or implement SCI, first they have to consider the importance of SCRM, as it has a significant relation with SCRM. Further SCI is more important because SCI is significant in all dimensions of SCRM and those dimensions are having a contingent relationship with organisational performance. Therefore, organisations need to implement SCRM techniques to

reduce supply chain risk to make a smooth flow of integration, Also, they need to develop their suppliers and train them in strategies to manage their production with low cost and provide standard quality to satisfy the ultimate customer.

Similarly, SCC develops joint initiatives to ensure that each partner has a stake in success. Supplier collaboration has a significant relation with SCRM whereas, customer collaboration has a negative significant relation with SCRM in Pakistan's textile environment. Through proper integration, demand risk could be managed. Meanwhile, they need to focus on obsolete and low-cost technological solutions and infrastructure, unskilled or poorly trained human resources. Moreover, lack of expertise in the field of product development and design, lack of attention towards upgrading the certified standard levels and environmental challenges are making the regional competition tougher.

Furthermore, as it is already explained that supplier collaboration is significant for SCRM, however if an organisation is having limited resources and wants to collaborate in any one of the dimensions of collaboration then it is advisable to capitalise on supplier collaboration first, the reason is, as supplier collaboration on one side will reduce the supply deliver risk and on the other hand customer collaboration is indirectly through demand integration significant to DRM which is the ultimate customer satisfaction. Therefore, two main objectives can be achieved simultaneously in one move.

The finding shows the positive direct relation of SCRM and organisational performance. SCRM can improve organisational performance and constitute a basis for competitive advantage over rivals through developing the resources and competencies in that regard, however, the companies are mainly keen to mitigate risk in order to have a smooth working flow, therefore, resilience is very essential for firms equipped with systems in terms of risk identification, assessment, mitigation, and monitoring are in a better position to absorb and accumulate knowledge from external sources and their internal efforts. Robustness is widely accepted as one performance measure to value sustainable returns in a disturbed business environment. Organisations must develop skills to shape the perceptions of outside constituencies. Corresponding skills deal with relational capabilities and management of change within the firm. Considering that this also applies to SCRM, more than ever before, because of globalisation, knowledge accumulation in SCRM cannot be an isolated effort.

5.3 Future recommendations

Our study offers both theoretical and managerial insights regarding how to successfully integrate the supply chain to realise improved performance. We hope that this study provides the foundation for interesting extensions on the topic of SCRM.

Additionally, future studies may gather data from the local firms, suppliers, and customers to gain a more encompassing supply chain perspective. Perhaps, further research can more fully analyse the relationship between operational and financial performance. Looking at other aspects of risk could provide further insights into the research. Another interesting extension would be to collect longitudinal data to see the results of integration, collaboration and other types of performance over time. Lastly, future research should examine how a local firm's SCI efforts enable it to better respond to a rival's supply chain actions.

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