Supply Chain Risk Assessment of SriLankan Apparel Manufacturing Organisations

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Abstract

Supply Chain (SC) is a process, which passes variety of materials and large amount of information among its several stages. In viewing of modern business environment, SC risks have a noteworthy impact on the continued operations of any business. Despite the risks and uncertainties, the existence of a business seeks to achieve profits and therefore managing those risks has become a key requirement for that. Even though giving prior attention to the risks associated with SC is very important for an apparel manufacturing organisation, the research regarding this concept has received less attention in global context as well as in the Sri Lankan context. Therefore, this paper aims to conduct a Risk Assessment (RA) and investigate the most critical SC risks in Sri Lankan Apparel manufacturing organisations. This study was approached through a multiple case study research method by carrying out five case studies within the apparel industry. The required data was collected through semi- structured interviews and the data analysis was carried out using content analysis together with risk matrix. A comprehensive literature review identified forty SC risk factors of which the level of criticality was measured through case studies. As the findings revealed, the most critical risk factors faced by Sri Lankan Apparel manufacturing organisations are quality issues, maintenance failures, forecasting errors, technological issues, inadequate labour force, performance issues in labour and machinery, health and safety issues of employees, system breakdowns, communication issues, information mismatch, oil crisis, spread of diseases and delivery delays. These supply chain risks should be identified and handled properly in order to enhance supply chain risk management and thus, to improve the business processes in apparel manufacturing organisation without any interruption.

***Keywords*:** Apparel Manufacturing Organizations, Supply Chain Risks, Risk Assessment, Sri Lanka

1. Introduction

The concept of SC was originated by a bunch of consultants in early 90's (Johnson, 2001). A SC has to manage the flow of a large amount of information and variety of products across all its stages(Prakash, Soni, & Rathore, 2017). The manufacturing organisations have to deliver the products in the accurate quantities, to the right places at the exact time in the least possible expenses and at supreme customer service levels (Waters, 2007).Risk is a part of every business environment. Worldwide developments and changes have created both newer inventions to reduce risk as well as newer sources to increase risk in businesses. However, like any other system, the SC is also subjected to various types of risks. Juttner, Peck, and Christopher (2003) defined SC risk as "the variation in the distribution of possible supply chain outcomes, their likelihoods, and their subjective values". It is fundamental for any business irrespective of scope, activity or sector, and this is necessary to minimize losses and also to maximize profit. When the organisations fail to detect and evaluate risk on time, they slip into losses. Accordingly, RA is about looking in advance to identify additional opportunities for escaping from losses (Sivagami & Sarath, 2018). RA is "a scientific and/or technical document that assembles and synthesizes scientific information to determine whether a potential hazard exists and/or the extent of possible risk to human health, safety or the environment" (U.S. Office of Management and Budget(OMB), 2006).

Sri Lankan apparel industry is reputed worldwide for producing top quality fashion apparel and as the most significant contributor of Sri Lanka's economy. Export Development Board (2015) stated that the apparel exports bring the largest export income to the country that recorded an increase of 9.26% year over year (YOY) by earning US $4.9 billion in the year of 2014 (Embuldeniya, 2015). According to Sri Lanka Country Commercial Guide (2018), Sri Lanka's apparel export industry is one of the most significant contributors to the economy. The industry has recorded substantial growth levels over the past four decades and is currently the country is leading export, accounting for approximately 40 percent of total exports, and providing about 33 percent of the manufacturing employment in the country. These are full of diversities, they face many infrastructural issues, and different group of people are involved at every level. Apparel manufacturing organizations consist of increasing the risks associated with in the SC. Often managing SC issues and other glitches in SC's are being continued without discerning risks (Sharma & Bhat, 2012). However, SC risks have a negative impact towards the performance of organizations. The mitigation of risks in the SC in the apparel manufacturing organizations can directly influence the success of the core business operations and supportive functions, which will lead to more satisfied customers and more effective workflow for employees (Chen & Fung, 2013). However, as the empirical findings(Bruce, Daly, & Towers, 2004; Sen, 2008 as cited in Mehrjoo & Pasek, 2015)suggest that the current RA in SC in the apparel manufacturing industry is not at an adequate level.

Hence, the aim of the research is to address this research gap by investigating the critical SC risks in apparel manufacturing organizations in Sri Lanka.

The structure of the paper begins with a review of literature related to key concepts of the study. Next it presents the method used in achieving the aim of the study and finally it presents the discussion on research findings together with conclusions and recommendations.

2. Literature Review

This section discusses the key literature findings related to the study in three sub sections.

2.1. Supply Chain of Apparel Manufacturing Organisations

A SC is a set of three or more entities directly involved in the upstream and downstream flows of products, services, finances, and information from a source to a customer. In other words, SC is an adjustment of firms that generates services or products to a significant market (Mentzer, et al., 2001). It is a process, which passes materials among several stages. Basically, different kinds of firms are involved in from manufacturing products to delivering them to the ultimate user. Wholesalers, retailer merchants, raw material and component producers, product assemblers and transportation companies are the main parties of a SC (La Londe & Masters, 1994). Mainly SC is developed with the intention to achieve several objectives like customer satisfaction and profitability (Peck, 2005). In today's competitive world, due to rapid change in technologies and globalization, SC's have been stretched out (Venkatesh, Rathi, & Patwa, 2015). Apparel manufacturing organizations consists of complex SC's, which are long and involved a number of parties (Bruce, Daly, & Towers, 2004).SC's within the apparel sector need to be managed carefully to have quick response and to reduce lead-time. Based on the SC's, they, can be categorized as internal and external where internal is measured by the organizations (manufacturers) while external is visible to the suppliers, distributors, retailers and customers) (Toni & Meneghetti, 2000).

2.2. Supply ChainRisks in Apparel Manufacturing Organisations

In the modern business environment, risk plays a significant role in any type of organizations. SC is generally complex as it usually spans over various functions or organizations and sometimes over lengthy time durations.

At present, there is a trend in SC to increase in complexity due to the involvement of numerous service providers, suppliers and end users in a network of relationships which causes risks for each and every one (Pfohl et al., 2010). Different reasons and causes have been identified for

SC risk through the previous researches. SC is a concept that has been built across the supplier, organization and customer. Among these parties, variety of functions and activities are on-going to precede a particular business process. In addition to that, there can be different relationships between these main parties and other sub parties. Mainly because of these, huge involvement of parties, SC is exposed to different risks, which can be grouped into different categories. Basically, these risks can be divided into two major categories as internal and external (Cucchiella & Gastaldi, 2006; Kleindorfer & Saad, 2005 as cited in Shahram et al., 2013). The risks, which generate within a particular organization, are known as internal risk factors while the risks generating from the business environment can be taken as external risk factors. Internal supply chain risk factors can be classified into operational, Competency and Information risks while the external supply chain risk factors can be classified into Business Environmental Risks, Natural Risks, Political Risks, Supplier Risks and Customer Risks as shown in Table 1.

To address these risk factors, concept of SC risk management was introduced and different approaches were built up with redevelopments. As the key stage of risk management, RA plays a vital role (Ho, Zheng, Yildiz, & Talluri, 2015). In Sri Lankan context, apparel handles a considerable SC network (suppliers, distributors, manufacturers, retailers and customers) according to their business environment and it faces a huge number of risks in each phases of SC (Martino, Fera, Iannone, & Miranda, 2017). Hence, currently the effort to mitigate those risk factors is getting more priority at strategic level. (American Production and Inventory Control Society (APICS), 2015).

Table 1:Internal and External Risk Factors

Internal risk factors		External risk factors	
Operational Risks	Accidents	Business Environmental Risks	Exchanging rates
	Theft		Competitors
	Quality issues		Price variability
	Maintenance failures		Oil crisis
		Natural Risks	Spread of diseases
	Forecasting errors		Natural disasters
Competency Risks	Lack of financial stability		Fire occurrence
		Political Risk	Rules and regulations
	Technological issues		Involvement
	Inadequate labour force		Labour disputes
			War and terrorism
	Performance issues in		Taxes

	labour and machinery	Supplier Risks	Low quality goods
			Delivery Delays
Information Risks	System breakdowns		Bankrupt
	Damages or losses		single source of supply
	Issues in Communication	CustomerRisks	Demand uncertainty
			Satisfaction
			Financial strength

Source: Kodithuwaaku (2014)

2.3. Supply Chain Risk Assessment for Apparel Manufacturing Organisations

The RA strategy was generated as a method of addressing the risk faced by business nature, which is a main process in the risk management system". RA is the identification of hazards that could negatively impact an organization's ability to conduct business". Focusing on entire SC instead of focusing on the individual levels for identification of risks and generating risk mitigating strategies is the major difference between traditional risk assessment and supply chain risk assessment (Hoeing & Thun, 2011).Assessing risk is a process that is identifying potential losses, evaluating the likelihood of losses, and assigning significance for them (Giunipero & Eltantawy, 2004). Further to the author, SC management is searching a way to mitigate these risks and enhance efficiency of the work by integrating internal functions and linking effectively with the external parties.

RA is separated into three sub areas as risk identification, risk analysis and risk evaluation (Institute of Risk Management, 2018).This is used to quantify the risks that businesses are subject to. This quantification is useful in identifying the important risks to develop risk management strategies. The most commonly used quantification method is defining risk using probability of occurrence (P) and impact of the consequence (I). Using these variables introduced a standard formula for a quantitative definition of SC risk (Mitchell, 1995).

Equation 1: Exposure of Risk Level

$$Risk = P \times I$$

Source: Revilla & Saenz (2017)

Where P is the probability of loss and I is the significance of the loss. Selection of multiplication function rather than using any other functions to combine the two variables in

this formula can be justified as risk can be expressed as the expected value from this formula. Further, (Cow & Townsend, 1998) also stated that risk management normally begins by assessing the two factors of risk, likelihood of a specific event occurring and the consequences if the event actually occur.

3. Methodology

This research aims at investigating critical SC risks in Sri Lankan apparel manufacturing organisations and answering the following two research questions.

- How SC related risks are currently managed in apparel industry?
- How are the critical supply chain risks in apparel industry in Sri Lanka?

According to the nature of this research, it was built up with qualitative approach. Since, the research questions begin with why or what or how, it is ideal to go for qualitative approach(Ritchie & Lewis, 2003) and this approach contributes to explore emerging concepts via in-depth investigation (Yin, 2009).In this study, the risk exposure of each case needed to be comprehensively analysed.

Table 2: Details of Selected Cases

Criteria	Case A	Case B	Case C	Case D	Case E
No of Employees	900	1100	1200	950	1000
Product	Glove	Lingerie	Jean	Knit Shirts	Swimwear
Designation of the interviewee	Procurement Manager	Maintenance Manager	Stores Manager	Group Facility Manager	Assistant Manager in Supply Chain
Experience of the interviewee	11 years	08 years	13 years	16 years	12 years

Hence, case study was the best approach for this research. The case study should be designed properly in order to acquire more reliable research findings. Unit of analysis, defining the number of cases and selection of cases were the major categories of the case study design. Accordingly, the unit of analysis of this research was the SCs in apparel manufacturing organizations in the Western province of Sri Lanka. According to Yin, the number of cases selection for a particular study may vary from one to eight based on researcher's scope and there is no any standard amount for the number of cases that should be included in a particular study. Therefore, five medium scale apparel manufacturing organisations were selected for the case study, depending on the time constraints and complexity. Case selection

should be conducted depending the expectations, accessibility and convenience according to the aim of the research (Yin, 2009). The data collection in this research was done mainly through semi structured interviews, from one respondent from each case who is knowledgeable and experienced in supply chain management related activities. The details of the selected cases are presented in the Table 2.

Mainly, literature survey and semi structured interviews were applied in data collection. Literature survey was performed at the initial stage of the research in order to identify the SC risks of apparel manufacturing organizations. The likelihood and the consequences of the occurrence of these risk factors in each case were identified by carrying out semi-structured interviews. These interviews were conducted among the parties who are responsible to manage supply chain of the selected cases. This study is based on qualitative method, thus, a qualitative risk analysing technique is needed to be used. Among the qualitative risk analysing techniques, risk matrix is the technique, which is frequently used for RAs (Chen, Chen, & Huihui, 2010). Accurate exposure level of risks can be shown as an index measure, after constructing the matrix using two variables such as Likelihood and Potential Consequences (Risk Level = Likelihood X Potential Consequences). The Table 3 and Table 4 respectively shows the risk matrix and legend of risk levels.

Table 3: Risk Matrix

Risk Matrix		Potential Consequences				
		Insignific ant (1)	Minor (2)	Moderate (3)	Major (4)	Severe (5)
Likelihood	Rare (1)	1=LR	2 =LR	3= LR	4=LR	5=LR
	Unlikely (2)	2=LR	4=LR	6=MR	8=MR	10=MR
	Possible (3)	3=LR	6=MR	9=MR	12=HR	15=HR
	Likely (4)	4=LR	8=MR	12=HR	16=ER	20=ER
	Almost Certain (5)	5=LR	10=MR	15=HR	20=ER	25=ER

Table 4: Legend of Risk Levels

Risk Level	Low Risk	Moderate Risk	High Risk	Extreme Risk
Legend	LR	MR	HR	ER
Risk Value	0-5	6-10	11-15	16-25

4. Findings and Discussion

This section discusses the findings of this study under three sub sections namely SC of apparel manufacturing organizations, SC risks of apparel manufacturing organizations in Sri Lanka and assessment of SC risks of apparel manufacturing organizations in Sri Lanka.

4.1. Supply Chain of Apparel Manufacturing Organisations

A well-managed SC helps organizations to achieve their goals in an effective manner. In order to achieve the aim, functions of the SC are needed to be performed well. When considering the SC functions of the five cases, similarities could be seen.

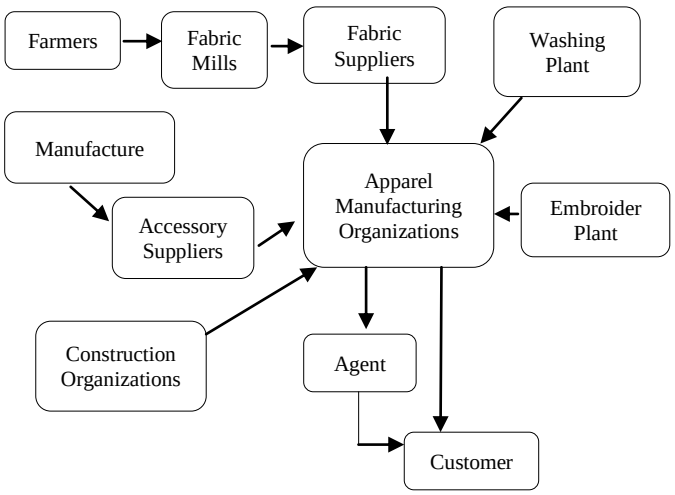

Figure 1: Supply Chain of apparel manufacturing organizations in Sri Lanka

Although the final outputs have several variability, SC and its functions are somewhat similar among each case which can be elaborated as in the Figure 1, customer is the end character of the SC as mentioned in the literature. On the other hand, raw material suppliers are the main suppliers in apparel manufacturing organizations. In addition to that, there may be service providers for outsourced functions. General SC process is illustrated as a summary of all five cases in Figure 1.

4.2. Supply Chain Risks of Apparel Manufacturing Organisations in Sri Lanka

As it was mentioned in Section II B, 40 SC risks factors in apparel manufacturing organizations were identified through literature and they were divided into two categories as internal and external. Further internal risk factors were also divided into three such as

operational risks, competency risk and information risk, and external risk factor is divided into five as business environment risk, political risk, natural risk, supplier risk and customer risk. The identified risks were checked through semi structured interviews, in order to investigate the relevance of those risks to apparel manufacturing organizations in Sri Lanka. As per the findings, all these risks identified through the literature could be risks relevant for Sri Lankan Apparel manufacturing organizations. The following explains the identified internal and external risk factors in apparel manufacturing organizations in Sri Lanka.

4.2.1. Internal Risks

Operational Risk: Case C has a high risk in accident, as the likelihood of an accident-taking place at least once a week is high while the consequences are at a moderate level. Case A and D have respectively major and moderate consequences from the theft with once a year probability of occurring yet, ultimately both ended up with a moderate risk levels. Case B has a high-risk impact by theft within their factory because of having major consequences and bi annual occurrence probability. Case C and D identified that although having some major consequences, there is a rare chance of a theft attack, hence, has a low risk level. Most of the organizations have identified quality issues as a critical supply chain risk factor within their organization having a serve impact on their organizations. Respectively Case A, B, C & E have at least an incident within a week and once a month regarding quality problems. Furthermore, “D” emphasized with a moderate consequence from quality issues by annually. Case B and D have a moderate impact by maintenance failure while having it once a month and bi annual probability of occurrence respectively. Thus, respectively they have high and moderate risk levels in maintenance failure. When considering forecasting error risk factor, majority has extreme risk levels. “D” and “E” have a major impact with an once a month of occurring. “C” and “D” have a moderate level of risk for forecasting errors, with moderate impact and probability of occurrence bi annually and once a year respectively. Case D only has an extreme risk level and all others have moderate levels of risk. Case B, obtaining a complex production may occur once a year, which has a minor impact on their organizations.

Competency Risk: All have a similar idea on the lack of financial stability as, “it is unlikely to have financial instability within the organization”. Accordingly, organizations have no doubt about their financial strength to manage their supply chain functions. As a result, have an insignificant consequence and rare probability of occurring, which ended up with a low risk level? “D” has a moderate consequence of having a monthly frequency of occurrence in infrastructural issues. Case A, B and E have a low risk in infrastructural issues as having a rare chance of happening and have insignificant consequences.“D” has an extreme risk level for technological issues, because it will occur once a week by having a severe consequence. Further, “B” and “C” have high risk level, it may be taking place at least twice a year and it will

lead to a severe damage to the organization. “C” has a low risk for inadequate labour force because they are confident enough on their amount of labour force; in contrast, “D” has an extreme risk level as having a major impact and once month likelihood. According to “B”, the effect of inadequate labour force will occur a moderate consequence while having a once a year probability of happening. Both “C” and “D” have similar idea on performance issues in labour and machinery as having a moderate risk level with moderate impact and will occur twice a year. Where Case A, B and E, have a high-risk level. Although “A” and “E” having a moderate consequence, one a week of occurrence, “B” has major impact and bi annual occurrence of probability. Case D has high level but Case C and E have low risk level for transport issues. “A” has high risk with a weak occurrence with moderate impact and all other have extreme risk levels for health and safety issues of employees.

Informational Risk: System breakdowns are one of the critical factors due to which Case A and D have extreme while Case B and E have high risk levels. But “C” gets low risk having severe impact and rare probability of occurring. “A” has low risk level for damages or losses, rare chance of happening a damage or loss. Case D has a major impact and once a month probability of happening, so has an extreme level in communication issues. Both “A” and “E” have extreme risk levels with a major impact and once a month probability of occurring for information mismatch, but “B” has a low risk level with a rare chance of happening.

4.2.2. External Risks

Business Environment Risk: Case C and D have a low level of risk for exchanging rates as having an insignificant impact and occurred once a month. Other three have a moderate level of risk as having a minor impact and once a week frequency of occurring. In case of competitors, all have moderate risk levels with once a year of likelihood with major or severe consequence.“C” has a low risk level for having an insignificant globalization of supply chains, but others have a moderate level of risk. All Cases have less risk level for regional instability than price variability other than Case C, which has low level of risk for both. Case A, B and C have a high risk of oil crisis.“A” and “B” have a bi annual chance of occurring with having a major impact but Case C is having once a month of occurring and a moderate consequence.

Natural Risk: Case C only has a low level of risk for spread of diseases, but all other four have a high risk level. “A” has a low risk level for natural disasters with a rare chance of occurrence and severe damage to the organization. Accordingly, “C” and “E”, reported high risk levels as having a severe consequence and with twice a year occurring. Case B and D has a moderate risk level as having a severe impact and once a year likelihood. In fire occurrence risk factor, Case A and B are at a low level as having a severe impact and a rare chance of hazard, fire.

Political Risks: Case B and C have a rare occurrence probability and respectively their consequence levels are moderate and major for rules and regulations and Cases A, D and E have achieved moderate risk levels with once a year occurring. All have low level for war and terrorism with having a rare chance of happening. All have a moderate risk for labour disputes and taxes. "D" has a high-risk level as having a major impact and bi annual probability in involvement risk.

Supplier Risks:"C" has a low risk level with a rare chance of happening and severe impact on low quality goods. But Case A has an extreme level of risk with a severe impact and once a week probability of occurring. Cases A and D bear the same idea for lack of trust as having a major consequence and a bi annual probability of occurrence. Hence, have a high-risk level. Other three has a low risk level. For factor delivery delays, Cases A, C and E have an extreme risk level, "B" has a high-risk level with having a bi annul probability and major consequences, and "D" has a moderate risk levels as having a moderate impact and bi annual probability. Most of the factories are having similar risk levels as low as having a rare likelihood for bankrupt, yet only the case D has a major impact and once a year occurrence probability, and it belongs to moderate risk level.

Customer Risks: All the factories have a similar consequence as severe in demand uncertainty. Here, for the cases A and D, there was once a month probability and ended up with an extreme risk level. Case A has extreme risk level with a major impact and once a month probability of occurring for satisfaction. Case A, B and C have a similar risk level as low in financial strength with having a rare occurring chance. Both "D" and "E" belong in moderate risk level and have a once a year probability of happening. Case C has a low risk level and all others have moderate risk level in variation in product specifications and volumes factor.

4.3. Assessment of Supply Chain Risks of Apparel Manufacturing Organisations in Sri Lanka

In order to make a clear picture of the identified risk factors, a RA was carried out by employing risk matrix. Those risks were assessed through the values given by the respondents for likelihood of occurrence (Insignificant, Minor, Moderate, Major, Severe) and potential consequence of occurrence (Rare, Unlikely, Possible, Likely and Almost Certain) of the risks from organisational point of view. The Table 5 shows the research findings on risk levels, i.e. Low Risk (LR), Moderate Risk (MR), High Risk (HR), and Extreme Risk (ER) that could be identified through the RA. Based on the level of risks identified through the risk matrix, the most critical SC risks of apparel manufacturing organizations in Sri Lanka were identified.

According to the common practice, where the level of risk is at extreme or high level in majority of cases (three or more cases), those risks were considered as a critical risk factors.

As the findings revealed, quality issues, maintenance failures, forecasting errors, technological issues, inadequate labour force, performance issues in labour and machinery, health and safety issues of employees, system breakdowns, communication issues, information mismatch, oil crisis, spread of diseases and delivery delays are the critical risk factors identified as critical with in the case studies. As all these cases are engaged in a business that manufactures a product for a particular customer, the quality of that is very important. They are exporting their garments to well recognized foreign markets. If there is a quality issue in a product, it would badly affect the reputation of the organization which results in a huge financial loss. In addition to that, inadequate labour force creates a lot of problems in these organizations. Although occurrence of oil crisis has a lesser probability, with a significant impact, it could become a critical risk factor for apparel manufacturing organizations.

The Table 6 below illustrates the risk levels regarding the identified forty risk factors for each case. Both Case B and C have fewer amounts of risks in extreme range compared with the other cases. The reason behind that difference was identified to be following standard procedures and policies as strategies. Furthermore, practicing the risk matrix to evaluate risk exposure within the organizations and having preventive maintenance procedures to eliminate the unexpected maintenance failures of the systems were used as risk overcoming strategies. However, most of others were following corrective maintenance, hence, downtime of a maintenance failure was very much high within their organizations.

Table 5: Internal and External Risk Factors

Risk Factors	Level of Risk LR- Low Risk, MR-Moderate Risk, HR-High Risk, ER-Extreme Risk					Criticality
	A	B	C	D	E	
Internal Risks Factors						
Operational Risks						
Accident	LR	LR	HR	LR	MR	
Theft	MR	HR	LR	LR	MR	
Quality issues	ER	ER	ER	HR	ER	√
Maintenance failures	ER	HR	ER	MR	ER	√
Forecasting errors	ER	MR	MR	ER	ER	√

Product complexity	MR	MR	MR	ER	MR	
Competency Risks						
Lack of financial stability	LR	LR	LR	LR	LR	
Infrastructural issues	LR	LR	MR	HR	LR	
Technological issues	MR	HR	HR	ER	MR	√
Inadequate labour force	HR	MR	LR	ER	HR	√
Performance issues in labour and machinery	HR	HR	MR	MR	HR	√
Transport issues	MR	MR	LR	HR	LR	
Health and safety issues of employees	HR	ER	ER	ER	ER	√
Informational Risks						
System breakdowns	ER	HR	LR	ER	HR	√
Damages or losses	LR	MR	HR	MR	HR	
Communication Issues	HR	LR	HR	ER	MR	√
Information mismatch	ER	LR	HR	HR	ER	√
External Risk Factors						
Business Risks						
Exchanging rates	MR	MR	LR	LR	MR	
Competitors	MR	MR	MR	MR	MR	
Globalisation of supply chains	MR	MR	LR	MR	MR	
Price variability	ER	MR	LR	ER	MR	
Regional instability	MR	LR	LR	HR	LR	
Oil crisis	HR	HR	HR	MR	MR	√
Natural Risks						
Spread of diseases	HR	HR	LR	HR	HR	√
Natural disasters	LR	MR	HR	MR	HR	
Fire occurrence	LR	LR	MR	MR	MR	
Political Risks						
Rules and regulations	MR	LR	LR	MR	MR	
Involvement	LR	LR	LR	HR	MR	
Labour disputes	MR	MR	MR	MR	MR	
War and terrorism	LR	LR	LR	LR	LR	
Taxes	MR	MR	MR	MR	MR	
Supplier Risks						

Low quality goods	ER	MR	LR	MR	MR	
Lack of trust	HR	LR	LR	HR	LR	
Delivery Delays	ER	HR	ER	MR	ER	√
Bankrupt	LR	LR	LR	MR	LR	
Single source of supply	MR	LR	LR	HR	MR	
Customer Risks						
Demand uncertainty	ER	LR	LR	ER	MR	
Satisfaction	ER	MR	MR	MR	HR	
Financial strength	LR	LR	LR	MR	MR	
Variation in product specifications and volumes	MR	MR	LR	MR	MR	

Case A and E are keener about their information systems as effectiveness of all the transactions depend on the performance level of information system and an already allocated a secured area for information systems with required facilities. Additionally, majority of data is being transferred through computer-based networks. But in other cases, they were using considerable amount of manual document for data sharing which had a higher risk regarding information mismatch, due to human errors. Case B has a specific procedure to carryout procurements without lading to a forecasting error and is always concerned of the historical trends before placing orders to suppliers.

Table 6: Risk exposure of the organizations

Risk exposure	LR (Low Risk)	MR (Medium Risk)	HR (High Risk)	ER (Extreme Risk)	No of Critical Risks
Case A	11	12	07	10	17
Case B	15	15	08	02	10
Case C	20	09	07	04	11
Case D	05	17	09	09	18
Case E	07	19	07	06	13

Ultimately, it reduces the financial losses for the organization. Case C and D, have conducted periodical training and development secessions to increase the productivity of the employees while enhancing the goodwill towards the organization. Moreover, lack of using up to date technologies is the main reason for having risk exposure regarding technological issues.

5. Conclusion and Recommendations

In the current context, the apparel manufacturing organizations are playing a major role in Sri Lankan economy. The parties who are involved in these organizations face various types of risks factors in different levels and magnitudes. The SC is well-established concept among the industries like apparel manufacturing. There are numerous risk factors directly connected with the SC of apparel manufacturing organizations. Among them, there are critical risk factors which can bring adverse impacts on a business. Therefore, the identification of these critical risk factors is essential in order to control them by using appropriate strategies, depending on the functions and operations of the business. Therefore, the aim of this research was to investigate the critical SC risks in apparel manufacturing organizations in Sri Lanka. Finally, after evaluating the risk levels of each risk factors quality issues, maintenance failures, forecasting errors, technological issues, inadequate labour force, performance issues in labour and machinery, health and safety issues of employees, system breakdowns, communication issues, information mismatch, oil crisis, spread of diseases and delivery delays were identified as the critical SC risks in apparel manufacturing organizations in Sri Lanka. According to the findings of the research, manufacturing organizations, which mainly deals with foreign market, should have a standard quality policy to enhance the quality of their products. In addition to that, all the suppliers should be evaluated using an appropriate method to eliminate the risks from the suppliers. It is ideal to follow preventive or predictive maintenance procedures for the maintenance practices. Continuous training and development programs will increase the productivity level of the employees. Thus, it is better to adhere to new upcoming technologies, which can carry out tasks efficiently.

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