
Consequences of Supply Chain Disruptions due to COVID-19 and Revamping a Way: A Research Through Bangladesh Apparel Industry

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Abstract:

A supply chain disruption is defined as major breakdowns in the production or distribution of a supply chain, including events such as fire break out, machine breakdown, natural disasters, quality issues, and an unexpected surge in capacity. Recently there has been an outbreak of COVID-19 which is affecting the supply chain process mostly. The study has been conducted to understand the impact of COVID-19 on the supply chain process. The relevant academic literature publication, reports, newspapers, webpages have been used for data collection. An online interview with the supply chain professionals from different industries has been conducted for primary information. The research found that the supply chain area in the Apparel Industry of Bangladesh has been affected most due to this pandemic. From improper management to production reduction, higher logistics bottleneck, the uncertainty of raw materials, higher lead time the COVID-19 has made drastic ascendancy to the supply chain sector. This paper highlights the supply chain disruption in the entire apparel industry of Bangladesh. It also includes what are the effects that have been done in the supply chain and the way out to mitigate the risk of Covid-19 which have been discussed at the end. This study will be supportive to the stakeholders of the apparel industry to learn the impact of this COVID-19 in the respective sectors and make the necessary adjustment for the future betterment.

Keywords: Supply Chain Disruption, Apparel Industry, COVID-19, Revamping, Mitigate risk.

Introduction:

A supply chain disruption begins with one simple mistake or issue that continues to affect the product, its assembly, testing the product, and shipping the product (Ozgur, 2020). Recently there has been an outbreak of COVID-19 which is affecting the supply chain process mostly. Coronavirus disease (COVID19) is a new contagious disease and This virus can infect people and transmit from person to person easily. This Coronavirus or COVID-19 was first identified in December 2019 by health specialists in Wuhan City in the People's Republic of China (Rman of the Myanm, 2019). Due to the COVID-19 outbreak, every country varying in their methods and capacity to contain the virus, social distancing and lock-down requirements limiting production in key supplier markets reveal the shortcomings of existing supply chain management (SCM) models (McMaster et al., 2020). COVID-19 virus caused downstream break and closure of production and distribution activities in many SCs abound (Ivanov & Das, 2020). Moreover, Bartik et al. (2020) show from a survey that, 43% of businesses had for the time being closed, and nearly all of these closures were due to COVID-19. Respondents that had temporarily closed largely pointed to reductions in demand and employee health concerns as the reasons for the closure, with disruptions in the supply chain being less of a factor (Bartik et al., 2020). there is no recovery in the near term and this impact will take place one to two years to recover (Profile, 2020). The whole world is now in unweaving. This virus is not the only effect on health, but also the global economy. When a large industrial city connected with other regions and countries through supply chains in a composite manner is locked down to prevent the spread of COVID19, the economic effect is going to spread across regions and countries (Inoue & Todo, 2011). Expertise has been said that the COVID-19 outbreak is one of the worst global pandemics for decades (Sen et al., 2020). Among the most pretentious economic sectors, the apparel industry is one of the highest vulnerably affected sectors (Rman of the Myanm, 2019).

Bangladesh is the second-largest exporter of clothing with 6.4% global share, after China. The textile and clothing industry funds 16% and 80% to Bangladesh's GDP and export earnings, respectively, while employing around 4 million workers ((Majumdar & Sinha, 2019). The sector provides around 2.5 million employment (Majumdar et al., 2020). unlike other supply chain disruptions, COVID-19 has created a swell effect in the clothing supply chain. This COVID-19 disease was first detected in Bangladesh in the first week of March and after that ever country including Bangladesh going for lockdown for 40 to 60 days then the problem is compounded. Due to the pandemic declared by WHO every Government is taking protective measures and people are thinking to wear masks to protect themselves (Profile, 2020). Like other countries, social distancing and lockdown due to COVID-19 affect the economy and business in Bangladesh. Every sector has been closed down and people are buying and shopping only necessity commodities (Sen et al., 2020). Therefore, COVID-19 created an unprecedented situation in the clothing supply chain where demand, supply, and manufacturing got completely disrupted and delinked (Majumdar et al., 2020). A survey report by Wright and Saeed (2020) shows that, In Bangladesh, US\$ 3.17 billion in orders have been canceled affecting around 2.27 million workers. Businesses have taken steps to reinforce the elasticity of their global SCs to risks posed by natural or industrial LFHI events – for, e.g., Hurricane Katrina in 2005, the earthquake and tsunami in Japan in 2011, an explosion at the BASF plant in 2016(Ivanov & Das, 2020). But because of the shortage of labor and time, many companies are not done supply chain risk mitigation plan to estimate, and also Many companies obtain supplies due to low cost and quality (Profile, 2020). The ongoing discussion highlights the severe impact of COVID-19 on the social sustainability of the clothing supply chain functioning in Bangladesh. The objective of this study is to find out the disruptions

that have been created due to COVID-19 and hence discover the way of managing new supply chains. The approaches needed in post-COVID-19 era and the roles of various actors to improve the social security of workers in the clothing supply chain have also been proposed. This paper makes unique contributions by deliberating on the specific issue of social security in the clothing supply chain due to disruptions caused by COVID-19 and ways to mitigate this problem. That is needed most to tackle the situation and get the best out of the circumstances to minimize risks and disturbances. The article will scrutinize all the aspects of disruptions of the supply chain drivers in the apparel industry and come up with the best possible solution to revamp thoroughly.

Objectives:

The primary objective of the study is to find out the disruptions along with the consequences that have been occurred in the apparel industry because of COVID-19.

The secondary objectives of the study are the following:

1. To identify the condition of the supply chain process in COVID-19.
2. To discuss the state of affairs of the Bangladesh Apparel Industry in this pandemic.
3. To write down some strategies to minimize the disruptions based on analyzing the COVID-19 impact on the supply chain.

Literature review:

The highly-infectious COVID-19 virus was avowed a global pandemic by the World Health Organization on 11 March 2020 (McMaster et al., 2020). Although its exact background is unknown, the COVID-pandemic is believed to have emerged in Wuhan, China in December 2019. Some people have started to call this virus as “China virus”, “Chinese coronavirus”, “Wuhan coronavirus”, “Wuhan virus”, or the “Kung Flu” etc. (Rman of the Myanm, 2019). As this virus is belonging to this earth the epidemic does not confine to the particular city or country and will affect the whole earth. The impact of this virus has spread globally (Sen et al., 2020). Several studies have appraised the economic impacts of the spread of COVID-19. For example, Organization for Economic Co-operation and Development (OECD) predicts that in early March 2020 that if outbreaks of COVID-19 spread widely in Asia and advanced countries in the northern hemisphere, the growth rate of real GDP in the world in 2020 would be 1.4%, which is 1.5% points lower than its estimate before the spread of COVID-19. The economic impact can be understandable from China’s President Xi Jinping, speech on television February 23, 2020: “It is unavoidable that the novel coronavirus epidemic will have a considerable impact on the economy and society” (Rman of the Myanm, 2019). While affected countries have practiced social distancing, community quarantining, and lockdown to contain the spread of this deadly virus, widespread unemployment has caused social sustainability challenges along with economic distress (Majumdar et al., 2020).

At G 20 gathering in Riyadh, Saudi Arabia, dated on February 24, 2020, Japanese Finance Minister Taro Kishida uttered: “The spread of the new coronavirus is a public health crisis that could pose a serious risk to the macroeconomy through the halt in production activities, Interruptions of people's movement and cut-off of supply chains” (Rman of the Myanm, 2019). The International Labor Organization (ILO) has estimated that there could be up to 25 million jobs lost as a result of the COVID-19 crisis. The estimation of McKibbin and Fernando indicates that in their worst scenario where all countries are hit, the spread of COVID-19 would reduce the GDP of China, Japan, the United Kingdom, and the United States by 6.2%,

9.9%, 6.0%, and 8.4%, respective (Inoue & Todo, 2011). Not only a single economic sector has been affected due to the COVID-19, the whole global economic sectors i.e. mining, transportation, leisure and hospitality chains, airlines, the luxury goods sector, etc. (Sen et al., 2020). Unlike other sectors the supply chain of the clothing industry has been affected much due to COVID-19., Supply chain disruption can cause havoc during as most of the developing economies of the world While this global network works efficiently in a stable business environment including those in South and Southeast Asia, rely on textile and clothing industries (Majumdar et al., 2020). This impact of COVID-19 on the clothing industry has been seen as an epidemic crisis. As the global supply chain extends beyond the geographic boundaries of a country, suppliers are located in different countries (Linton and Vakil, 2020). The major reason is that the main source of raw materials for the clothing industry China has been infected at first by the COVID-19 (Rman of the Myanm, 2019). (Majumdar et al. (2020) presented that the supply of clothing raw materials from China was disrupted due to a lockdown in Wuhan which started in January 2020. As China has stooped the production, the other apparel manufacturing countries like Bangladesh, India, Sri Lanka, South Africa, Myanmar, etc. apparel industry has stunned. For example, Bangladesh export more than 50 percent of apparel raw materials from China, and about 40 percent of the machinery and spare parts for this industry (Sen et al., 2020). However, demand for clothing has weakened harshly since the second week of March 2020 as lockdown started in parts of Europe. Global clothing brands reacted by canceling confirmed orders or by delaying the payment. As the disease started to spread in South Asia, a lockdown was announced in India and Bangladesh in the last week of March 2020 bringing the clothing industry to a complete standstill (Majumdar et al., 2020). Sen et al. (2020) state that, the production factories have to stop production for the shortage of raw materials and show through a survey that, around 93 percent of Bangladesh apparel producers reported that they faced a delay in raw material shipments during this pandemic (Sen et al., 2020). Another problem is facing the workers that the brands and retailers started to cancel the production order. A recent study result shows that about 23.4 percent of suppliers indicated that lots of existing orders had been canceled while another 22.3 percent of the suppliers marked “most” in respect of orders cancelation. In another survey, Wright and Saeed (2020) showed that Bangladesh, US\$ 3.17 billion in orders, has been canceled affecting around 2.27 million workers. For that reason, the factories have to close down and the workers got a tremor. A survey accompanied by CMAI among 1,500 clothing manufacturing units exposed that 20% of them have considered permanently closing their business following lockdown. A recent survey result found that about 72.4 percent of manufacturers in Bangladesh were unable to provide their workers with some income when furloughed. Around 80.4 percent of the Bangladeshi suppliers stated that they were incapable to provide compensation to the workers when order cancellations resulted in worker dismissals. Bangladeshis the second largest exporter of clothing after China with a 6.4% global share. The textile and clothing industry contributes 16% and 80% to Bangladesh's GDP and export earnings, respectively, while employing around 4 million workers (Majumdar & Sinha, 2019). But the global pandemic COVID19 has created an unprecedented situation in the clothing supply chain where demand, supply, and manufacturing got completely disrupted and delinked in Bangladesh.

Agarwal et al. (2006) considered market sensitiveness, information drivers, process integration, and flexibility as supply chain performance dimensions. Furthermore, Hendricks and Singhal (2003) presented a set of operational measures that relate supply chain performance to areas such as forecasting and planning accuracy, supplier performance, delivery performance, lead time, inventory, capacity, and quality. Although the choice and importance of operational measures will vary across firms, the performance of a firm on its chosen operational metrics will determine the efficiency, reliability, and responsiveness of its supply chains. To cope with supply chain disruptions, firms need to invest in the supply chain capabilities identified as resilience enhancers. In that regard, improving supply chain flexibility is critical to achieving a higher level of organizational resilience, which enhances a firm's response to process disruptions. For supply chains that are exposed to demand risk, supply risk, and environmental risk, the best strategy is

investing in supply chain flexibility. Organizations would be able to reduce the negative effect of control disruptions through investment in collaboration with their supply chain partners. In the last two decades, researchers have addressed various facets of supply chain risk management, including risk identification, assessment, mitigation, and monitoring. Chopra & Sodhi (2004) stated that, while building resilience in the supply chain has been proposed to tackle supply chain risks, the COVID-19 outbreak has proved beyond a doubt that even the best combinations of traditional strategies like agility, robustness, flexibility, redundant capacity, surplus inventory is not enough to cope with this particular global pandemic (Chopra & Sodhi, 2004). The reviewed literature Provides the factors that affect the supply chain disruption due to the Coronavirus. The question as to which factors mostly creating the disruption. This study makes unique contributions by deliberating on the specific issue of social security in the clothing supply chain due to disruptions caused by COVID-19 and ways to mitigate this problem.

Research Methodology:

This purpose of this study was to identify the consequences of Supply chain disruptions due to COVID-19 in Bangladesh Apparel Industry. Both primary and secondary data were used to conduct this study. Primary data were collected from different apparel industries of Bangladesh and the secondary data were collected from the books, magazines, and journals.

1. Demographic Information of the Respondents:

This study conducted on 201 Supply Chain Professionals from different Apparel Industries of Bangladesh. Among the respondents, 74.1% of the respondents were male and 25.9% were female (Table 1).

Table 1: Gender Distribution of the Respondents

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Female	52	25.9	25.9	25.9
Male	149	74.1	74.1	100.0
Total	201	100.0	100.0	

The respondent workers mostly (31.3%) were at the age of 30-40 years followed by (20.4%) at the age of 26-30 years & 41-50 years, (14.9%) at the age of 18-25 years and (12.9%) at the age of 50 years and above. (Table 2).

Table 2: Age Distribution of the Respondents

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid 18-25	30	14.9	14.9	14.9
25-30	41	20.4	20.4	35.3
30-40	63	31.3	31.3	66.7
40-50	41	20.4	20.4	87.1
50+	26	12.9	12.9	100.0

Total	201	100.0	100.0
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Marital status of the respondents shows that, 65.7% of them were married which is the most percentage among the respondents followed by 23.4% were unmarried, 6.5% were divorced and 4.5% of the respondents were widowed (Table 3).

Table 3: Marital Status of the Respondents

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Divorced	13	6.5	6.5	6.5
Married	132	65.7	65.7	72.1
Unmarried	47	23.4	23.4	95.5
Widowed	9	4.5	4.5	100.0
Total	201	100.0	100.0	

Most of the workers are above 10 years of experienced followed by 7-9 years, 4-6 years, 1-3 years and below 1 year (Table 4).

Table 4: Working Experience of the Respondents

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid <1 Year	27	13.4	13.4	13.4
>10 years	53	26.4	26.4	39.8
1-3 Years	37	18.4	18.4	58.2
4-6 Years	38	18.9	18.9	77.1
7-9 Years	46	22.9	22.9	100.0
Total	201	100.0	100.0	

In (Table 5) it is visible that, most of the respondents who are working as supply chain professionals are from the department of Distribution followed by Operations, Logistics, Planning, Procurement & Inventory.

Table 5: Working Department of the Respondents

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Distribution	38	18.9	18.9	18.9
Inventory	27	13.4	13.4	32.3

Logistics	34	16.9	16.9	49.3
Operations	37	18.4	18.4	67.7
Planning	34	16.9	16.9	84.6
Procurement	31	15.4	15.4	100.0
Total	201	100.0	100.0	

2. Sample Design and Determination of Sample Size:

This study interviewed 201 supply chain professionals from 201 organizations related to apparel products. All of the respondents were working in the supply chain department in different organizations of Bangladesh with industrial procurement, distribution, inventory, planning & logistics experience from Private, Government, Multinational and National companies.

3. Questionnaire Design:

The questionnaires of this study were developed through literature review and the expertise school of thought. Responses to all the statements in the questionnaires were measured on a five-point scale ranging from 1 to 5 with 1 indicating strongly disagree, 2 disagree, 3 neutral, 4 agree and 5 indicating strongly agree. One of the relative advantages of using this scale is its suitability for the applications of multifarious statistical tools used in marketing and social research study (Malhotra, 1999). The collected data were statistically processed subsequently to get the useful information. The reliability statistics show that the internal consistency of the questionnaire is under the acceptable limit (Nunnally, 1978). The Cronbach's Alpha was identified as 0.721 which are at the acceptable level (Table 6).

Table 6: Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.721	.714	5

4. Data Collection & Analysis:

Data were collected from both primary and secondary sources. Primary data were used for the purpose of analyzing the effect of Covid-19 on the Supply Chain process of Apparel Industries in Bangladesh. The survey was conducted among the 201 organizations associated with apparel products. The data were collected through google form and informal interviews of supply chain professionals among these organizations. The interviewers were properly trained on the items included in the questionnaire for data collection before commencing the interview. Along with descriptive statistics, inferential statistical techniques such as, Factor Analysis and Multiple Regression Analysis were used to analyze the data. A Principal Component Analysis (PCA) with an Orthogonal Rotation (Varimax) using the SPSS (Statistical Package for Social Sciences) was performed on the survey data. Multiple Regression Analysis such as, Multiple Regression was conducted by using SPSS to identify the relationships between the dependent and independent variables and the significant factors.

Results & Findings:

This section describes the results of Exploratory Factor Analysis (EFA) and the results of Multiple Regression Analysis for the variables.

1. Results of Factor Analysis:

The study identified the consequences of supply chain disruptions due to COVID-19 in Bangladesh Apparel Industry. Factor analysis results show that the communalities of the variable concerning disruptions are very high indicating that the data set has higher level of relations ships among them (Table 7).

Table 7: Communalities of the Variables

Variables	Initial	Extraction
1. Supply chain disruptions due to Improper manpower management	1.000	.739
2. Supply chain disruptions due to Inadequate co-ordination	1.000	.704
3. Supply chain disruptions due to problem with production reduction	1.000	.567
4. Supply chain disruptions due to problem with higher logistics bottleneck	1.000	.511
5. Supply chain disruptions due to low staffing level	1.000	.629
6. Problem with transportation of raw materials from suppliers	1.000	.626
7. Problem with transportation from factory to warehouse	1.000	.564
8. Problem with transportation from warehouse to customer	1.000	.591
9. Communication problems between the factory and the warehouse	1.000	.738
10. Communication problems between the warehouse and the stores	1.000	.831
11. Communication problems between the stores and the customers	1.000	.762
12. Too much inventory in the factory	1.000	.684
13. Too little inventory in the factory	1.000	.679
14. Problem with demand weakening	1.000	.811

15. Problem with demand skyrocketing	1.000	.814
16. Uncertainty of raw materials	1.000	.495
17. Lead time worsen	1.000	.505
18. Suppliers operating at low rate	1.000	.742
19. Problem with cutting capital expenditure	1.000	.649
20. Problem with the downgrade of profitability	1.000	.471

Extraction Method: Principal Component Analysis.

The results of the analysis also identified five disruption factors through EFA. The factors are: (i) Problem regarding facilities (ii) Problem regarding logistics efficiency (iii) Problem with communications (iv) Problem regarding delivery of the product and (v) Problem regarding imbalance between demand and operation. The most important factor is Problem regarding facilities (22.13%) followed by Problem regarding logistics efficiency (18.70%), Problem with communications (10.50%), Problem regarding delivery of the product and Problem regarding imbalance between demand & operation (Table 8).

Table 8: Total Variance Explained

Extraction Method: Principal Component Analysis.

Components	Initial Eigenvalues		
	Total	% of Variance	Cumulative %
1. Problem regarding facilities	4.427	22.134	22.134
2. Problem regarding logistics efficiency	3.741	18.704	40.838
3. Problem with communications	2.100	10.502	51.340
4. Problem regarding delivery of the product	1.643	8.217	59.556
5. Problem regarding imbalance between demand & operation	1.202	6.010	65.566

Table 9 shows, the rotated component matrix of the variables which indicates that the factors constituted with the variables have higher level of correlations between them. It shows that the factor named Problem regarding facilities is constituted with six variables and the variables have higher level of factor loadings indicating that the variables have higher level of correlations with the factor. The second factor is constituted with seven variables, third factor is formed with three variables and the fourth & fifth factor is constituted with two variables. It can be noted that all the variables have high correlations with the respective factors.

Table 9: Rotated Component Matrix^a

	Component				
	1	2	3	4	5
Supply chain disruptions due to Improper manpower management	.852				
Supply chain disruptions due to Inadequate co-ordination	.838				
Supply chain disruptions due to low staffing level	.757				
Too little inventory in the factory	.195				
Problem with demand weakening	.679				
Problem with cutting capital expenditure	.658				
Supply chain disruptions due to problem with production reduction		.692			
Supply chain disruptions due to problem with higher logistics bottleneck		.604			
Problem with the downgrade of profitability		.546			
Uncertainty of raw materials		.528			
Problem with transportation of raw materials from suppliers		.718			
Problem with transportation from factory to warehouse		.710			
Problem with transportation from warehouse to customer		.709			
Communication problems between the factory and the warehouse			.824		
Communication problems between the warehouse and the stores			.893		
Communication problems between the stores and the customers			.853		
Too much inventory in the factory				.799	
Lead time worsen				.530	
Problem with demand skyrocketing					.455
Suppliers operating at low rate					.846

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.^a

a. Rotation converged in 6 iterations.

2. Results of Regression Analysis:

Multiple regression analysis was calculated to test production reduction based on Suppliers operating at low rate, higher logistics bottleneck, Uncertainty of raw materials. Taken as a set, the predictors Suppliers

operating at low rate, Supply chain disruptions due to problem with higher logistics bottleneck and Uncertainty of raw materials account for (28.1%) of the variance in production reduction (Table 10).

Table 10: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.530 ^a	.281	.270	.886

a. Predictors: (Constant), Suppliers operating at low rate, Supply chain disruptions due to problem with higher logistics bottleneck, Uncertainty of raw materials

Analysis of variance shows that all the predictors are significantly related to the production reduction. The overall regression model was significant, $F(3,197) = 25.67$, $p < .001$, $R^2 = .281$ (Table 11).

Table 11: ANOVA^a

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	60.395	3	20.132	25.668	.000 ^b
	Residual	154.511	197	.784		
	Total	214.905	200			

a. Dependent Variable: Supply chain disruptions due to problem with production reduction

b. Predictors: (Constant), Suppliers operating at low rate, Supply chain disruptions due to problem with higher logistics bottleneck, Uncertainty of raw materials.

The individual predictors with the production reduction also show that all the factors are significantly related (Table 12). This indicates each of predictors identified through this analysis is significantly connected to the dependent variable. That means that if there is a change in each factor there will be the change in dependent variable.

Table 12: Coefficients^a

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
1 (Constant)	.597	.442		1.351	.178

Supply chain disruptions due to problem with higher logistics bottleneck	.444	.068	.420	6.583	.000
Uncertainty of raw materials	.301	.093	.208	3.234	.001
Suppliers operating at low rate	.047	.059	.049	.805	.422

a. Dependent Variable: Supply chain disruptions due to problem with production reduction

Managing Supply Chain Disruptions:

The Covid-19 pandemic has changed the business environment for many organizations, creating compulsion for adapting new crisis management mechanisms to overcome uncertainties. Companies no longer have the luxury of using a conventional supply chain - apart from ensuring emergency supplies, they need to plan for establishing a new supply chain process for the post-pandemic situation. Companies of other countries have revised their operational strategies and Bangladeshi companies would need to do so. Regarding Bangladesh Apparel Industry, the Government can take lots of initiatives i.e. tax rebates, reduce VAT, financial support to the owners, loan installment reschedules, etc. A proper policy strategy is indeed an emergency to support the destitute workforce during the COVID-19 as well as in future financial crises that can happen due to this kind of epidemic or any reason.

Sodhi et al. (2012) suggest four key elements for managing supply chain risks: (1) risk identification, to identify sources of risk and uncertainty, an initial step recommended by many researchers; (2) risk assessment, a process involving the evaluation of the likelihood and the impact of each source of risk; (3) risk mitigation, to reduce the likelihood of a particular risk's occurrence, reduce its potential impact, or both; and (4) responsiveness to risk incidents, to develop a response to each actual risk event so as to reduce its potential impact and hasten recovery. To mitigate the supply chain disruptions in Bangladesh Apparel Industries it is high time to make the changes inside and outside of the organizations. Some of the companies shifting their base from China to the new location for example Wistron corp one of the suppliers of Apple eyeing to shift base from China to India, Vietnam, and Mexico. They also emphasized the actions to be taken in short term and long term as per the following.

Short Term:

1. Organizations has to understand financial and operational impact across multiple scenarios.
2. Balance supply and demand and build buffer stock.
3. Financial evaluation of the key suppliers and their impact on supply chain.

Long Term:

1. Built Finite, decentralized, agile, mini operating models with flexible supplier relationships.

2. Diversify the supplier base and geographically identify suppliers in the event of emergency.
Dual supplier base for sourcing of critical components.
3. Short term approach to long term supply chain strategy.

So, in order to mitigate the disruptions and revamp the process in the Apparel Industry some effective initiatives can be taken as follows:

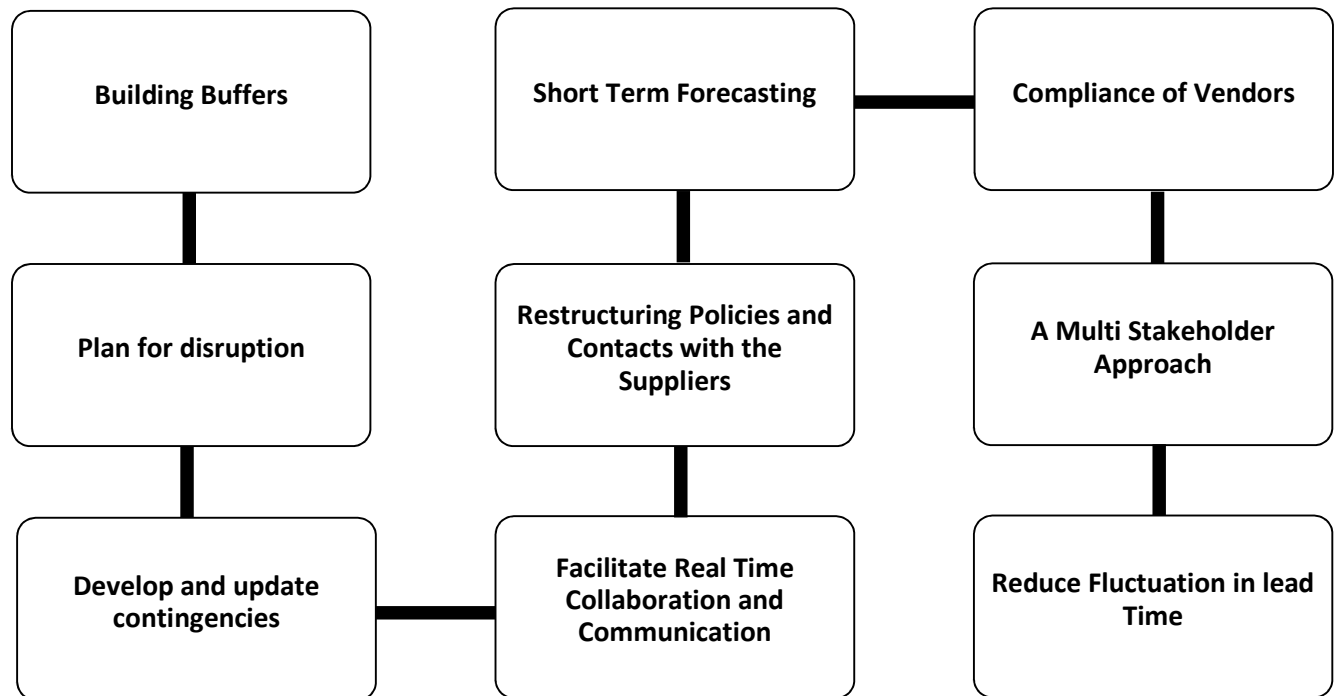


Figure: Supply Chain Revamping Plan for the Apparel Industries of Bangladesh during and post pandemic COVID-19.

Building Buffers: In the medium-term Industries can look to build ‘buffers’ to mitigate the ripple effect when a single supplier is compromised. A ripple effect occurs when an initial disturbance to a system propagates outward to disturb an increasingly larger portion of the system. This can be done in two main ways: (i) firms can create an inventory buffer or ‘safety-stock’ of essential components and products and, (ii) firms can create a time buffer by delaying the production of goods where demand is unpredictable.

Plan for disruption: When the COVID-19 was reported in China communication forward to Latin America to start toothbrushes to back up supplies in Europe, Asia, the US, and China and when the virus spread to Europe and the US then China has stabilized and start manufacturing to make supply Chain agile to withstand the crisis. So, the industries must be aware and of this situation and try to make the chain agile.

Develop different levels of contingencies: The crisis management team has to establish for evaluating priorities contingencies depending upon the conditions. As the uncertainty of the end date of the COVID-19, the conditions can be up and down now & then.

Update and test contingency plans: When the one supplier fail to deliver then source for the second supplier the goal is to identify weak supply chain links. After finding the link the main focus should be in that part to decrease the possible disruptions.

Facilitate Real-Time Collaboration and Communication: By using information technology artificial intelligence and the internet of things to improve the visibility of the supply chain. Make use of tools like Google hangout s, WeChat, WhatsApp that keeps your team connected.

Stay ahead of demand: Due to this crisis demand is uncertain, the industries have to plan according to the requirement in the current crisis. So, the production must be aware of the fact of customer demand to keep it at a balance.

Restructuring Policies and Contacts with the Suppliers: Due to the pandemic the company needs to adjust its ongoing policies to minimize the disruption. Because it is no longer the normal situation, so in order, to keeping up with the circumstances new policies must be adapted for the benefit of the buyers and the industry heads.

Short Term Forecasting: As the end date of the pandemic is uncertain, so from now on the whole forecasting should be short term based. It is just like taking the demand calculation at a suitable amount in which disruptions can be tackled thoroughly.

Compliance of Vendors: Vendor compliance policy can be beneficial as the company may avoid myriad problems, including improper PO numbers, wrong products sent, product substitution without approval, incorrect labels, improper packaging, mixed POs, mixed SKUs, nonstandard pallets, incomplete bill of landing, late deliveries, damaged products and much more.

Decentralized Warehouses: The company should use a decentralized warehouse system to meet the demand according to the place because several places are in lockdown situations and the retailers are not getting the products as they need.

Reduce Fluctuation in lead Time: As the demand has decreased and there are several products in the inventories, so there has to create a system and increase in demand to reduce the fluctuation in lead time. This is also applicable to import and export supplies and products.

A Multi-Stakeholder Approach: Besides the brands, organizations, and retailers, employees and the Government must collaborate the work with trade unions to find ways to support apparel workers during this unprecedented time.

Discussion:

The results clearly show that the COVID-19 has already done a severe drawback in the Apparel Industry of Bangladesh mostly on the supply chain process. After conducting the research, it has been found that the supply chain disruptions have occurred on the conviction of the Problem regarding facilities, Problems

regarding logistics efficiency, Problem with communications, Problem regarding the delivery of the product, Problem regarding imbalance between demand & operation. The research contained survey questions that were answered by different apparel industry personnel and analyzed along with primary and secondary data. A Principal Component Analysis with an Orthogonal Rotation (Varimax) was performed by using the software named IBM SPSS (Statistical Package for Social Sciences). Factor analysis results show that the commonalities of the variable concerning disruptions are very high indicating that the data set has a higher level of relations ships among the variables. The rotated component matrix of the variables which indicates that the factors constituted with the variables has a higher level of correlations between them. Multiple regression analysis was also performed to test production reduction based on Suppliers operating at a low rate, higher logistics bottleneck, Uncertainty of raw materials. The regression analysis showed that all the predictors are significantly related to production reduction. So, all the important questions before the research were found successfully. The research findings were close to the expectations and have shown the actual and major consequences of supply chain disruptions due to COVID-19 which need the proper attention all at once. The revamping model has exhibited a way to mitigate the situation. The model was conducted based on literature reviews of future supply chain risk management and the expert opinions of the supply chain personnel of the Industries. The current and the post-pandemic supply chain management of the apparel industries can go around with the revamping solution for the best of their circumstances.

Limitations & Future Research Direction:

The study was conducted based on a survey. Due to unpleasant situation of the pandemic the interviews weren't one to one physically. So, verbal and expressional answers were missing in some kind of way. The sample size can be bigger, Because the more the sample size the accurate the result. Even though the study has found that COVID-19 has disrupted the supply chain process of the apparel industries, but it didn't perceive the consequences the whole industry problems. There is a vast way to find out more and effective way to mitigate the disruptions with practical implications.

Conclusion:

COVID-19 has disrupted supply chains around the world. But they've also been a vital lifeline to support the response, keeping essential medical supplies, food, and other key necessities flowing where they're needed most. There's no doubt that the pandemic has tested the ingenuity, resilience, and flexibility of supply chain leaders globally, as they have sought to maintain essential operations. Supply Chain Disruption has taken place in every sector due to Covid-19. It has shaped the global economy as pandemonium, where everyone is panicked. The end date of this pandemic is uncertain, so it is crying need to find out the major sectors where the supply chain has been affected most and take necessary initiatives to minimize the disturbance. The research aims at finding these consequences of supply chain disruptions due to COVID-19. The research was conducted in the Bangladesh Apparel Industry. Both qualitative and quantitative approach has been taken. The quantitative approach contains the most important part in finding out the true consequences which have been the issue in recent times. The GDP of Bangladesh is largely depending on the Apparel Industry, thus the disturbance in the sector has hampered the sector along with the country's economy thoroughly. So, by a brief qualitative approach, the research proposed some ways that could be the way in revamping the Supply Chain Management. Companies need to adjust their policies and contracts with suppliers to address possible disruptions in supply. They also need to develop a better forecasting system for demand and production to minimize the gap. Compliance with vendors in a new

situation may be an issue. Companies need to decentralize warehouses to ensure uninterrupted supply and automation should be adopted for smart management. They can do business both offline and online.

However, there is an ample scope to conduct further study on this topic and there might have more factors influencing the disruptions. The outcome of the study could be a good indication for Supply Chain professionals to the factors considered industry-wide. Besides, the study results will be beneficial for suppliers along with the industry giants as it will help to improve on the evaluating criteria and achieve a competitive position in the market.

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