

Horizontal Collaboration to Reduce Traffic Congestion: Opportunities for Industries of Bangladesh by improving Collaborative Logistics

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Abstract

Collaboration in supply chain is widely recognized as one of the core challenges for the next future. In this context, horizontal collaboration is believed to be one of the innovative solutions to tackle the growing logistic challenges from both, environmental and economic points of view. In this paper, a close look has been taken on the horizontal collaboration opportunities across industry sectors of Bangladesh to reduce traffic burden, capture more opportunities and make their supply chain more efficient. Horizontal collaboration is characterized by the sharing of information, knowledge, risk and profits among industries working in the same level of supply chain. The aim of this paper is to discuss possible horizontal collaboration opportunities in supply chain between Bangladeshi industries to impose an impact on the reduction of traffic burden. Further, a new comprehensive model named 'Smart Conveyance' has been proposed which will not only allow the companies to improve their efficiency but also will play a significant role in reducing traffic congestion.

Keywords

Horizontal Collaboration, Supply Chain Management, Logistics, Traffic Congestion

1. Introduction

Simatupang et al. has defined collaboration in supply chain as "when two or more independent companies work jointly to plan and execute supply chain operations with greater success than when acting in isolation". The purpose of supply chain collaboration is to reduce costs, make the operations run smoothly, reduce lead time, meet uncertain demands with rapid delivery and to increase revenue. Collaborative practices can facilitate the operations of different industry sectors; and this collaboration can occur either vertically or horizontally. Vertical collaboration takes place between partners (typically suppliers and customers) located at different levels of the supply chain, while horizontal collaboration refers to partnership between two or more unrelated or competing organizations that operate at the same level of the supply chain (Barratt et al. 2004). This paper focuses on various ways through which horizontal collaboration can be established across different industry sectors of Bangladesh. Industries in Bangladesh have steadily increased their production rate and quality during the last few years. But the quality of transportation in Bangladesh isn't up to the mark, which hampers not only the smooth flow of products but also affects the quality of life. As a result, both the working class people and the companies are pushing towards private transports rather than choosing public transport. In consequence to this, the number of vehicles on the roads is increasing everyday causing more trouble on our traffic system. Traffic congestion is one of the severe problems in Dhaka city which is home to major Bangladeshi industrial conglomerates. In accordance with World Bank report, the average traffic speed has dropped from 21 kilometers per hour (kmph) to 7 kmph. Another study, according to Brac Institute of Government and Development, indicates traffic congestion in Dhaka eats up around 5 million working hours every day which eats up almost 6% of annual GDP and costs the country USD 11.4 billion every year. This financial loss is due to the money spent on conducting vehicles for the extra hours. As transportation is one of the most vital elements for transferring goods in all the industries and it determines the overall logistics costs, finding out the most cost-effective and most efficient way for transferring goods is the major concern for every company. Unplanned

transportation management and the increasing number of vehicles are creating harmful impacts on economy, health and environment. According to the government's decision to set weight limits for trucks on highways has increased the number of vehicles on the road. As such, a large number of transports are needed to transfer loads of various industries which could have been done before with a smaller number of vehicles. Due to this traffic burden we are losing man-hours, extra transportation cost, extra fuel consumption, vehicle operating cost etc.

Traffic burden in the big cities of Bangladesh can be solved by practicing collaborative supply chain management across different industry sectors in Bangladesh. In this paper, horizontal collaboration due to traffic congestion has been investigated, such as in the case of Bangladesh Future industries. The companies producing or trading same kinds of goods can take joint initiatives which will allow them to increase their efficiency and responsiveness. This collaborative ecosystem will not only allow the companies to improve their efficiency but also will play a significant role in reducing traffic congestion. The purpose of this paper is to focus on reducing or minimizing the traffic burden and what this means for the management of freight transport, a key process in the supply chain as it acts as a physical link between customers and suppliers. It aims to propose some possible solutions based on a comprehensive framework, and also to develop a supply chain-driven model for Horizontal Logistics Collaboration (HLC).

2. Literature Review

Horizontal collaboration is the process of two or more companies cooperating at the same level on a certain market activity to realize benefits they could not achieve independently. As defined by Supply Chain Brain, it is collaboration across rather than along the supply chain. This collaborative approach aims to achieve a win-win situation among two or more firms. The scope of horizontal collaboration between different industries has been thoroughly studied and widely discussed from both, scholars and practitioners but the available literature on such a topic is still limited and quite recent. Moreover, Naesens et al. (2009) pointed out the lack of a strategic decisional framework for the implementation of horizontal collaboration. Cruijssen et al. (2007) presented an initiative of eight Dutch producers of sweets and candies that intensively cooperated by supplying 250 drop-off points and contracting with a logistics service provider that would consolidate the shipments and achieve delivery efficiency. Pomponi et al. (2013) have proposed a framework assuming an incremental perspective, according to which mutual trust among partners can be developed through increased collaboration. Raweewan et al. (2018) have conjectured that information sharing is arguably the most critical factors among all other elements of supply chain collaboration (SCC). They have developed a framework for valuing information that could help in taking decisions about what information to share in a collaborative venture to make both of their supply chain successful. Whereas, Deshmukh et al. (2014) have addressed the approach to evaluate the horizontal collaboration of two flexible supply chains by focusing on inventory decisions between all players of the supply chain. According to their research findings it was clear that horizontal collaboration can reduce the overall cost of the supply chains.

In the light of abovementioned literature review, it is evident that horizontal collaboration is very important for the global competitive edge. From the prominent review of literature, it can be clearly seen that a lot of researches have been made in horizontal collaboration but there are very few researchers who have studied the ways through which horizontal collaboration can contribute to the reduction of traffic congestion. Thus the paper presents a novel study of various horizontal collaborative ways in logistics and transportation through which, planning uncertainty and ineffective time in supply chain can be reduced.

3. Situation Analysis: Challenges & Problems in the Existing System

In a country like Bangladesh where people keep trying to hold on to their root, restructuring a system that is currently at work is a challenging job. In the current strong competitive industrial context, enterprises must react quickly to the market changes. In this section, we have tried to identify the factors that can affect the efficiency of the performance of horizontal collaboration between Bangladeshi industries. The main challenges which exist in the current structure of supply chain collaborations across industry sectors of Bangladesh are given below:

- **Increasing Competition:** Bangladesh's industrial sectors have witnessed rapid growth over the years, which has led to significant competition between rival companies, which in turn holds back the scope of establishing sustainable collaboration between entities working in the same level of supply chain.
- **Cost control:** Operating costs are under extreme pressure by rising energy/fuel and freight costs, greater number of global customers, technology, increasing labor rates, new regulations and rising commodity prices.

- **Poor transportation management:** Transportation management is another critical element of logistics and supply chain management. Inadequate transport infrastructure and lack of proper transportation management are the key obstacles in collaborative logistic operations.
- **Non-collaborative logistics:** Because of non-collaborative logistics, companies are failing to achieve lower logistic costs and faster deliveries.
- **Lack of coordination of long trips:** Lack of coordination of long trip deliveries is another cause of traffic congestion which increases response time.
- **Political Instability:** Conflict between the political parties, inefficiency of local administration, good governance and corruption in the government levels etc. are main causes for political instability in Bangladesh, which leads to strikes. A day of strike stand can cause a loss between Tk. 1500 crore to Tk. 2000 crore. A strike can hinder supply chain activities of industries.
- **Current vertical logistic collaboration:** Current vertical logistics collaboration approaches based on a single supply chain seems insufficient to achieve further improvements in transportation systems.
- **Retention of Authority:** In most of the leading industries of Bangladesh, the managerial decisions are centralized. This means employees do not get any freedom in decision making regarding any problem. This tendency slows down the collaboration process.

The abovementioned situations are the reasons why ambitious production and marketing strategies, such as Just-In Time (JIT) and increasing product customization cannot be achieved

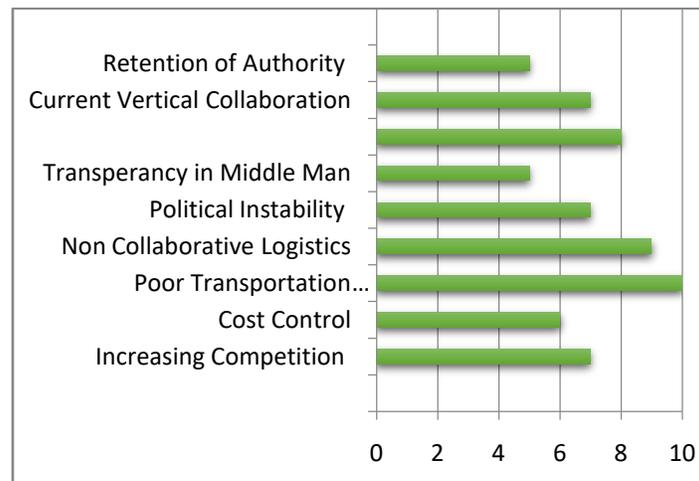


Figure 1. Priority queue of the challenges in the existing system

4. Methodology

Horizontal collaboration can be complex and multifaceted. This research presents a theoretical study for defining different types of horizontal partnerships which can be applied in different industry sectors of Bangladesh. At first, a survey has been done to realize the existing condition of collaboration scenarios of Bangladeshi Industries. Then a comprehensive framework has been suggested through which collaboration between industries can be developed. Later, based on the stages of the framework, some collaborative models have been identified. Later on, a new technologically advanced model has been suggested. At last, the opportunities of establishing horizontal collaborative models in different industries of Bangladesh have been discussed.

5. Survey Questionnaire: Design for Interviews of Bangladeshi Companies

Our study was conducted following the descriptive method of research. This method of research was employed to gather information about the existing condition of collaboration scenario in Bangladeshi companies. The following Table 1 shows the main categories of the questions which we have asked the employees of different companies.

5.1 Objectives of the survey

This survey focuses on the existing situation of supply chain collaboration between Bangladeshi companies. Aim of this research is to identify the major obstacles for horizontal collaboration between the companies. Objectives of the survey are as follows-

- Identification of the major challenges in collaboration between companies.
- Ensuring the profitability of the supply chain.
- Suggestion and recommendation regarding horizontal collaboration opportunities in Bangladesh
- Proposing a sustainable collaborative model that will reduce the traffic burden of Bangladesh without hampering supply chain efficiency.

Table 1. The main categories of question

Research Objective	Interview Question
Key competency among companies	1. What are the key competitive criteria?
Criteria to select key suppliers	2. How does the company select the key suppliers? 3. What are the basic criteria that help to choose their supplier?
Agreement with the suppliers and distributor	4. Does the company have any agreement with their key suppliers? 5. What extent does the company share their information with their suppliers and distributor?
Partnership maintenance	6. How does the company maintain their partnership with their SCC partners?
Competitive advantages	7. Does the company gains any competitive advantage from SCC?
Horizontal Collaboration in terms of logistics	8. Does the company want to collaborate their logistics operation with others? 9. What are the main things that will affect the logistic collaboration?
Freight sharing possibilities	10. What are the main locations of their distribution centers? 11. How do the company manage to meet the demand through shipments?

Based on this questionnaire, interviews of employers from different major departments (IT, logistics, sales) have been taken to understand the horizontal collaboration opportunities of different companies in Bangladesh.

From the survey across different industries situated mostly in Gazipur, Narayanganj and Chittagong we have determined how different industries feel about collaboration. It is observed from the pie chart in figure 2 that among the main factors affecting the horizontal collaboration between companies, responsiveness possesses the greatest importance.

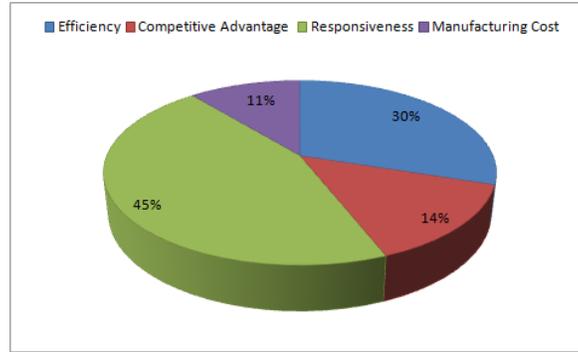


Figure 2. Pie chart showing the factors affecting horizontal collaboration

6. Comprehensive Framework

The framework proposed by Pomponi et al. (2013) identifies three incremental steps to develop the collaboration between industries; operational, tactical and strategic (see also Lambert et al. 1999). The first level is related to the engagement process (which ranges from the identification of compatible partners to the pooled network design), the second to the management of interdependencies (from the localization of joint warehouse to the information sharing), and the third to the effective implementation of operations (from execution of operating specifications to definition of protocols for disputes' resolution) (Moutaoukil et al. 2012). Pomponi et al. (2013) have also suggested that there exists a variation in the number and nature of assets to be shared among partners. Based on such findings, we also propose a comprehensive framework which uses variables while implementing horizontal collaboration. In this framework, the collaboration evolves on a time horizon basis. As a consequence, it is impossible for two or more companies to implement tactical or strategic partnership without a previous adequate experience with the operational stage. (see among others, Pomponi et al. 2013, Lambert et al. 1999)

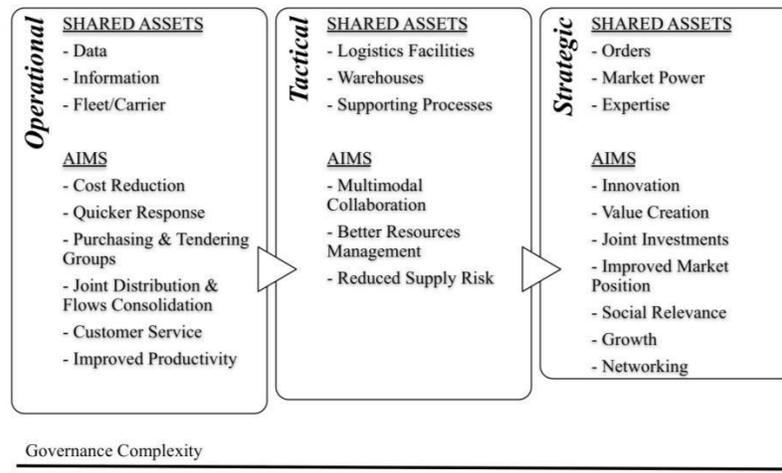


Figure 3. The Comprehensive Framework Proposed for Horizontal Co-operations (Pomponi et al. 2013)

The combinations of aims and shared assets mentioned in the incremental steps are going to help us in finding out which companies of Bangladesh share a common objective and also on which incremental step they can collaborate.

7. Possible Horizontal Collaboration Opportunities in Bangladesh

Horizontally, the companies more often treat each other as competitors rather than collaborators. Most of the company personals are not familiar with this new way of collaboration. By reviewing documents gathered from various sources, this study identifies different ways to implement horizontal collaboration in practice. Based on the

strategic, tactical and operational decision levels, industries can collaborate horizontally in the following ways in order to decrease traffic burden as well as improve their efficiency and effectiveness.

7.1 Operational Level- Increasing Load Factors

Increasing load factors can also increase efficiency in transport activities. Horizontal collaborative activities can raise these load factors in several ways. Industries having similar or complementary transportation needs can collaborate horizontally by bundling their orders and use a common transportation channel to ship their products. In Bangladesh, customers are widespread over the geography generating long empty back-hauls after deliveries. Thus, by sharing their logistics companies can improve load factors and reduce empty back-hauls. (see also, Hernandez et al. 2017) Further, the burden of excess number of transport plying onto the roads can be solved by collaborating roundtrips in which different routes that tie in with each other, can be combined into one tour, also putting an end to empty miles. By integrating the transportation operations of different companies, efficiency can be increased and the ecological footprint decreased without touching existing service levels. Li et al. (2013) showed in their case study that load factors could reach 92% by using such a collaborative strategy.



Figure 4. Example of a) Bundling, b) Back-hauling and c) Round trip opportunities

Figure 4 shows examples of bundling, back-hauling and round trip activities. In the example (a) of bundling, shipments A and B both have their origin near Savar and their destination near Dhaka, which allows for a bundling of shipments. In the example (b) of back-hauling, the destination of shipment A (Dhaka) lies close to the origin of shipment B, whose destination (Gazipur) is close to the origin of shipment A. The empty truck after delivery of shipment A can be used for shipment B. In the example (c) of round trip, the destination of A (Narayanganj) is close to the origin of B, whose destination is close to the origin of shipment C (Keraniganj). The destination of C (Dhaka) is again close to the origin of A, which completes the roundtrip.

7.1.1 Using Conjoint Routes

In this context, different companies can create conjoint routes, by pooling their customers to serve them from a shared depot. High level of synchronization between the companies is required to make a conjoint route successful. (see also, Hernandez et al. 2017) The companies can exchange their clients' orders to get a better match between customers and depots. This will reduce long travelling distance of the vehicles, and also increase response time,

allowing to achieve greener routes and to reduce the logistics activities in city centers. Many studies have been done based on conjoint routes. Wang and Kopfer (2014) have introduced a pick-up and delivery problem with time windows to illustrate the benefits of horizontal collaboration. Similarly, Nadarajah and Bookbinder (2013) have considered a two-stage framework for less-than-truckload transportation: firstly, collaboration between multiple carriers at the entrance of a city was considered; secondly, there was carrier collaboration for transshipment to finalize the initial routes. Finally, Dahl and Derigs (2011) have developed a real-time collaborative decision support system in the express carrier network. Their main purpose was to assess potential benefits obtained by sharing customers.

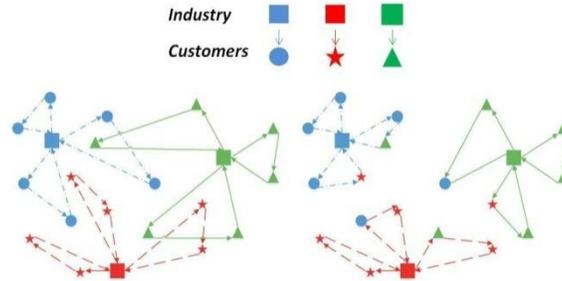


Figure 5. Non-collaborative (left) vs. collaborative (right) scenarios for conjoint routes. (Hernandez et al. 2017)

7.1.2 Train Scheduling

A rail-road can improve on-time performance by scheduling some of trains instead of building all of them. Heavy products that are easily loaded can be passed at peak hours by rail-roads. Some trains can be scheduled as they will enter the city after midnight and by roads the freights can be distributed at night.

7.2 Tactical Level-Consolidation Centers

Tactical decisions are focused on the mid-term and they typically require a high level of synchronization among the firms (Hernandez et al. 2017). As described in Verdonck et al. (2016), fixed assets such as warehouses and distribution centers can be shared in order to consolidate production from several manufactures, thus reducing the number of long-trip deliveries required. Collaborative hubs are proposed by Groothedde et al. (2005) to deal with a real case developed in The Netherlands. Collaborative warehousing can be helpful to simplify the inbound and outbound transportation network, especially when shippers have common customers. A single warehouse serves the purpose of storing and delivering different products in the same area. Reduction in the number of long trips will clearly lessen the traffic congestion caused by big delivery trucks.

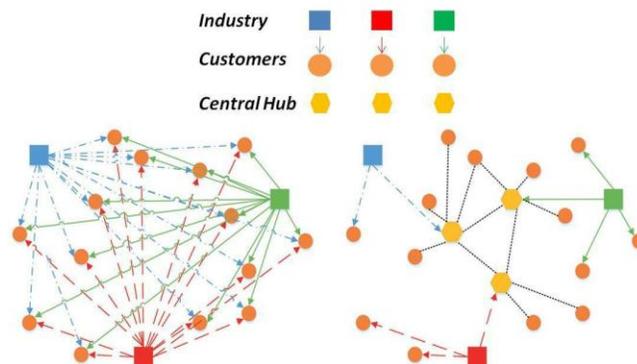


Figure 6. Collaborative (left) vs. collaborative scenarios (right) for freight consolidation (Hernandez et al. 2017)

7.3 Strategic Level- Joint Procurement/ Order

Purchasing collaboration at the strategic level focuses on the sourcing of the service supplier. Small individual partners' buying power is consolidated together to make the purchasing group a very attractive business customer for service providers. (see also, Zeng et al. 2015) Supply chain partners can coordinate by jointly purchasing from the same supplier by using the same LSP. This will reduce the unit cost of product, and improve load factors. And improving the load factor will reduce the number of traffic on the road.

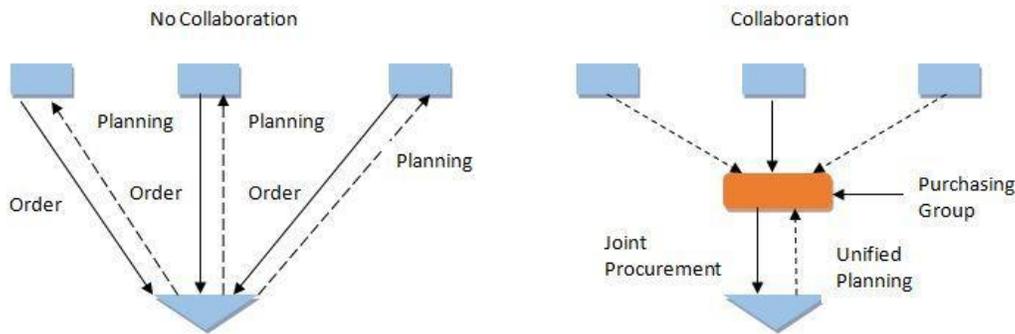


Figure 7. Joint Procurement Operation between three companies. (Zeng et al. 2015)

8. Proposed Horizontal Logistic Collaborative Solution

In this present study, a technological based model where possible opportunities of horizontal collaboration between industries has been taken in to account. From collaborative planning, forecasting, and replenishment model a proposed information model is proposed for Bangladeshi industries. By sharing information this has enabled core processes to become considerably more visible to partners leading to collaborative possibilities. In our study, available technologically updated SCM system has been considered where industries will get benefitted by collaborating and sharing information. All the orders, replenishments and deliveries are monitored and distributed by the requirements of the industries and all the above traffic control has been prioritized. A common manufacturing industry produces product by using the raw materials provided by the suppliers. The distributor stores inventories and supply the products to customers through retailer. The manufacturing plant and warehouse might belong to the same company. Manufacturers of same area can share management information at any time by a common data base system. The information which flows among chain partners can be stored in the top level data base. Using the central data base system, every individual member can exchange the data with other members to synchronize their business operations. A scheduling model can be established from receiving raw materials to delivering shipments to meet the demand can reduce the load factors. Consolidated deliveries with common timings can provide the transportation administration smooth flow of materials to customer. The unique benefits of this smart conveyance system lie in the fact that it offers a “transparent” mechanism to monitor many different logistical operations, providing an opportunity to facilitate possible mutually beneficial collaborations. It is also very flexible and can customize the visibility of transport jobs, running status of a load to whoever values the information. Warehouses, for example, could receive early notification of a vehicle running late or can communicate with all in-bound deliveries during a period to notify them of late running at the DC to reduce unproductive waiting time. For the proposed horizontal collaborative solution companies of Bangladesh can increase their supply chain performance in these areas illustrated in following table.

Table 2. Impact of following proposed solution for Bangladeshi Companies

Performance measure	Impact of following proposed collaborative solution
Manufacturing cost	Decrease
Inventory Cost	Decrease
Service level	Increase
Replenishment lead time	Decrease
Transportation cost	Decrease
Freight cost	Decrease
Shipping and receiving cost	Decrease
Profitability	Increase
Internal Communication	Increase

9. Possible Application of the Proposed Model in Different Industries of Bangladesh

Industrialization is an essential prerequisite for rapid economic growth of a developing country like Bangladesh. Bangladesh has significant numbers of industries such as textile, leather, food, fertilizer and pharmaceutical industry that have direct impact on socio economic development of the country. This section focuses on the possible application of the proposed collaborative models in different industries of Bangladesh.

9.1 Readymade Garments Industry (RMG)

Readymade Garments Industry is the largest foreign exchange earning sector of Bangladesh. Presently, the Bangladesh RMG industry is struggling with lead time. Many recognized buyers of different countries in the world are conducting trading activities simultaneously with different countries of the world. (see also, Chowdhury et al. 2018) In Bangladesh, over the last two decades there has been a major transition from resource based export manufacturing to process based exports (see also, Chowdhury et al. 2018). Year-wise growth of RMG industry of Bangladesh is shown in Table 3. The common components of Bangladesh RMG include: Supplier, Garment Industries, Individuals, Buyers, Raw Materials, Finished Goods, and Payment (Nuruzzaman and Haque 2009). Bangladesh RMG manufacturers are exporting their finished products to the first world countries. But in lack of proper transportation infrastructure their lead time is increasing, and thus they are lagging behind in fulfilling customer demand. If the garment industries come together and make a collaborative network, it can bring a huge impact in their import as well as export system. Two or more garments making the same kind of product can purchase raw materials from the same foreign supplier. This will bring economies of scale as well as reduce the inbound transportation cost. Further, by increasing the number of shared logistics, (trucks, and warehouses) they can reduce their outbound transportation cost which will also reduce traffic congestion, and increase response time as well as make them more efficient.

Table 3. Year wise Growth of Garments Factories and Employment (Source: BGMEA-2016)

Years	No. of Garment Factories	Employment (In Million Workers)
2005-06	4,220	2.2
2006-07	4,490	2.4
2007-08	4,743	2.8
2008-09	4,925	3.5
2009-10	5,063	3.6
2010-11	5,150	3.6
2011-12	5,220	3.7
2012-13	5,330	3.7
2013-14	5,450	3.7
2014-15	5,490	3.8
2015-16	4,300	4

9.2 Pharmaceutical Industry

One way that companies can see if horizontal collaboration is right for them is by determining whether or not their supply chain offers them differentiation. If a supply chain does not present a specific market opportunity, then it makes sense for this to be an area where companies do not invest additional funds. The most developed and hi-technological sector in Bangladesh is the pharmaceutical industry. Due to recent development of this sector we are exporting medicines to global market including European market. This sector is also providing 95% of the total medicine requirement of the local market. Pharmaceutical firms in Bangladesh mainly sell to the private sector pharmacies, the government and its public health care facilities, and international organizations operating in Bangladesh (e.g. UNICEF). The drug distribution marketplace is composed of small independent pharmacies. On average, each pharmacy visits 10-50 pharmaceutical firms that supply them medicines on a daily basis. The Bundling of shipments for two collaborated pharmaceutical companies will make it possible to use the same means of transport and thus increase the load factor. Bundling opportunities can be detected prior to shipment, with the help of smart conveyance system and, if necessary, the timing of a shipment can be altered. These horizontal collaborative opportunities can reduce the traffic burden to a great extent. Also using the GPS coordinates of the beginning and end of each route can be effective.

9.3 Agriculture & Food Industry

Another promising industrial sector in Bangladesh is agriculture & food industry. This industry consists of commodities like frozen food, tea, bakery and confectionary, fruits and vegetables, dairy, carbonated beverages and non-carbonated fruit. Among these dairy, fruits and vegetables are highly perishable. Collaboration is needed in agri-food supply chain system in order to minimize cost, increase the profit, fulfil the quality assurance, and gaining trust from consumers. (Dania et al. 2016). However, complexity lies in the application of collaboration in the agri-food industries of Bangladesh. As also identified by Bezuidenhout et al. (2012), trust, commitment, and willingness to share risks become the main keys in achieving a long term goal to create strong collaboration. Horizontal collaboration can be applied in reducing outbound transportation among confectionary SMEs participating in a logistic system consortium as suggested by Ghaderi, et al. (2012). SMEs that have small orders can implement the horizontal collaboration by combining the load among the parties. Horizontal collaboration can also be applied to support the relationship among the food retailers (Nielsen, et al., 2014). It is identified that collaboration among retailers need enthusiasm, strong commitment, a high level of maturity, and willingness to override individual actions. Companies prefer to cooperate with an organization that has a similar size, structure, capabilities, and resources (Dania et al., 2016). Perishable products from suppliers can be cross-docked and sent to retail outlets for daily basis. Cross-docking during night time will reduce traffic pressure during day-time.

10. Limitations of the Study

The main limitations of our study are due to a limited research budget and time. One of the main limitations is only qualitative analysis is done in our study. But the study developed in this paper has the potential to have significant managerial implications. The research demonstrates the importance of taking a supply chain approach when evaluating the feasibility of horizontal collaboration among competitors.

11. Conclusion

To conclude, horizontal collaboration is a basic need now for the industries all around the country for their own existence. It brings many advantages for the industries like reduced transportation cost, less transport emissions which may lead to Greener Transport Modes. The biggest impact is less traffic clogging during peak hours. Moreover, horizontal collaboration holds promise of far larger efficiency and sustainability improvements. So it is proposed that the industries should collaborate with each other and simultaneously consider appropriate performance measures, integrated policies as well as information sharing to make a win-win situation for all parties, The main objective of this study was to identify the possible solution to design a system that will affect the efficiency of performance of supply chain collaboration of Bangladeshi industries and reduce traffic burden. It has demonstrated possible approaches that can improve logistics performance. This paper was concerned with finding a framework for developments of possible collaborative model within supply chain partners for Bangladeshi industries. The study developed in this paper has the potential to have significant managerial implications. But much

has to be worked on within the industries before the fuller potential of transport collaboration can begin to be achieved.

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