

Port Efficiency and Supply Chain: Implication for Bangladesh

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ABSTRACT

Port and supply chains are closely connected to each other as a port is considered as an important node of the global supply chain. So the efficiency level of port has an impact on the performance of supply chain operations. Chittagong port is the principal seaport of Bangladesh and it provides a major gateway to the outside world. The cost of doing business is increasing as a result of the inefficiency in the main seaport of the country. In this paper, an effort has been taken to examine the efficiency of Chittagong Port and the causal factors of inefficiency. The impact of inefficiency at Chittagong port on the supply chain of Bangladesh has also been identified. To do this, at first a relationship has been built between port efficiency and supply chain in respect of Bangladesh.

Relevant data has been gathered through extensive review of the literature, field surveys, interacting with top management of different business entities such as shipping agency, freight forwarder, logistics companies, exporter, importer as well as Government regulatory and monitoring bodies using both the structured and unstructured questionnaires.

The study has revealed that the inefficiency at Chittagong port causes serious consequences on the supply chain of exporter and importer and lead to loss and disruption of trade and ultimately incur extra costs and time. This paper, therefore, recommends a substantial infrastructure improvement to Chittagong port along with other related measures in order to facilitate the supply chain of exporter and importer.

Keywords-- Port Efficiency, Supply Chain, Port, Exporter, Importer

considered an average 10% of the total supply chain cost* (Francou, 2002). Therefore, when the port is inefficient, the freight and handling cost will become higher, leading to the extra cost of export and import. As a result, the cost of import rises and export encounters tough competition in the global market. Eventually, exporters must have to minimize the profit margin in order to survive in the international market.

A new World Bank report shows, in the last two decades South Asia has had an excellent economic growth and could be able to achieve a bigger share of the global trade, but inefficiencies in its ports hinder the development compared to the other regions. It was found from the comprehensive World Bank study of the status, structure and deficiencies of the region's container ports that if Bangladeshi, Indian and Pakistani ports had been as efficient as those of Sri Lanka it could have cut shipping costs by up to around 9%, boosting the region's exports by up to 7% [4]

Over the past few years, many reports have highlighted the challenges in Chittagong Port such as slow vessel turn-around times, low labor productivity, a multiplicity of trades unions (around 25 of them), high dwell time of containers, restrictive practices and corruption (particularly for customs function), poor onward connection, etc. Considering both direct and indirect cost, port services for customer are getting expensive. Though, productivity in the Chittagong Port has been improved when vessel turnaround time and containers handled per vessel in a day are measured, but overall performance is still under the global standard. Congestions in Chittagong port has slowed down the freight throughput and is incurring extra cost for importers/exporters. From current estimation, it is found that the average 'dwell' (wait) time is still 17.48 days for a loaded import container, whereas the global standards are 4 days and 2-3 days for imports and exports respectively. The low handling productivity in port results in high ship-turnaround times, averaging 3-4 days, while more productive ports in the region turnaround larger ships in 12 to 24 hours. Such slow turnaround is being reflected in the shipping freight rates, making Chittagong Port an expensive one compared to its

I. INTRODUCTION

Ports are considered as important transit points for international trade and it permits the import and the export of goods [1]. The role of Seaport has been transformed into an essential value adding and logistics-related activities from a traditional regional gateway [2]. The export and import trade, at present, consist of more and more logistical components and a port is a crucial element of the logistic chain [3]. According to Beth, "Experts estimate that the port cost is

service level. Indicative container handling charges for Twenty-foot Equivalent Unit suggest that Chittagong (US\$200/TEU, including unofficial and ancillary costs) is much higher than Karachi (US\$113/TEU), India (Nhava Sheva and others; US\$80-90/TEU), Port Kelang, Malaysia (US\$53/TEU), Singapore (US\$106/TEU), Shanghai (US\$107/TEU), Hong Kong (US\$142/TEU), Port Qasim, Pakistan (US\$105/TEU). The historical comparison of these figures indicates very little improvement in Chittagong port since the late 1990s[5]. It can be said that the efficiency of Chittagong port is in question in various aspects from this brief background study. The purpose of this paper, therefore, is to analyze the impact of port efficiency on the supply chain considering Bangladesh.

II. STATEMENT OF THE RESEARCH PROBLEM

Port efficiency level affects a lot in increasing or decreasing the cost of logistics and supply chain. Bangladeshi seaports are considered as less efficient due to congestion and other operational problems, whereas container congestion is a vital problem in Chittagong port. This paper tried to measure the impact of port efficiency of supply chains and logistics.

III. OBJECTIVE OF THE STUDY

The estimated outcome of this study would be a comprehensive analysis of the problems at Chittagong Port and the impact of those problems on supply chain and logistics. The outcome would also include strategies to mitigate identified impediments.

IV. RELATIONSHIP BETWEEN PORT EFFICIENCIES AND SUPPLY CHAIN

The supply chain varies from company to company and therefore, this definition is not suitable for this study and hence not adopted. However, in global supply chain there are a number of actors from buyer to seller and port is one of the major players. The port is also known as a third party logistics (TPL) service provider intervening in a series of different companies' supply chains in respect of both cost and time. This concept of global supply chain is adopted in this study.

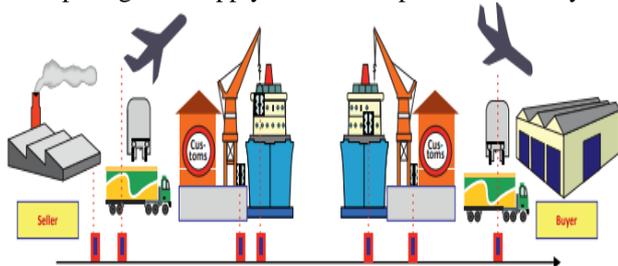


Figure 1: The networks of global supply chain
Source: International Trade Centre, 2000

Ports are significant since its key activity like loading and unloading of goods has been essential to world trade and transport and also represent a comparatively greater share in the total global supply chain cost. Therefore, the requirements of fitting port activity rightly into the logistics chains is getting importance day by day. It is evident that Inefficiencies at ports are preventing a match between ports and their logistics chains, thus, a seaport has a direct relationship with the global supply chain.

V. REVIEW OF EXISTING LITERATURES

César Ducruet et al (2014) emphasized turnaround time and dwell time as an indicator of port inefficiency. Their research has explained for the first time the average number of days that container vessels need to enter and exit ports of the world. Such a measure was interpreted on the level of ports and countries as an indicator of efficiency, in a context of fierce competition within and between complex logistics and supply chain[6]. Victor OyaroGekara (2013) examined the importance of efficient hinterland connectivity for the performance of ports. Congested logistics networks, inadequate overland transport infrastructure less sophisticated intermodal facilities and prohibitive transportation costs are identified as the major constraints that continue to undermine the effectiveness of the port as a key gateway to the region's international trade. Other factors that hinder the efficiency are also identified, including roadblocks, inefficient customs clearance procedures at inland frontiers and the poor state of security in the region. The Author failed to state other important factors responsible for inefficiency of a port such as efficient maritime operators, equipment maintenance, service quality, competitive labor costs, and information system[7].

Yingigba (2016) identified a study for Mozambique and Cameroon perspective, the factors that encourage port inefficiency. He found that insufficient cargo handling equipment makes hindrance in unloading and clearance of cargoes, ultimate results of which are shipment difficulty and consuming of time. He also found the factors like incremental ship turnaround time, relatively low skilled manpower, over charges and less security for imported goods cause container terminal congestion at ports. Sources of finance; regulatory support, organizational policies, and level of investment are the factors that found as the causes of poor performance of ports[8].

As a result of port inefficiency, the suffering of the business world is immeasurable. The slowdown in the west coast because of port inefficiency has put the entire business world in inconvenience whereas the retail industry is in the most suffering. They have already counted a loss of millions of dollars as their seasonal shipment plan is not working due to bottlenecks of ports

on the west coast[9]. The economic impact of port congestion is incredible. Importers account losses due to damage or deterioration of products, extra costs to help stopping damages and extra charges at every supply chain nodes. Consumers suffer from unavailability of products and importers pass the extra burden of costs to its customers. Accordingly the entire supply chain becomes inefficient in terms of cost and it has a greater negative impact on the national economy and the global economy as well.

A research conducted by T.F Golob et al (2000) to reveal the impact of congestion at the port terminals in California. 1200 private carriers operating near the port were selected as sample to conduct this research. More than 40% operation managers claimed that drivers had to wait more than an hour outside the port prior to access. 75% claimed that drivers had to spend more than an hour inside the port. Over 80% said that the time was not predictable driver would spend at the port. This accumulated delay and variability forced 44% of the firms to be affected significantly by congestion. The study recommended that more employees were required at the port for the ease of service delivery and port to be expanded to serve the increasing number of customers.

A survey research was carried out by Kenyan shippers' council to investigate the impacts of port congestion on business operation in 2013. It was found that for years, congestion of cargo at the seaport caused delays of ships at the berth for the purpose of unloading containers. The delay time was approximately 6 days. These extensive delays had a rational connection with the increase of the prices of various products in the market. Not only this increasing of price had a serious disturbance in the whole supply chain network, but also the delay led to loss of property, especially the perishable goods and thus accounted loss for the cargo owners. The council provided some recommendations such as implementation of an electronic cargo clearing system, making improvements in dispatching of cargo from the port and increase of staff at the port to make the service delivery easier. It is practical that the ships calling at Chittagong port have to wait 8 to 10 days at outer anchorage before getting berth allocation due to the container congestion and slower operation[10]

Otieno Robert Kennedy et al (2011) stated that seaport operational efficiency is a critical factor for handling of goods in the international supply chains, and is viewed to impact transportation and logistics. Seaports are called a component of freight distribution since they present a maritime to land interface for cross-border businesses. Thus, efficiency in seaport operation is vital for supply chains[11]. Trade of Bangladesh is basically export oriented and the exporters have no alternative without the Chittagong port for transporting their goods overseas. Ready-made garments are the main portion of the export oriented products of Bangladesh and they are carried by container through Chittagong port.

Therefore, the operational inefficiency in this port seriously hampers the exporting activities.

Begum (2003) discussed about the impact of port efficiency and productivity on the economic development of Bangladesh. The Author took the port of Chittagong as a case for her research. In this study, the Author showed the relationship among macroeconomics, port economics and port performance. Overview of Bangladesh economy and nation's maritime dependency discussed, the role of the port of Chittagong and its importance in Bangladesh economy, SWOT analysis performed to show the weakness and strength of the port authority locally and within in the region, a comparative analysis conducted to analyze the port competitiveness. Short-term and long-term solutions have been recommended in order to improve the present condition[12]. In her study she did not relate the inefficiency of Chittagong port with the supply chain and logistics of Bangladesh. Due to the low performance of Chittagong port the supply chain of containers has broken down. The containers are kept stuck in the port for even 15- 20 days, though they are supposed to be released within 3 days. The poor port facility is adding up to the lead time as the import of different products takes a much more time to reach the respective entity's premises due to different port complexities. Chittagong port is one of the most inefficient ports in south Asia and it has a detrimental effect on supply chain and logistics of Bangladesh.

Chittagong Port, the prime seaport of the country, has long been very rightly considered the heart of the export-import trade of the country and the important node of supply chain for different business. Port inefficiency damages the link between port logistics and entire supply chain up to the port's hinterland area. Shippers have to plan and coordinate to ports that are further away, which will cost more money, time and effort. Therefore, the impact of port inefficiency is a nightmare to the entire supply chain of Bangladesh that involves ocean carriage.

The literatures reviewed so far, have no doubt made significant contributions to the field of study. However, none of them considered port inefficiency and supply chain in the context of developing countries like Bangladesh. Therefore, this study seeks to bridge this gap by examining the port inefficiency and supply chain in Bangladesh.

Table 1: Container shipping cost in different countries

Country	Container shipping cost
India	1200 USD
China	600 USD
Singapore	400 USD

Source: World Bank-2018

VI. EXAMPLE OF PORT EFFICIENCY AND SUPPLY CHAIN OF OTHER COUNTRIES

In this part, Egypt and India have been taken as an example to draw lessons in respect of port efficiency and supply chain.

Egypt: Damietta in Egypt is considered as less efficient due to its lengthy manual documentation process. This also affects the important documents being lost or misplaced beside the duplication of work and prolongs the process of loading and unloading the cargo and its final delivery. As a result, it increased the costs that the exporter and importer would have to pay since the ship would have to stay longer and increase the costs by up to \$20000 (Boliden and Wesley, 2006). This, in turn, caused traders to look for other less costly outlets for their products. To minimize this problem, Damietta Port and the Egyptian government has contracted “ProsyLab” to transfer the documentation manual system to a totally automated system (Egyptian Maritime Transport Sector, 2008). The process then is set to encourage trade at Damietta Port through managing and optimizing the flow of goods within the entire supply chain. It offers monitoring and control of vessel operations, equipment operations, yard operation and any real time operation in the port[13].

India: The main problem faced by the Indian ports is a highly inadequate infrastructure that increases time for costs of exports. Indian ports inefficiencies led higher sea transport costs, making cargo shipped from Indian ports cost-inefficient and non-competitive[14]. India’s underperforming trade logistics due to the port, resulting in shipping cost of export from the country twice over China and near about three times that from Singapore, according to the Associated Chambers of Commerce and Industry of India (ASSOCHAM). For instance, shipping a container from India costs around USD 1200, while from China it is in the range of USD 600, and Singapore about USD 400, data from the World Bank.

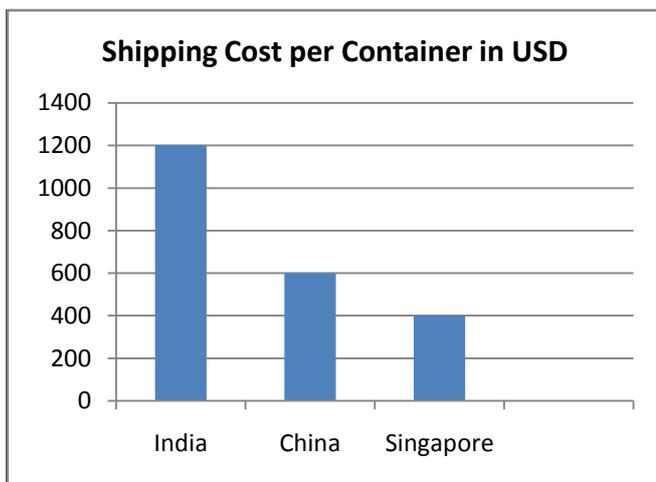


Figure 2: Shipping Cost per Container in India, China and Singapore

The turnaround time at JNPT port in India that handles more than 50% the country’s containers, is 1.1 days (36 hours) whereas in Singapore Dubai, Shanghai

and Colombo, its less than 12 hours[15]. The Ennore Port Limited has the highest turnaround time of 5.69 days, followed by Paradip Port (5.68 days), Kandla Port (4.96 days), Visakhapatnam Port (4.52 days), Tuticorin (4.28 days) and Mumbai Port (4.07 days) broadly reflecting the efficiency and finally in the cost of export and import[16].

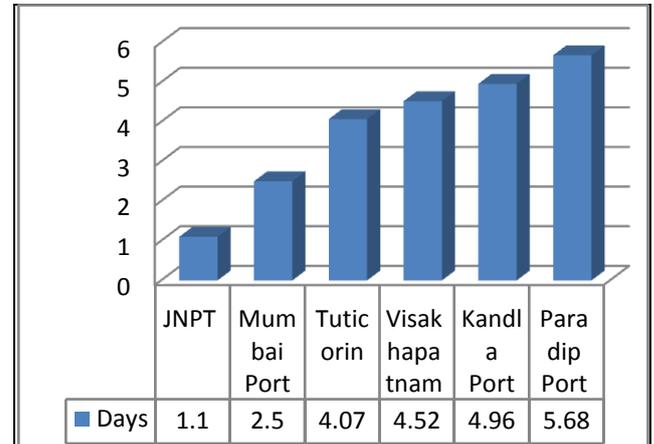


Figure 3: Turnaround Time of Different Ports in India
Source: Thedollarbusiness.com-2016

VII. LESSON LEARNT FROM THE SELECTED COUNTRIES

The above examples present some lessons for the study, In the case of Egypt, one of its ports named Damietta was an inefficient port because of its manual time-consuming process. It can be said that how a single factor influences the efficiency of a port. Moreover, due to this lengthy process, importer and exporter had to incur a huge cost as extra. But when port took the step to start automation in its custom operation, the efficiency had been raised. In short, it is understood that custom automation is one of the important elements that can add value to the supply chain of exporter and importer through automation.

The logistics cost is much higher in India due to inefficiency of ports. Ports integrate a country with global production networks. Due to the integration of port into the supply chain, countries which have higher shares in international trade or having exports or imports as the major source of their national incomes have no alternative without having an efficient port.

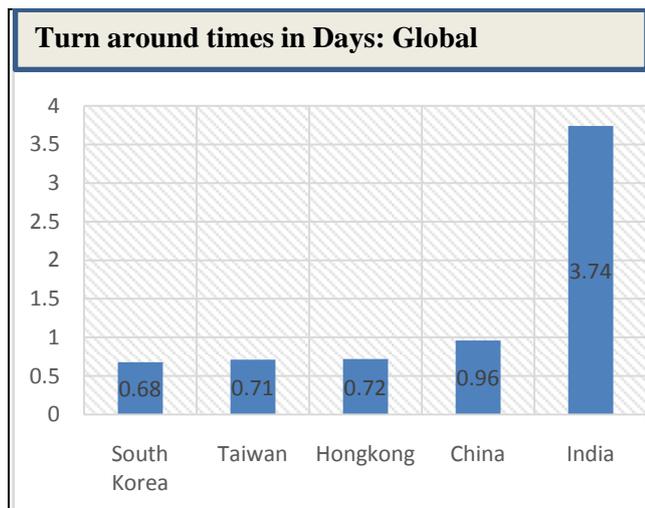


Figure 4: Global Comparison of Turnaround Time
Source: TDB intelligence unit-2016

In Indian ports, the average turnaround time of ships is high compared to other international countries. From the table, it is seen that average turn time in Indian ports is 3.73 days, whereas in South Korea it is only 0.68 days. The term high turnaround time indicates the poor efficiency of Indian ports.

So from those examples, it can be said that by improving the performance of ports it is possible to handle higher levels of cargo with the same facilities in a shorter time and can be a far more cost-effective approach to reduce transport and trade costs.

VIII. METHODOLOGY OF THE STUDY

This study is conducted by field survey method on the basis of which consultation and document analyses were arranged. Official documents and publications, unstructured interviews, administrative proposal through questionnaire were entitled to conduct this study. This study included respondents from Chittagong Port, freight forwarding companies, logistics, Companies, manufacturing companies, exporter and importer.

The study used data from both primary and secondary sources. Primary data were collected through interviews, discussions and questionnaires. The questionnaire, a sample copy of whose is shown in Appendix, focused on inefficiencies at Chittagong port and its impact on the supply chain. In some cases, questionnaires were obtained through unstructured interview and researcher has compiled those in a consistent manner for obtaining the factual information. Moreover, questionnaires were sent through e-mail and were retrieved through the same means. The telephone interview was also administered for the remote respondents. Secondary data were gathered from the Chittagong Port Authority, freight forwarding companies, logistics companies, exporters, importers and manufacturing industries. Secondary data were also

collected from several unpublished materials, books, journals, magazines and through the internet.

The analysis of the data collected for the study used both qualitative and quantitative methods. Qualitative analysis has been used for logical reasoning in order to approach at cogent deductions. Data generated from administered questionnaires were analyzed and used to draw conclusions and make recommendations regarding inefficiencies at Chittagong Port and its impact on supply chain and logistics.

IX. ANALYSIS: OVERVIEW OF PORT EFFICIENCY AND THE SUPPLY CHAIN

There are many issues involved in the performance of a port and global supply chain. These are- range of logistics services, time taken in operation, provided equipment utilization, stacking and handling practices, container handling equipments, training activity, truck management in the port, volume of cargo, skilled manpower, chain of command, efficient customs operation, performance clearing and forwarding (CNF) agent working within port, inland distribution facility, efficiency of berth operator, reliability of vessel operators and permitted capacity of a vessel in a port. When a port lacks any of those, it will result in poor performance or inefficiency and raise the cost and time of export and import. Ultimately the supply chain becomes disrupted.

Along the way, the total cost of a product from producer to a consumer consists of production cost, transport and distribution cost, the profits that every single member adds to its own costs as well as a number of taxes. Figure 4.1 represents the overall cost structure of the global supply chain of a product starting from the manufacturer to the consumer when shipping using sea. Becoming an important node in the logistics chain, port performance has a major influence on the supply chain. From the figure 4.1, it can be seen that the transport cost of a global supply chain is mostly in maritime transport where the cost in port is considerable.

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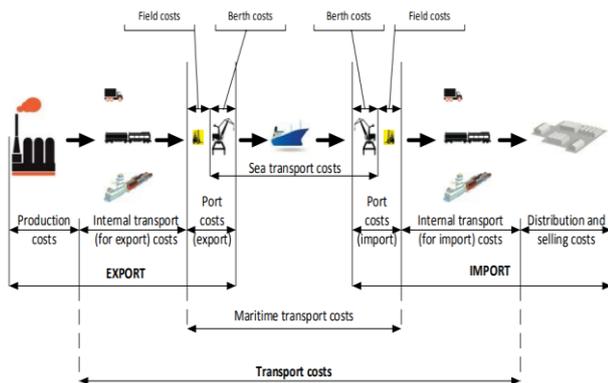


Figure 5: The cost structure by considering the maritime transport

Source: Trade Logistics in the Global Economy, 2014

A low port performance enables speed reduction in operating the vessel and longer time of the vessel at berth. This increased time at port leads to the extracost per ton of cargo handling, because operating costs are disseminated over a smaller amount of cargo handled per unit time. The consequence of lower operating speed is additional staying of the ship in port; as a result, an increase of voyage costs will be recovered by shipowners through higher freight. Finally, poor port performance will be reflected in higher costs of ocean transport and products, and all the consequences will be supported by consumers. In these circumstances, consumers can redirect to other products, in which case producers will be forced to reduce their profits or, most frequently, to shift towards more efficient routes (ports).

When ports that are frequently congested, navigation unions introduces a congestion surcharge for liners and impose a particular demurrage for charters. Ultimately, these extra charges will be passed on to a higher freight resulting in an increase of the price of all goods passing through the port. In other words, producers and their buyers are finally affected by these surcharges [17]

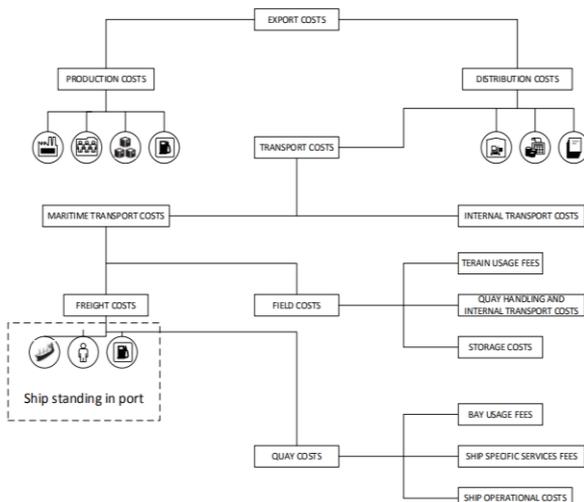


Figure 6: Structure of port costs

Source: Trade Logistics in the Global Economy, 2014

Poor performance and congestion in ports is due mostly to poor organization of cargo-handling activities and inefficient use of available resources. In order to minimize these problems, the ports tend to reduce the congestions by investing in extra berths or introducing new facilities. This will result in a temporary reduction in congestion without thereby eliminate the real causes of poor performance. The costs of such large investments will be covered by increased port fees and charges, negatively influencing once more transport and product costs. As shown in the foregoing effects on port performance on shipping costs, increasing these costs can be a major obstacle and an important barrier to international trade, supply chain and freight traffic through the port. Even if economic reasons compel the manufacturer to maintain and not lose some markets, foreign trade earnings will be reduced dramatically due to reduced profits. This effect will be felt particularly for low-value products such as raw materials, agricultural products, heavy goods and low volume metallurgical products etc which form the majority of exports from developing countries. As long as costs in port activity have a significant role in transportation costs, improvement on port performance is a very important key to reducing the cost of transport, so necessary to stimulate foreign trade. The consequences of increasing port performance in this context are clear enough that it will directly or indirectly enhance the global supply chain performance by reducing the cost per ton of cargo handled, the cost of shipping; costs of the distribution of goods and the cost of goods imported by sea. As a result, there will be an increase in profit from export activities made by sea and for the port and its customers.

Chittagong port is considered as less efficient and more costly port in the world as well. The port is already operating beyond its normal capacity of 1.7 million TEUs. If expansion is not carried out and operational efficiency is not improved, the port is likely to become a bottleneck to the international trade of Bangladesh

If the port could improve efficiency, it will improve reputation and will attract shipowners to port which eventually will encourage new investments and create new jobs, stimulating the local and national economy and industry. Ports will expand the range of services for its users and develop existing services, activities such as banking, freight, insurance, supply vessels, repair, etc. Significant effects will be realized by business entities throughout the country as logistics and supply chain performance will be improved due to increased port performance.

X. EFFICIENCY ANALYSIS OF CHITTAGONG PORT

Port operational efficiency is measured by providing logistics support to customer, service time, and ship turnaround time, Dwell time of containers,

berth occupancy, Equipment availability, and utilization. Chittagong port is the prime gateways of Bangladesh needed to provide essential service to exporter and importer. The slow operational procedure, inadequate facilities, and excessive charges have made Chittagong port Inefficient.

Logistics services: At present, the competitive position and the efficiency of a port depend on the range of logistical services it provides to add value to the global supply chain. For example, the port of Antwerp, the most efficient port in the world, works as a multi-user platform that facilitates transparent business processes and manage logistics chains. Most of the logistics service providers in the Port of Antwerp operate as a one-stop-shop, offering complete solutions including freight forwarding, storage, and value-added logistics (VAL), customs administration, and fiscal representation and distribution services[18]. It has more storage space than any other European port. In combination with its state-of-the-art infrastructure and equipment and great expertise of its personnel, it can handle any cargo efficiently and safely, including hazardous and refrigerated cargo. However, in Chittagong port, due to space limitation, congestions and other associated problems, it could not ensure better logistical facility to the business entities of Bangladesh. From the following table, it is understood that the logistics performance of Bangladesh is lower than that of the India and Pakistan.

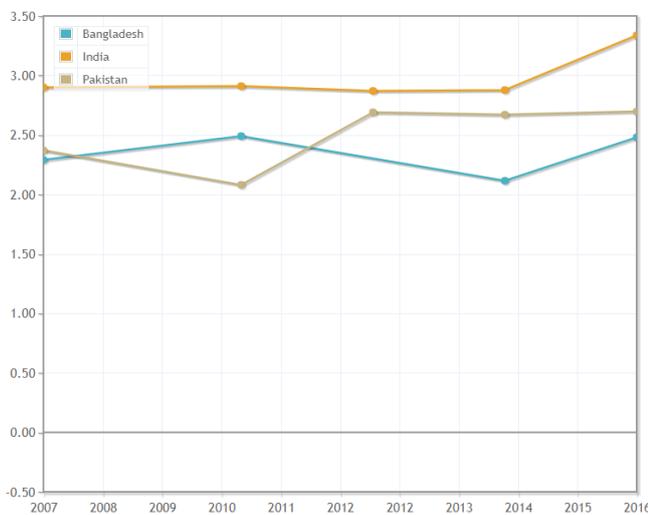


Figure 7: Logistics performance comparison in terms of ports, railroads, roads

Source: World Bank-2017

Ship turnaround time: Ship turnaround time is the indicator to determine port timing and quality of port services as it is directly related to the transport cost of the ship. Waiting time and service time together constitute ship turnaround time at any port. With a 15% reduction in service time will reduce turnaround time by 28% and waiting time reduction will be 45%. (Francou, 2002, p.9).The average turnaround time for Chittagong port is 3-4 days, whereas turnaround time in the port of

Singapore and Taiwan is 12hrs & 10hrs respectively, 0.96 days in Shanghai port, 0.68 days in Bussan port in South Korea, and 1.7 days in Colombo port in Sri Lanka.

Table 2: Turnaround time at different ports

Ports	Turnaround time
Chittagong	3-4 days
Taiwan	10 hrs
Singapore	12 hrs
Shanghai	0.96 days
Bussan	0.68 days
Colombo	1.7 days

Source: HPC 2016

Table 3: Operational performance indicator of Chittagong port

Fiscal Years	Dwell time of container(days)	Berth occupancy (in%)	Equipment availability (in%)
2013-2014	15.64	57.75%	64.55%
2014-2015	17.48	65.04%	60.63%
2015-2016	11.88	73.95%	54.06%

Source : CPA-2018

Service time: Service time is the total time spent by a vessel at the port. Which includes waiting time, working time, shifting of vessels, time spent for documentation, lashing of cargoes, opening, and closing of hatches, etc. Almost 30% of the service time occurred due to idle time. This can happen due to the shortage of equipment, coordination, and shifting.

Dwell time: Dwell time is considered at the time a container stays in a port. If the dwell time increases, storage capacity decreases and as a consequence port faces congestion and causes delays at berth. Dwell time increases mainly due to delay in clearing documentation and customs formalities. Although port works for 24 hour customs work only during the office hours and which cause a significant increase in dwell time. The average dwell time of a container at present is around 17 days in CPA which is much higher than the other ports in the region.

Berth Occupancy: Berth occupancy is another indicator of port efficiency. High Berth occupancy rate means ships are waiting and berths are not available. According to the standard, the berth occupancy should not be more than 70%. The berth occupancy rate at CPA is higher than that of the standard, which is 73.95% (2015-16)

Waiting time: Chittagong port is a low drafted port and all the berths are located on the bank of the Karnafully River. For this reason, CPA has to depend on the tide. Ships need to wait for the high time in order to enter the port. Also, waiting time can be due to bad weather, congestion, non-availability of cargo, non-availability of the pilots, non-availability of tugs, clearing of documents, strikes and technical problems. Most of the delays occur due to looking for berths and the rest occurs due to the documentation process.

Equipment availability: Use of equipment is the pre-condition for the better port performance. Lower availability occurs with the higher downtime of equipment. Equipment availability will reduce idle time for ships at berth which will increase berth productivity. At the port of Chittagong availability of equipment is very low that happens due to the lack of supply of equipment, lack of maintenance, lack of skilled operators and poor inventory management.

Utilization of equipment: Utilization of the equipment is the duration of time equipment is used during a specific year. Utilization hours depend on the port to port and time to time. CPA is a 24 hour operational port, but utilization of equipment is high during the vessel's sailing period or berthing period. Utilization can be high during pick hours and weekdays. Low utilization indicates that there is no need for a new order and in case of high utilization may require ordering new equipment. Low utilization occurs due to idle time, which is mainly due to the administrative process, bad weather, spending more time while operating equipment, labor lunch/tea/praying breaks. It has been noticed that demand for equipment is always higher than the availability of equipment at the port that means that there is a shortage of equipment at the port or maybe a breakdown of equipment at the port.

Berth utilization and output: Berth utilization indicates the ratio of maximum uses of berth using best management techniques. Efficient berth utilization depends on good planning and coordination, maximum uses of resources and facilities. Berth output is the total amount of cargo handled by a berth throughout the year. It gives an idea about a port capacity. CPA is not effective in terms of both Berth utilization and output for lack of planning.

Ship output: Ship output is the total number of cargo handled at the jetty to and from a vessel. This is a good indicator of berth productivity in a particular time frame. It also depends on the number of cranes or gangs are engaged for a particular ship and type of equipment used for the cargo operation. Due to the shortage of equipment and lack gangs engagement ship output is comparatively less in Chittagong port.

Quality of service indicators: Quality of service indicators is also important as like physical service indicators due to high competition in the market. Quality of service relates to turnaround time, waiting time, idle time, dwell time, productivity, storage period, working hours and logistics support at a port. Chittagong port is unable to maintain its quality of service because of these constraints.

Custom integration with port: Customs integration with a port is vital to foster the smooth delivery of cargo. World most efficient ports are the examples of how their customs and port are strongly cooperating with each other. Non-cooperation among the service delivery agencies like port authority, Chittagong Customs House, Customs Clearing and Forwarding Agents, transport

operators and banks are mainly responsible for the delay in the release of goods.

Chittagong port has to improve efficiency and be responsive to meet the commercial needs of exporters, Importers, and carriers. Above indicators of port performance should be taken into consideration as these are the influential factor of poor efficiency. Poor port performance is a challenge for the shipper since it increases the cost of ship shipment and thus hinders the supply chain.

XI. IMPACT OF PORT EFFICIENCY ON SUPPLY CHAIN

Every single stage of a port has an influence on the export-import supply chain. Firms involved in import or export rely on well-functioning ports and efficient customs procedures to bring in needed input and send out finished products. The supply chain of an export or import firm highly depends on the efficiency of a port as it would reduce the cost and time whereas it could also increase the cost and time. So the impact of port inefficiency in the supply chain that involves ocean carriage is considerable.

Table 4: Comparison of Turnaround time, maritime transport and container shipping cost

Country	Turnaround time in days	Maritime Transport Cost	Cost of Shipping a Container
Bangladesh	3-4	14%	\$600
Other countries	1 to 2	8%	\$150-300

Source: World Bank

Chittagong is the second largest city in Bangladesh and it is also called the commercial city or the port city of Bangladesh. The biggest and main seaport is situated in this city. But the port area is not as big as it is needed. It is a common scenario in the port that, number of commodities are waiting in the port area for the shipment. For the lack of efficiency and sufficient infrastructural facilities, it takes a long time to unload a vessel. It is seen that, when some vessels are being unloaded in the jetty, some other vessels are waiting in the queue on the deep sea. They cannot drop the anchor in the harbor for insufficiency of places. As a result, a plenty of shipments are stacked in the port area. Suppliers cannot ship the goods in time and ultimately it causes hindrance in the supply chain performance.

XII. IMPACT OF EFFICIENCY ON THE EXPORTER OF BANGLADESH

The impact of an inefficient port on the exporter's supply chain is enormous. It was estimated that Bangladesh could see about 30% increase in export by simply making the port more efficient. According to

Dhaka Chamber of commerce, Chittagong Port's inefficiency Costs US\$ 1.1 billion extra to the economy every year, which is about 2% of GDP. The port continues to be one of the slowest, most inefficient and costly in Asia. Purchase order to delivery cycle is one month longer in the port than that of major competing countries which is a problem for investors. The Rail network is poorly utilized by any international standards while Dhaka-Chittagong main road cannot handle container Lorries due to capacity constraints. The ongoing automation and infrastructure development at Chittagong port would cut the vessel turnaround time to less than 24 hours from existing 3-4 days. Bangladesh has adopted an outward-oriented growth strategy, and the garment industry's competitiveness, particularly depends on the ability to move imported fabrics and garment exports through the port quick, in order to meet tight delivery deadlines. However, the lack of discipline at the port slows the movement of goods and allows extraction by port workers and customs officials.

A cross country review by the World Bank found that turnaround time for feeder vessels in Chittagong is 3-4 days, compared with two days in Bangkok and one day in Singapore. Bangladesh can move a container for \$ 600, but neighboring ports can do it for \$ 150-300. Maritime transport costs account for 14% of the cost of Bangladeshi textile exports to the U.S, compared to less than 8% for countries such as India, Thailand, China and Taiwan. Thus, this discrepancy taxes Bangladesh's Economy and lastly passes the costs of inefficiency to customers. According to another study, Bangladesh's exports could earn about 30 percent more if port inefficiencies were removed. A 30% increase in earnings could boost foreign exchange earnings from garment exports by 125%. In other words port inefficiencies each year cost the country close to what the garment sector earns – about \$ 1.1 billion.

The port management's inefficiency has to be borne by the businessmen ultimately. Bangladesh could not achieve its garment export target in 2016 and longer lead-time at the port was one of the major reasons. Garments exports from Sri Lanka, Cambodia and India, all Bangladesh's competitors in the global apparel trade, increased. Shorter lead-time for excellent performance by their ports was one of the reasons for better export performance[19]. Garment exporters tend to use the expensive air shipments to maintain the strict lead-time of buyers due to delays in Chittagong port and delays in Chittagong port have been costing them unusually at a time when profitability declined a lot and production cost rose. If the Chittagong port performed even at the same level as the Colombo Port in Sri Lanka, the maritime cost would have reduced a lot and Bangladeshi exporters could have sent goods to the US for 0.6 cents and 0.8 cents per kg, said M Masrur Reaz, a programme manager of the World Bank.

A case of USA cotton shipper exporting to Bangladesh: Congestion at Chittagong port with no end

in sight is compounding US cotton exporters' concerns that there will not be enough capacity to move their containerized commodities to Bangladesh's textile and apparel factories. In response to congestion that has been mounting for weeks, the port authority has instituted tighter limits on how long ships may remain at Bangladesh's top port. Bangladesh cotton importers have been advised of a surcharge of \$150 per TEU because of congestion that is reaching a "critical level" at Chittagong. "All shipping lines calling Chittagong terminals are heavily impacted, with vessels waiting an additional 7 to 10 days on average above the normal berth wait times," according to a notice to customers from ANL, an Australia-based carrier offering worldwide shipping services.

US cotton exporters said that although Bangladesh is a growing market, its port congestion and lack of direct services adds complexity to their supply chains. Unlike Vietnam and China, whose ports are called by numerous weekly mainline services from the US East and West Coasts, Bangladesh is served mainly by feeder services. US cotton exports to Bangladesh rose nearly 35 percent to 5,021 TEU in 2017, according to PIERS, a sister product of JOC.com within IHS Markit. The increase was aided by crop issues that affected exports from neighboring India. Total US cotton exports last year were up 3.7 percent to 254,610 TEU. US cotton exports move year-round, but the peak season generally is in the first quarter, after the crop is harvested, ginned, compressed into 500-pound bales, and containerized for export. The peak was particularly strong this year, as US cotton exports to Bangladesh rose more than 240 percent year-over-year to 7,486 TEU.

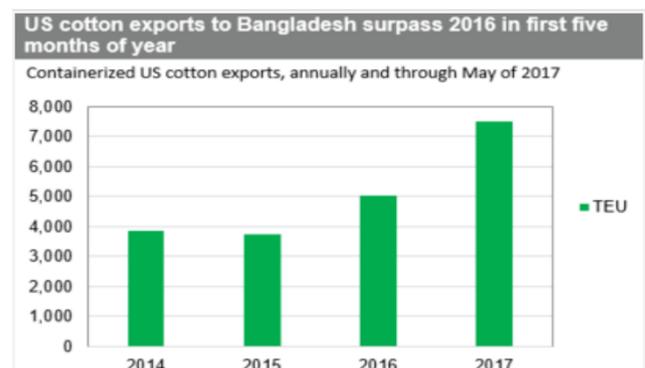


Figure 8: US cotton Exports to Bangladesh

Source: PIERS/IHS Markit

Bangladesh has become the world's second-largest garment manufacturer, after China, and has a fast-growing spinning industry that processes raw cotton into textiles. Last year, Bangladesh imported about 7 million bales valued at \$3 billion. With demand rising, Bangladesh depends on imports for almost all of its raw cotton. The country's farmers can provide only about 3 percent of the annual demand for cotton needed to produce yarn and fabrics. Monsoor Ahmed, secretary of the Bangladesh Textile Mills Association, said port

congestion threatens to raise costs. He confirmed that carriers have advised “that due to congestion in Chittagong port, they are in dilemma whether to send vessels in Chittagong port or not.” “If the present situation continues, cotton prices may go up and the problem may turn worst,” According to Mahmudur Rahman Sumon, managing director of Zaheen Spinning Ltd., a producer of cotton yarn, supply problems could hurt the country’s spinning industry by raising raise prices for raw cotton and yarn. “Now both the imports and exports are affected severe due to the congestion in port impacting competitiveness[20].

The export of Bangladesh is facing a huge problem due to the constraints of Chittagong port. From the above analysis, the extreme sufferer is the garments industry because of the poor performance of the port. The supply chain of ready made garments exporter becomes disrupted as a result of higher lead time caused by the port. Eventually, this port inefficiency is negatively impacting on the competitiveness of export trade and supply chain of Bangladesh rising extra cost and time of shipping.

XIII. IMPACT OF EFFICIENCY ON THE IMPORTER OF BANGLADESH

The value of imports to Bangladesh is growing in each year. As a result, the importer has to greatly rely on the Chittagong port since it is the main gateway of Bangladeshi trade. The Figure 4.8 presents the value of import in USD for the year 2013 to 2017 and it is clear that the trend is rising. In 2013 the import value was \$ 37.09 billion, whereas within four years, it became \$52.84 but the capacity of Chittagong port remained the same.

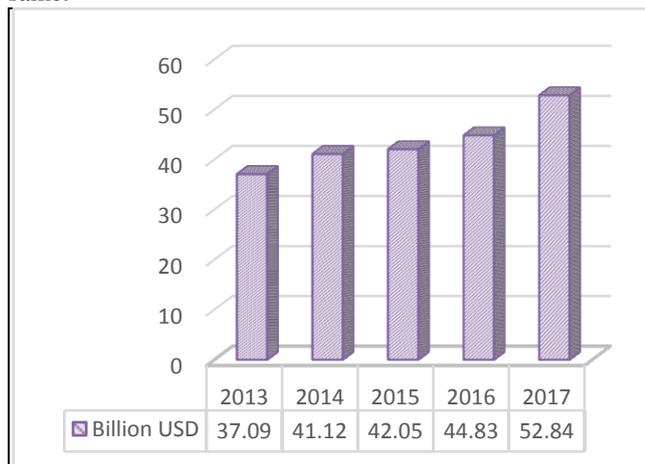


Figure 9: Import value of Bangladesh

Source: Statista - 2018

The speed and cost of import depend mostly on the efficiency of a port. The Importer of Bangladesh incurs around BDT 12 billion in losses every year due to delayed cargo unloading at Chittagong port caused by a shortage of lightering vessels and jetties. The importers

hire foreign vessels, with an agreement to unload roughly 3000 tones every day. But the vessels have to remain beyond schedule until the goods are unloaded. The importers have to pay overseas shipping companies \$10,000 to \$16,000 on average for every day that a vessel overstays. According to Chittagong port authorities, the port has 1,450 lightering vessels and six jetties. The importers, however, said that the port right now needs 500 more lightering vessels and inclusion of two jetties every year for container-less vessels. Not a single jetty has been built since the country's independence for container-less goods like steel, raw materials for cement production, and other essentials.

Local steel manufacturer BSRM Group imported 603,481 tons of raw materials for steel manufacture last year in 25 ships. The company had to count losses of \$7.5 million as it could not unload the goods on time. The company compensated overseas ship companies \$1.2 million in 2016. BSRM Group executive director Tapan Sengupta told that at least two or three ports can be constructed with the money that is going abroad every year for lack jetty facilities. A company named “Abdul Monem Sugar Refinery Limited” could not unload raw materials for sugar production on time for lack of lightering vessels. Director General of the company, Abdul Haque, said, "We had to count losses of around BDT 160 million. It's difficult to conduct business in this manner. According to the businessmen, they have to incur a loss of BDT 11.95 billion every year for inefficiency and mismanaging at the prime port of the country.

Large cargo vessels cannot directly anchor at the jetties of the Chittagong port. These vessels anchor at the outer anchorage, some 16 kilometers away from jetties. The goods are shifted from large cargo vessels to lighter ships by cranes at the outer anchorage.

The goods are unloaded from lighter ships at 39 spots, including Chittagong, Dhaka and Narayanganj. In 2017, goods were unloaded from 1,327 ships at the outer anchorage and jetties at the port. On an average, 1306 tones of goods are unloaded from these ships daily. As per conditions of shipping companies, more goods are supposed to be unloaded. These cargo vessels remain ten days more than the stipulated time. If per day compensation is estimated at 12,000 dollars, the total compensation will stand at BDT 11.95 billion.

Chittagong chamber president Mahbulul Alam said per kilogram imported goods cost BDT one to one and half times higher last year (2017) due to compensating the foreign shipping companies. All importers including City, Basundhara, Meghna, Aman Group, Sheikh Brothers, and Mosharrif Brothers have had to compensate. Some 250 lighter ships can be bought from the money compensated in the last year. Businessmen said the compensation money is ultimately collected from the pockets of the consumers.

It took 73 days to unload 52,500 tonnes of wheat from a ship imported by TK group. Director of this

group Tarique Ahmed said about BDT 180 million had to be paid in compensation due to shortage of lighter ships. Lighter ships are allocated in favor of private firm Water Transport Cell, for shifting goods from big vessels at the outer anchorage. After holding a meeting daily, the company allocates empty ships to importers. But since September to December last year, out of 120 days, meetings were not held in 78 days. The meetings that were held 35 days and the firm could not allocate lighter ships as per the demand of the importers. Out of 11 days this year, the firm could not allocate even a single lighter ship for eight days. According to the Managing director of Premier Cement Amirul Haque, BDT 166 billion could be saved if sufficient lighter ships and jetty facilities could be ensured. For example, he said, it takes 60 to 70 days to unload 50,000 tons of goods from a ship. But when there was no shortage of lighter ships, there was a record of unloading 16,000 to 17,000 tons of goods daily. If 10,000 tones of goods are unloaded daily, it takes five days to unload 50,000 tons of commodities. The fare of 50 to 60 days for a ship could be saved. The foreign shipping companies need not to be compensated. The importers have to incur losses for nothing. The money is being paid in compensation to foreign shipping companies while the consumers have to buy commodities at higher prices[21].

The global supply chain means export and import chain of a business where port is the crucial node and the objective of supply chain is to minimize the cost and time in order to maximize profit. The Bangladeshi importer has to face difficulty to make their supply chain more cost effective and less time consuming because of the inefficiency of the Chittagong port.

XIV. STRATEGIES TO MITIGATE THE CHALLENGES AGAINST PORT EFFICIENCY

This chapter refers to the strategies to mitigate challenges which underlies in the way of prospects of port inefficiency and supply chain. The limitations or challenges of port inefficiency and supply chain discussed in the earlier chapter cannot be put in the same area of concentration. Some need to be mitigated very early and some can be later; even some cannot be mitigated at all. Strategies should be the long-term plan of action(s) to remove the bottlenecks. Along with this, the chapter will also illustrate the current remedial steps should be taken by the Government as well as the private entity to mitigate those challenges.

XV. THREE COMPONENTS FOR IMPROVING THE PERFORMANCE OF CPA

The best approach for improving the performance of Chittagong Port would have three components:

- Private sector participation has to be encouraged within a well-regulated and administered landlord port model;
- Strengthen the governance of the port authority
- Promote competition within ports through the transparent and competitive way.

These reforms have to be carried out together through CPA rather than individually.



Figure 10: Three Components for Improving the Performance of CPA

Source: Copied by the Author

Developing Human Resources

The Shipping ministries or respective authorities should approve the recruitment of additional manpower according to the demand of the Chittagong Port Authority. High quality training should be ensured to the employees on a regular basis, sending them to maritime institution located in both home and abroad. Candidates with shipping background can be recruited as they have the adequate theoretical and practical knowledge in the field of maritime to apply, the better management of the port and improve the performance of a port that will add value to the exporter and importer.

Simplification of Documents and Customs Procedure: Customs documentation and Chittagong Port internal port procedures are very complex, which can be made simplified through introducing an online system for reducing the dwell time of cargo. The electronic data exchange with port and customs administrations can be started two to three days before the vessel's arrival at the port. Once this can be introduced with the paperless export procedures for containers and 24/7 customs supervision in the port, there will be smooth cargo's flow through the Chittagong port. By streamlining and simplifying the clearance procedures, importers and exporters can get benefits since it ensures lower costs and faster delivery.

5.4 Elimination of Stuffing/Un-stuffing Practice in the Port: The current practice of stuffing and un-stuffing of containers at the Port should be minimized to allow direct container transport by trucks and rails. This needs an investigation on each factor hampering the direct container transport. including the lack of container

vehicles, the capacity of BR to operate additionally dedicated freight train, but practical and quick improving measures should be implemented immediately. However, ICD can be used as a place for both stuffing and unstuffing container, as well as a CFS, can be built outside the port by CPA to reduce the pressure within the port area as early as possible that will minimize the dwell time and cost.

5.5 Increase of Container Storage Charge: Importers often use the port area for their storage due to very low storage charges for keeping imported containers in the CPA area, which increases congestion and severely limits the capacity of the container yard. The storage charge should be increased to that of an international level by the port authority to discourage importers from using CPA area for storage purposes. It will have a positive impact on the productivity and timely delivery of cargoes.

5.6 Initiatives to Commence Direct Vessel from the Originating Country: Bangladesh uses feeder and indirect vessels via Singapore and Malaysia that increases the current 14 days shipping time. A mother vessel-oriented seaport in Bangladesh would significantly reduce the lead time and unit cost of shipping as well.

5.7 Expansion of Chittagong Port: Due to the restriction of area expansion of Chittagong port in its present location is not possible. Though strategies can be taken to improve the existing facilities for improving productivity, because of the restrictions on the draft and length of a ship, it will not be able to cope up with the shipping industries' concentration on the larger vessel for economies of scale. As a result, a construction of a deep sea port is indispensable to meet the demand of upcoming shipping industry. To implement the construction of a deep sea port government should allocate budget, particularly for deep-sea port construction and seek for regional co-operation. A timeline should be made by the government discussing with maritime stakeholders on the implementation of the plan so that the construction of deep-sea port will be completed within shortest possible time.

5.8 CNF activities during Weekend: To make Chittagong Port fully operational for 24 hours and 7 days in a week, the port authority should take initiative to make it mandatory 7 working days for CNF agents. As a consequence, at the beginning of the week there will be less pressure on the port that will help users to avoid delays and congestion.

5.9 Encouraging Shippers to Use Inland Terminal: Government should encourage shippers to use river routes for carrying containers that would be hassle free and cost less to the exporter and importer. Government can also welcome private sector investments in inland container terminals (ICTs) to ferry containers from the capital Dhaka via river routes to seaports to avoid shipment delays caused by acute port congestion.

Attractive tariffs can be offered to the shippers situated in Dhaka to make them interested in using the ICTs.

XVI. CONCLUSION

Ports are widely recognized as crucial nodes in international trade and transport. Port inefficiency implies a loss of time and money and therefore undermines the competitive position of ports and maritime supply chains. The success of an ocean involved supply chain is directly associated with how efficiently a seaport can serve its customer. In respect of this matter, the Chittagong port is lagging behind due to its poor operational performance and other factors affecting its efficiency. For instance, poor hinterland connectivity, the shortage of skilled human resources, navigational restrictions, lack of IT facility and lack of adequate equipment availability, slow process of decision making, long chain of order, shortage of lightering vessel and slow customs operation have made Chittagong port an inefficient and costly port. There will be a shortage in the capacity in the near future if the port will not focus on new capacity and performance improvement. The average ship turnaround time is 3-4 days and dwell time for a container is 17 days. Moreover, the port has some natural limitations and because of this reason, the port cannot provide services to larger vessels. It is found that Bangladesh's exports could earn about 30 percent more if port inefficiencies were removed. Port inefficiencies each year cost the country close to what the garment sector earns. Due to delays in Chittagong port, garment exporters sometimes tend to use the expensive air shipments to maintain the strict lead-time of buyers and delays in Chittagong port have been costing them abnormally at a time when profitability declined a lot and production cost rose. On the other hand, because of the delayed cargo unloading at Chittagong port Importers incur around BDT 12 billion in losses every year. Allowing our ports to be operated in an inefficient and unsafe manner increase the freight rates both for exports and imports and ultimately, the poor consumers of our country bear the burden of increased freight rate.

The survival and reputation of the Chittagong port will depend on its performance to add value to the supply chain of exporter and importer. As there is limited area in Chittagong port, expansion in its current location is not achievable. As a result, a construction of a deep sea port is necessary to meet the demand of upcoming shipping industry and international trade volume in Bangladesh.

RECOMMENDATIONS

Focusing on the all previous discussions the following recommendations are suggested in respect of port performance and supply chain.

- a. Deep Sea Port Construction or substantial infrastructure improvement of Chittagong port should be done through the Government of Bangladesh.
- b. A transition to a landlord port model is recommended that CPA should be transformed into a Landlord Port as early as possible
- c. For developing human resources, Port Authority should recruit candidates with maritime background and also should train the existing employees on a regular basis.
- d. The customs documents and procedure should be simplified and integration of custom with port is needed. The port authority should go for immediate action to implement.
- e. The capacity at sheds and warehouses, storage yards, cargo storage has to be upgraded and regulations to be modified by CPA within shortest possible time to lessen cargo dwell time through punitive measure and persuasions on shippers to have delivery on time.
- f. Greater involvement of the private sector in port management, significant improvement of port governance and introduction of competition in different services needed to improve overall efficiency through the interference of respective ministry considering a specific time boundary.
- g. The number of lightering vessels should be increased by the port authority.
- h. In case of Chittagong port CNF activities should be carried out 7 days in a week that should be implemented by port authority.
- i. CFS, stuffing and un-stuffing practice should be outside the port and should be done through ICTs or ICDs.

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